



TRANSACTIONS

26th National Safety Congress

NATIONAL SAFETY COUNCIL, Inc.

KANSAS CITY, MISSOURI
OCTOBER 11 to OCTOBER 15, 1937
Municipal Auditorium

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PLAINTIFF'S EXHIBIT

Foreword

THE Transactions of the Twenty-sixth National Safety Congress, 1937, are published by the National Safety Council in two volumes. This, the first, contains the general, the special subject, and the Industrial Section sessions. The second volume contains the sessions of the Child Education, Home Safety, Street and Highway Traffic, Commercial Vehicle and Transit Sections.

All industrial members of the Council automatically receive Volume I. Volume II is sent to members believed to be interested chiefly in the sessions it covers. Other Council members, however, may obtain it upon request.

Many members have found it worth while to distribute copies of the Transactions to supervisors, foremen, and others in an administrative or supervisory position who may make practical use of them for reference purposes. The following quantity prices are quoted on extra copies: 1 to 10 copies of the large volume (Volume I), \$2 each; 11 copies or more, \$1.75 each; copies of the smaller volume (Volume II), 75 cents each.

THE Transactions are published as a condensed record of the proceedings at the National Congress. The papers of each session or division of the Congress have been edited carefully to eliminate extraneous matter and to abbreviate the less essential portions because of space limitations. Thus the material herein presented is not a verbatim report of all the speeches presented at the Congress, but rather an abridged version made as compact as possible, yet without injury to the technical aspects of any address. The original manuscripts are on file in the Council's Bureau of Information, where they are available for additional reference. Where illustrations were sent by the speakers to the Council, these also are on file.

The National Safety Council at its Congresses seeks to eliminate from discussion matters which are not pertinent to the aim of the Congress or which are contrary to Council policies. It cannot accept responsibility for the views expressed either in the papers presented or in the discussions based upon the papers.

NATIONAL SAFETY COUNCIL, INC.
20 North Wacker Drive
Chicago

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Council Purposes and Policies

The conservation of human life is the basic purpose of the National Safety Council.

The Council works toward this end through a continuous campaign of accident prevention that is nation-wide in scope, applies to all types of hazardous activity, and directly or indirectly reaches the entire population.

Recognizing that improvement of health conditions and the prevention of vocational diseases in industry are closely allied with accident prevention, the Council is also active in these fields.

The National Safety Council is a non-profit, non-sectarian, non-political organization.

It has approximately 5,000 members, representing every state in the Union and many of the Canadian provinces. There are about 400 foreign members. Included in the membership are industrial corporations, firms, individuals, public officials, schools, chambers of commerce, clubs and civic organizations. About 70 per cent are industrial concerns, including the large steel companies, the oil companies, most of the railroads in the United States, the automotive industry, and others of outstanding importance.

Origin and Growth

The history of the Council begins with the first cooperative Safety Congress held under the auspices of the Association of Iron and Steel Electrical Engineers in Milwaukee in 1912. As an aftermath of this Congress the National Safety Council was organized in New York in 1913 with 14 members. During the first year the membership increased to 971.

These safety pioneers based their program on the assumption that accidents are unnecessary and avoidable. They began to develop the principles and the materials to make accident prevention possible.

The continuous growth of the Council and expansion of its activities attest the soundness of these principles. Every field in which a coordinated program has been applied of-

fers striking examples of the possibilities of accident reduction.

Results of Organized Safety

Since the National Safety Council was organized in 1913, the national accident death rate in all fields except motor vehicle has been reduced 30 per cent. Because the traffic field does not offer the possibilities of control that are found in the industrial field, the motor vehicle accident problem continues to be a serious one. While there was a slight decline in fatalities in 1932—the first decrease that had occurred since the advent of the automobile—increases have occurred in succeeding years, with an all time high in 1936.

Better-than-average results in motor vehicle safety have been achieved among school children, in commercial vehicle fleets, in states with properly administered drivers' license laws, and in cities with an effective community safety organization. These cases indicate that the national problem can be solved by a careful study and application of the methods which have already produced results.

The National Safety Council was started as an industrial safety organization. The results of safety work in this field have often been phenomenal.

For example, the steam railroads have reduced the accident rate among employees 74 per cent since 1923. A group of the largest steel industries has cut its accidents 90 per cent since 1913. It is not uncommon for an industrial establishment to complete an entire year without a single disabling injury among its employees.

In the face of such reductions the psychology of accidents is changing. Accidents are becoming out of date both from the viewpoint of the employer and the employee. They are being recognized as a reflection on the efficiency of the plant.

Looking Ahead

The universal character of the safety problem makes it natural that the idea which

has been fostered in the United States should reach into other countries of the world. Organizations similar in purpose and activity to the National Safety Council have been formed in many countries. Council posters have been widely copied for foreign use, and several National Safety Council

publications have been translated into other tongues.

The National Safety Council is still young, but it has made amazing progress during its short lifetime. These achievements offer inspiration and incentive for continuing its humanitarian efforts.

* * *

Objectives

The purposes and policies of the National Safety Council are not always understood by those who are not in close touch with the Council's work. As a concise presentation of the Council's objectives, the following has been approved by the Executive Committee as an official statement of policy:

"The National Safety Council's objective is the elimination of accidents to men, women and children, as being deplorable, unnecessary and wasteful. It seeks memberships, cooperation and contacts to insure that its services may provide for instrumentalities and finances to accomplish this objective.

"Through education it seeks to demonstrate that the safe way is the right way and the best way, from the standpoint not only of human satisfaction but of social effi-

ciency and economy. It seeks those ways and means for safety that satisfactorily fit into the practical affairs of life.

"Its financial policy is to return in service all moneys received, so operating without profit, and to undertake only those activities which can be assured of reasonable permanence. Much of its administrative personnel consists of volunteer workers.

"The National Safety Council holds itself open to give fullest and most cordial cooperation to all individuals, industries, organizations, communities, states and nations that are in accord with the principles and objectives of the organization, and the National Safety Council likewise asks and seeks cooperation from all these in carrying out its purposes."

Annual Meeting of Members

MONDAY MORNING SESSION

October 11, 1937

The Annual Meeting of Members of the National Safety Council at the Twenty-sixth National Safety Congress, assembling in Kansas City, Mo., was called to order by Dr. C. H. Watson, President, who presided.

The invocation was delivered by the Rev. Walter H. North, Pastor, the Country Club Congregational Church of Kansas City.

The secretary reported that a quorum of members entitled to vote was present in person or by proxy, and the formal roll call was dispensed with.

The chairman then introduced D. L. Fennell, President of the Kansas City Safety Council, who welcomed the delegates in behalf of the Kansas City Congress Committee.

Address of Welcome for Kansas City Safety Council

By D. L. FENNEL

President, Kansas City Safety Council

The Kansas City Safety Council in the Heart of America, welcomes you.

This is a welcome in which every phase of Kansas City's varied interests sincerely joins.

Our schools, churches, women's organizations, civic clubs, fraternal societies—in fact, I feel I can speak for every citizen of this community—bid you welcome, because we realize that the ideals of the National Safety Council tend to make a happier life for all of us.

The Kansas City Safety Council, in welcoming you this morning, is realizing a hope of which we have long dreamed, and wishes to express appreciation to you for bringing your twenty-sixth Congress here, not because it is merely another large Convention, but because it presents a splendid opportunity for Kansas City and this Mid-West area to learn from the assembled delegates things that will make possible better safety records.

We are aware that the eyes, ears and minds of the entire nation are focused upon this Congress in Kansas City, with prayers for the success of its accident prevention program. Our Country wants this Congress to succeed in its purpose. Why?

Because America today realizes, as never before, the terrible significance of its huge accident losses. Because America knows today, as it has never known before, that its homes and its dear ones are threatened with their very lives.

This wonderful Safety Congress has the power, organization and unity to accomplish great things. The American people expect and have the right to expect that from this Congress will come a program adequate for their protection against death and tragedy by accidents.

Kansas City, on the evening of October 6, completed a year in which we had no fatalities to children 15 years of age and under, from motor vehicle accidents. This is a record of which we are extremely proud. The record as to motor vehicle fatalities to persons above this age is not such as we desire, but our record for 1937 shows an improvement in this respect over the same period for 1936.

With all public officials and civic organizations cooperating with the Kansas City Safety Council, we have made plans to the best of our ability to see that your visit with us is an enjoyable one.

Following Mr. Fennell's address the official welcome for Kansas City was ex-

tended to the delegates by Mayor Bryce B. Smith.

Address of Welcome in Behalf of Kansas City

By HON. BRYCE B. SMITH

Mayor of Kansas City, Mo.

For nearly eight years in my capacity as a city official I have extended this community's welcome to various and sundry conventions. Never before, however, have I ever offered our greeting to so important or so vital a group.

Your goal, the reduction of America's staggering accident toll, reaches into every home, every store, every office, every factory—it touches all of us in our daily lives.

You who are assembled here are the generals in the unceasing war on accidents, mobilized to devise new and more effective tactics in the national campaign against a common enemy who last year caused a casualty list of 111,000 killed and 10 million injured.

In your great, humanitarian undertaking you have not only the best wishes and blessings of this community, but of the entire nation, which has awakened to the staggering economic loss, the suffering and sorrows that are the results of needless and preventable accidents.

Kansas City is proud to be host to the twenty-sixth congress of the National Safety Council. We of this community feel that in honoring us with this convention, you have given national recognition to our efforts to make Kansas City safe.

And beyond a question of doubt, Kansas City is making a sincere and successful effort to be a safe community, and its citizens have become definitely safety-conscious. This result, I believe, is due to constant effort and close cooperation of our local safety council, the Chamber of Commerce and other civic organizations in preaching safety, and to the educational and enforcement activities of our city administration.

The city administration's part naturally is limited to the educational and enforcement activities of its fire and police departments and the traffic division of the public works department. We have made no effort to assume the duties and tasks that more

readily may be fulfilled by the safety council and other civic organizations, but we have been ready at all times to cooperate.

In our fire department we maintain an active fire prevention bureau, and frequent, checks of business, industrial and apartment districts are made in search of dangerous hazards. Our active fire fighting force is trained in one of the finest drill and life saving schools in the United States, and is equipped with the most modern apparatus.

In the police department an accident investigation squad is maintained with gratifying results. A training school is conducted for traffic officers and first aid training is given to all officers. By the use of an inter-district safety contest all uniformed officers have been brought into active traffic duty. Officers trained in public speaking give safety talks and show safety movies in the schools and to organizations. Enforcement of traffic laws is continuous, eliminating the necessity for sporadic "campaigns," and the most modern methods of enforcement, including portable short wave radio sets for the checking of speed, are employed.

Our traffic engineering division is directed by a competent traffic engineer. Surveys of traffic conditions are being made continually, based largely upon accident records; and traffic control signs, signals and markings are installed as indicated by facts learned from the surveys. More than 500 crosswalks are maintained for the protection of school children and raised concrete safety zones are being installed for the protection of street car patrons.

And what have been the net results of this concentrated campaign for safety? Per capita fire losses have been more than cut in half; traffic fatalities last year were 18½ per cent less than the average for the previous five years; and there has not been a child traffic fatality in Kansas City for more than a year. Such are the dividends of safety.

May I extend to all of you the best wishes

of Kansas City and all its citizens for a pleasant and enjoyable visit with us. We are proud to have you as our guests, and

we wish for you and your organization a full measure of success in your great and noble undertaking.

Unable to be present in person to welcome Congress delegates in the name of the state of Missouri, Governor Lloyd C. Stark was represented by Col. C. M. Casteel, Su-

perintendent of the Missouri State Highway Patrol. Col. Casteel read the address prepared by Governor Stark for the occasion.

Address of Welcome for the State of Missouri

By HON. LLOYD C. STARK

Governor, State of Missouri

It is a high honor and privilege to welcome the National Safety Congress and Exposition to the State of Missouri for its 26th annual meeting. Safety—especially safety on the public highways and on the streets of our cities—is a subject in which we are all interested. Anything that can be done to educate the people to a closer observance of simple laws and rules for their own protection, and for the protection of others, is of vital importance.

It has been said that the American people are the most wasteful people on earth. We have wasted our national resources until they are sadly depleted, and in many parts of the country all but destroyed. It is charged that we waste our money, our time, and about everything else we have! And in no direction is this tendency toward national wastefulness more noticeable than in the appalling waste of human life which is taking place before our eyes every day. One has but to glance at the headlines in our daily newspapers to gain an idea how many precious lives are lost and how many tens and hundreds of thousands of people are being crippled and maimed in the mad rush of haste and waste. And the pity is that so much of this slaughter and suffering—the greater part of it, I might say—is absolutely unnecessary and uncalled for.

Evidently and unquestionably, the time is ripe for a great nation-wide movement for greater safety—not only on the streets and highways, but in industry, in business; in our offices and in our homes. I am glad to see the National Safety Council and its

affiliated organizations have taken hold of this question in a big, comprehensive way. The program of this Congress is itself a very comprehensive outline of your work, with general and sectional meetings devoted to almost every imaginable kind of action, and I am sure much good will result from your deliberations of the next four days.

I am always happy to welcome visitors to Missouri. We believe we have something to show them. Right here in Kansas City you have a fine example of what can be accomplished by an active, intelligently-directed Safety Council.

You are engaged in the serious business of saving human lives—of saving human suffering—of saving human sorrow and tragedy. What business can be more serious or important than that?

Your business has its economic side too, of course. For in saving human lives, suffering and sorrow, you are, at the same time, saving millions and millions of dollars—for government, for industry, for individuals.

We believe you have chosen wisely in selecting a meeting place, for I am proud to be able to report to you today that Missouri is winning its war on accidents.

There are many items in Missouri's program of Safety to which we can refer with pride. Our highways are all designed for the maximum degree of safety, and our highway system is one which reflects credit upon the State of Missouri. Our State Highway Patrol, supervising the movement

of traffic upon these highways is the pride of every citizen of this State, and, notwithstanding its limited personnel, its effectiveness has been conclusively shown in so far as accident reduction is concerned.

With pride we point to the fact that we, a western state, have finally taken the first step towards the adoption of a state-wide driver's license law. While this law will not permit us to eliminate from the highways those drivers who should be eliminated as a result of failing to pass the fitting examination, still it is so worded that we will be able to take from our highways those individuals who, by their actions, prove that they are unfit to enjoy the privilege of driving a motor car.

It is fitting that you should have selected, for your first Congress to be held west of the Mississippi River, the State of Missouri, because our forefathers, in the establishment of this great commonwealth, selected as a motto to be written upon the great seal of this State, a phrase which today is being recognized by every state in the Union. The motto is, "The Welfare (or Safety) of the People is the Supreme Law."

I am told that this great Council started in industry and that only in the last few years has it launched into the field of public safety and home safety. In the field of

home safety we need special attention from the best experts in the safety field, when accident fatalities equal and sometimes exceed traffic fatalities. This record of accidents in the home is one which we are forced to face with considerable embarrassment. We are proud that Missouri furnishes to your national organization, one of the outstanding authorities on home safety, Miss Rosamond Losh, Director of the Children's Bureau of Kansas City.

In the field of public safety there are seated on this platform, and there are in attendance at this meeting, experts who are recognized all over the world, as being the best authorities on all phases of highway safety. There are participating in this Congress representatives from the automobile industry, who are bringing to you today reports of improvements which they have made in motor vehicles, all tending to increase the safety to the occupant of the vehicle, as well as the safety to others upon the highway. As the executive of this state, as host to this Congress, I urge you all to carry on. The records indicate that you are starting to win in this great humanitarian battle for safety to life.

I welcome you to our great State of Missouri. I hope your stay will be pleasant and your sessions profitable, and that you may soon come this way again!

In response Dr. Watson expressed his thanks and appreciation in behalf of the

National Safety Council. He then read his message to the Council.

The President's Address

By C. H. WATSON, M.D.

President, National Safety Council; Medical Director, American Telephone and Telegraph Co., New York City

It has indeed been a rare privilege to have served the National Safety Council as its president for the last two years. No one can occupy this post without appreciating the obligation and sensing its importance. Any contribution I may have made has been balanced many times by the personal experiences gained. These have made the holding of this office both profitable and delightful.

Looking back over the years I have been associated with the safety movement, and taking stock of the benefits received, I feel that none has been more important than the friendships established with those engaged in this great common cause. This applies not only to those who have been chosen to serve on your Executive Committee and in the Sectional Offices, but to all who are engaged

in the field of accident prevention. May I, therefore, take this opportunity of expressing my appreciation to my fellow officers and to the membership of the National Safety Council and the Council's headquarters' staff for their courtesy and consideration. No individual should be signalled out as deserving of special praise, but the loyal and devoted service of our thousands of members has given the safety movement a vitality and effectiveness which even economic stress has not been able to halt.

It is proper, at this time, to express on behalf of the entire membership, our appreciation to our Kansas City hosts. Here in the heart of America, we have found not only a welcome which is always extended to conventions, but a thoughtful understanding of the safety objectives and an appreciation of their social and economic values.

Since I last addressed the membership of the National Safety Council assembled at the Annual Meeting in Atlantic City, twelve months ago, an eventful year has passed. It has been a year marked by certain enviable achievements and the laying down of an essential groundwork on which to build the safety structure of the future. It was inevitable that there should have been some disappointments. The record of accidental deaths for 1936 and the projected estimates for 1937 of more than 100,000 of our citizens and the crippling of several hundreds of thousands of others can leave us little opportunity for self-congratulation. There has been a substantial increase in highway, home and occupational fatalities. However, there are forces and agencies at work which will eventually improve this tragic situation.

In this constantly changing modern world, we have yet to learn that the individual or the group which has freedom without discipline will eventually have some control measures imposed from without, either for self-administration or for administration by others. This would seem to be inevitable as we inspect the trend of our present accident experience.

Self-administration is always preferable, as self-intelligence then becomes the guide to personal performance. The most satisfactory accomplishments in safety which have been recorded by so many industries have been the work of comparatively small disciplined groups. Discipline, it must be remembered, should not be merely coercion, but bespeaks reliance on intellect.

It is true, an industry must have certain rules together with penalties for violating them, but I cannot believe that any outstanding safety record was ever established on penalties alone. A point I wish to emphasize is that a group imbued with the importance of an objective can often achieve astonishing results. Such a group invariably has not only such essentials as safe work places and safe materials, but also the leadership and supervision which inspire men to extra effort.

Transfer our attention for a moment to the field of public safety. We find the same principles of individuality involved but in a vastly more complicated and newer theater of operation. Rapidity of transport, from one place to another, has been an objective of mankind from the most ancient times down to today. For 250,000 years man, in the several areas of the earth where he sought to subject the environment and its contents to his advantage and wishes, has endeavored to get from place to place more and more speedily. The boat on swift water, the smooth surface runners gliding over ice or snow-covered hills, the wind-catching expanse of sails all gave short periods of perhaps excessive speed. But, it was not until the horse and certain other powerful four-footed beasts were utilized that the greatest feats of transportation became possible. Then it was that the horse or horses and the various vehicles devised prompted the possibilities of other sources of power.

For many centuries the races of mankind moved as speedily as possible, hither and yon, engaged in wars, business, recreation or simple transportation. The technique of the control of the horse and horse-drawn vehicles became, with few exceptions, quite adequate. Occasionally, horses ran away, sometimes people were killed and maimed by them or by the vehicles which they drew, but nowhere in the historical records do we find much comment about the morbidity and the mortality. There were no governors' committees, no department of commerce committees, and the police agencies were not greatly concerned. The desultory type of penalization for faulty highway conduct under this form of transportation seemed adequate. So entrenched in our recreation, science and business has the horse become, that we use and will continue to use the term "horsepower" as the name of the standard unit for measuring power.

With the coming of the internal combus-

tion engine, small units of energy were possible, doubling and tripling transportation facilities. Wheels, tires, steering devices, brakes and the hundreds of other complementary attachments which have been so important in the high development of the present day motor car are stirring memorials to the ingenuity of the motor car manufacturer in meeting the public's demands for speed, safety and luxury. Within a scant 20 to 30 years, our now civilized race of man, brought up for thousands of years to use quadruped transportation, has been obliged to care for and manage a new agency endowed with many horsepower. The speediest horse of a generation ago registered less than a mile a minute, controlled in a large degree by the pulling of the reins and the tones of the driver's voice. This is quite different from transportation possible where control through the touch of the hand or foot on levers or steering gear governs a machine which can go 80 to 100 miles an hour and can keep the pace all day long. Human reaction time tuned to the biological requirements developed over a hundred thousand years cannot be adequately adjusted to meet the situations which arise under conditions imposed by the super-speed of today in the course of a 20 to 30 year interval. We should, then, not be too pessimistic over the present deplorable record, but rather marvel that it is not worse.

Every motorist is an individualist, some of extremely rugged varieties, others grossly unfit for physical, mental and temperamental reasons, and still others can be classified as the great group of normal every-day competent drivers.

How individualistic all these forty million motorists may be is always going to be difficult to ascertain through any reasonable and economic plan for licensing. Many of these persons would not be allowed to operate a stationary engine, but are permitted, under very simple regulation, to drive motor vehicles capable of speeds up to 100 miles an hour. By and large, most of the physical defects would not be serious if the individuals were aware of them. Even more serious are the faulty mental and emotional attitudes. In other words, after a hundred thousand of years of relatively slow transportation, the motor vehicle has within a short period of time been thrust upon us and we have not been competent to meet the requirements of its safe operation.

Engineering skill has developed these wonderful machines and made them available at prices which make automotive transportation possible for practically every family. The motor car is here to stay, and it has affected our entire economic and social structure most profoundly. Viewing the situation as a whole, neither the highway systems nor the individuals who drive upon them are, as yet, equal to the safety demands which modern traffic imposes. Rebuilding the highways, the separating of groups of different classes of traffic and many other engineering improvements are most desirable, but such projects involve many years and staggering sums of money. Furthermore, we cannot overlook the fact that a large number of persons do not have at all times the exacting natural qualifications needed to drive a motor car at speeds of more than 50 miles an hour on any road.

Society, automatically, has provided a psychological laboratory where the various types of accident prone people have been studied and classified. They may be tabulated as follows:

1. The person with a marked hostility to authority. (There is a vast number of us unconsciously included here.)
2. The exhibitionist with insatiable craving for admiration, attention and acclaim.
3. The day dreamer.
4. The persons with well developed destructive impulses, and there are many such.
5. The great multitude of persons who suppose themselves to be normal, yet who on unpredictable occasions may take the characteristics of any of the previously mentioned four groups.

At work these types are restrained to some extent by their working environment, by supervision and by the influence of fellow-workers of more stable mentality and temperament, but on the highway away from these control influences, they may perform very differently. Our efforts, therefore, should be directed toward preventive rather than punitive legislation.

I can think of no better example of constructive legislation than the standard drivers' license laws which have proved their value in many states and in the formulation of which the National Safety Council has played such an important part. Of course, no test yet devised can detect all potential accident makers. A relatively small propor-

tion of them are so obviously unfit that they may be eliminated at the start on the basis of certain minimum requirements. Others will demonstrate their unfitness by their driving, often before they become involved in serious accidents and under suitable administrative policing be refused the privilege of driving. It is quite possible that such a procedure is more logical than the imposition of drastic penalties after the incompetent driver has caused death and destruction on the highway. We are not, however, recommending any relaxation of the penalties for gross violations, but it is to be remembered that the indiscriminate use of penalties will often defeat the purpose of legislation.

We have learned too, that adult education has very decided limitations and while child education through the schools has given a good account of itself, it cannot do the entire job of preventing accidents. Teaching children to cross the streets correctly is of the utmost importance, but it should be only the beginning of safety training. The inclusion of motor vehicle operation in the high school training has many advantages, but should not be limited to the purely mechanical side. Students must also learn the morals and manners of traffic, and it may be possible that in time the class room will prove to be the place where potential dangerous drivers are detected.

Much of our propaganda has been based on an appeal for greater courtesy. Too many people regard courtesy as something that can be smeared on like a cosmetic. Instead, it is usually an outward index of character. The road hog, the driver who weaves through heavy traffic, the chronic horn-blower and many other types would seem to have some character deficiency, some personality defect or aberration, the nature of which we are not able to predict in advance. As for the dangerous types, it is debatable whether the intelligent boor is more of a menace at the wheel than the mild moron.

Recently, appeals to fear have been used quite freely and we have read some appalling word pictures as to the results of accidents. The featuring of the fear motive must be limited in effectiveness, because if read often enough, it but serves to excite an undesirable morbid curiosity.

It would seem, then, that our propaganda needs the cooperation of the psychologist and other specialists in the vagaries of human behavior. Personality, exaggerated, de-

pressed or normal, owes its contribution to performance, to certain agencies of control the most effective of which are the natural ones, but with our growing civilization and its increasing hazards, artificial regulation, education and licensing are inevitable.

However, not all of the influences which menace safety are within the individual. Our development, particularly within the present century has been lopsided. We have accomplished wonders in the control of natural forces, but humanity's ability to live and work cooperatively has not kept pace with inventive genius. Science has released a host of new materials and processes of tremendous value to industry as well as in the mere matter of living. We are constantly learning of their value and at the same time we find that many possess qualities dangerous to health and even to life. This means research is necessary with respect to hazards as well as for the purpose of establishing proper methods of usage.

I cannot agree with those who feel we should declare a holiday on scientific progress. Nobody can ignore the strides that have been made in advancing man's physical welfare and the pressing need for still further progress. Changing customs and conditions demand it. I, for one, would hesitate to trust the removal of my appendix to the best surgeon of 1880, nor would I care to have my mouth decorated with the dentistry of that period.

Our progress in medicine and public health has been one of the brightest achievements of the past half-century. There are many social, economic and industrial fields that cannot boast of anything comparable in the way of progress. Middle-aged people often recall, with pleasure, the static calm of their earlier years, or what appeared to be calm as viewed in retrospect. But, if we take the trouble to read contemporary literature, we find there has been no millennium at any period. Our economic and diplomatic machines have groped more or less continuously and broken down at intervals even before mechanized and formulated methods were the vogue in industry. Those who bewail the dangerousness of certain things in this era forget that injustice and lack of consideration are not new.

Not so many years ago neither the public conscience nor civic pride were much disturbed over the high death rate due to typhoid. Many in this audience can remember

when certain industrial plants were aptly described as slaughter-houses and butcher shops, and neither the management nor the public were much concerned. Today, loose charges are frequently made against industries concerning the prevalence of accidents. In the great majority of cases, they represent but hearsay, poor judgment and even prejudice and ignorance.

Undoubtedly, we must continue to learn more about the new projects of the chemical age and interpret the recent advances in mechanics, pure physics and chemistry into forms of safety operation and production. It may be advisable, in thinking along these lines, to delay increases in motor vehicle horsepower until highways can be rebuilt to accommodate them and legislation and education formulated to insure the conduct necessary to handle them.

Turning from the many phases of the accident problem to the internal affairs of the Council, we find much that is encouraging. Never has the prestige of the Council been higher and never have the membership, the officers and the staff faced the problems of the day with a greater conviction of the need for organized safety work. The problems of the future are not different from those of the past. The same energy and enthusiasm will bring about their solution. The material services of the Council which were greatly curtailed, during the earlier depression years, have been growing steadily during the past two years.

The NATIONAL SAFETY NEWS and PUBLIC SAFETY have increased in circulation, advertising revenue and total number of pages. The INDUSTRIAL SUPERVISOR, the SAFE WORKER and the SAFE DRIVER are being used in industry in increasing quantities as aids to plant and fleet safety programs. The statistical publication, ACCIDENT FACTS, is finding an increased field of usefulness and has called forth favorable comments from all parts of the country.

Continuous work is being done to keep our own technical literature up to date. During the past year numerous Safe Practice Pamphlets have been reviewed and Industrial Data Sheets giving brief and authoritative information on industrial hazards have been made available. Our safety posters, News-Letters, Safety Instruction Cards and other service items have improved in quality and popularity.

The continued moral and financial support of the Automotive Safety Foundation and of the National Bureau of Casualty and Surety Underwriters has been of inestimable value in the promotion of child safety education in the schools and in the continued expansion of our public safety activities. This support has likewise enabled our field representatives to visit hundreds of communities in all the states, thus enabling them to develop comprehensive safety organizations and activities, and improve and obtain legislative enforcement of educational remedies for traffic accidents.

Especially encouraging was the result of the 1937 legislative campaign, in which the Council took a leading part working with public officers and many national and local organizations. As a result 13 new drivers' license laws were passed. Another noteworthy achievement was our symposium for safety organizers and managers in which 50 state and community safety directors received a week of intensive training. During the year several valuable pamphlets on community and traffic safety were published.

The distribution of the Council's income through the various channels of accident prevention work is receiving the continued attention of your officers. In a cooperative association like the Council there are likely to be differences of opinion on the emphasis which should be given to the various divisions of the accident prevention job. In our membership solicitation we have always made it clear that business and industry have a large stake in the prevention of public and home accidents as well as those accidents which take place in the industrial field.

On the average, an employee spends not more than eight hours in the day on his employer's premises. For the 16 hours he is away from the work place, the idea of safety fostered by the plant safety program must be supplemented by other safety activities both governmental and community. It has been the policy of the Council to spend about one-third of its income in what is termed "general safety." It has long been our hope that through philanthropy, memorial funds, foundations or a general appeal to the public, adequate sums of money could be secured to meet the issues presented to us. Our national problem, after all, is not so different from that of the industrial safety man.

We must have leaders and workers in every community. The men we need and the

men who are rendering outstanding services are busy men. There are many others, leaders in their communities, who would gladly serve if the opportunity were presented to them in its true public significance.

In conclusion, let me summarize some of our major problems as I see them.

For industry:

1. Increased attention to simple and often neglected fundamentals of safe-housekeeping, ventilation, mechanical safeguards, protective equipment. These have been repeated so often as to have become axiomatic. No industrial plant has yet reached 100 per cent on these most elemental requirements.

2. Skilled medical supervision for all workers.

3. Continued research in the industrial materials, processes and methods of protection, by governmental as well as by private enterprise.

4. Job training and supervision to meet present day requirements.

5. Participation in community safety programs and instruction in methods of meeting the hazards of home and highway as well as those of the factory.

Turning toward the broader national aspects of the problem, the National Safety Council recommends:

1. Cooperative effort of community and state organizations.

2. Promotion of laws which will remove a large percentage of the unfit from the highways.

3. Uniform fundamental traffic laws throughout the entire country.

4. Firm and impartial enforcement of reasonable traffic laws throughout the entire country.

5. Improvement of highway systems based on traffic requirements and financial considerations, realizing, however, that engineering, alone, is not a cureall for accidents.

6. Extension of child safety education to the high school with training in motor

vehicle operation as a part of youth's education for modern living.

7. Psychological and physiological research into accident causes and studies of the accident prone.

Safety is not independent, in fact, there are few conditions involving so many phases of our everyday lives. Only in recent years have we begun to realize its complexity. It embraces science in exactness from psychology to mathematics. Safety will profit by any raise of the general standard of both morals and intelligence and the safety movement in turn can help to raise these levels. It is our duty to be faithful to the truth and to scientific methods so that our authority is accepted everywhere. Publicity we must have if we are to reach the public with the message, but we must avoid the methods that bespeak sensationalism.

Progress is always fraught with danger. Progress in human society always means that something is being changed and that when we change something, we interfere more or less with the interests of others. If there are going to be any changes in human living, therefore, there must be taken into consideration the contributions which have been made to conduct, out of the distant as well as the recent past, and which have been responsible probably for racial continuity.

Safety perhaps is a state of mind. The safe machine, safe materials and safe processes, after all, are but contributions to this thing we call safety. They are entirely static and without function, until the human element is introduced. Safety, then, is a state of being. Patterns of conduct must be found, and this takes time. That is why progress in safety as well as in all other things is so slow.

Nevertheless, universal safety is well within the reach of human endeavor. It is purchasable as health may be purchasable. And, it may be attained through proper conduct. It waits upon knowledge, but also upon some imagination and greater courage.

We have many, perhaps most of the patterns of safety procedure available. Let us determine to put them to the maximum use.

Traver, and Walter D. Ladd.

Since the minutes of the last annual meeting of the Council had been printed and distributed, their formal reading was dispensed with.

The Executive Committee having appointed three inspectors of election, the chair appointed these men to act as tellers of the meeting.

They were Reyburn Hoffmann, George

Report of Nominating Committee

The chair called for the report of the Nominating Committee, which was presented by C. B. Boulet, chairman of the Committee, as follows:

"Complying with your instructions, we, the Nominating Committee, appointed by you, with the approval of the Executive Committee, and as provided for in Section 4, Article 7, of the By-Laws of the Council, and as further provided by Section 5 of Article 7 of the By-Laws, present herewith the report of the nominations for directors to serve until the Annual Meeting in 1940.

"The names of the following directors, whose terms expire October 11, 1937, are submitted for re-election: W. H. Cameron, James B. Douglas, D. D. Fennell, Howard B. Fonda, John B. Gibson, Otho M. Graves, W. A. Griffin, Harry Guilbert, Isaiah Hale,

Charles E. Hill, C. L. LaFountaine, Thomas H. MacDonald, R. B. Morley, Lew R. Palmer, A. V. Rohweder, G. E. Sanford, C. W. Smith, and W. E. Worth.

"The names of the following are submitted for election as directors: C. W. Dempsy, Frank H. Harrison."

No other ticket having been nominated, it was moved and seconded, in accordance with the by-laws, that the secretary be directed to cast one ballot for the candidates named, for the terms for which they were nominated.

The motion was carried. The secretary cast the ballot. The report of the tellers showed that 1815 votes had been cast for the nominees and none against. The chairman announced the formal election of the nominees.

Report of Resolutions Committee

Chairman Watson called for the report of the Resolutions Committee, and the following resolutions were presented by Past President John E. Long, chairman of the committee, and were approved by the delegates:

WHEREAS indications now are that more than 100,000 men, women and children will be killed accidentally in the United States in 1937 on highways, in the homes, in industries and elsewhere; and

WHEREAS this huge army of the innocently killed is as great or even greater than last year's human toll of accidents; and

WHEREAS increasing and continuing prosperity is bringing millions more men and women onto the highways and into factories, thereby greatly increasing possibility of accidents of all kinds; and

WHEREAS this situation throws the National Safety Council face to face with the plain fact that its job is growing continuously greater; and

WHEREAS the Council's figures prove conclusively that in localities and states where energetic, intelligent safety measures have been applied conscientiously and continuously, definite results have been ob-

tained in reducing traffic, industrial and school accidents; therefore

BE IT RESOLVED that the members of the National Safety Council, assembled at the National Safety Congress and Exposition in Kansas City, Mo., October 11, 1937, do hereby emphatically, unqualifiedly and militantly refuse to accept any suggestion that any such toll in death and suffering is inevitable; and

BE IT FURTHER RESOLVED that we also refuse to accept increased population or increased traffic or industrial activity as justification for more accidents or more deaths or injuries; and

BE IT FURTHER RESOLVED that we put this question squarely and without qualification to every state, city, locality, factory, school, home and individual in this country: "Do you actually want to reduce accidents?" And

BE IT FURTHER RESOLVED that the National Safety Council enlist every person or organization that answers "yes" to that question and lead them into even more relentless and vigorous warfare on carelessness and accidents of all kinds through the following specific program:

Public Safety

1. Take a fresh hitch in our belts on the Council's Five-Year Campaign to reduce accidents which was launched on a nation-wide basis January 1, 1936, defy the fact that the first two years of this plan have brought increases rather than decreases in accident fatalities, and wade in and fight all the harder to put this campaign across.
2. Work ceaselessly and fearlessly for better, up-to-date and uniform traffic laws and ordinances, especially standard drivers' license laws and standardization of signs and signals.
3. Fight for stricter, fairer and more intelligent enforcement of all traffic laws and personally support such enforcement at all times.
4. Create efficient safety organizations in every state, city and community possible throughout the country.
5. Work for more and better traffic engineering, with safer highways.
6. Demand regular inspection of all motor vehicles in properly equipped inspection stations, either operated or closely supervised by state or city.
7. Encourage, promote and actively work for intelligent safety instruction and training in all schools—elementary, high schools and colleges—and make definite instruction in safe driving compulsory for every high school student.
8. Probe still further through statistical, engineering and psychological research into causes and possible means of prevention of highway accidents.
9. Encourage and help every practical measure to increase safety on land, water and in the air, as well as in recreation and all public places.

Industrial Safety

1. Encouraged by the definite gains already made, go still further into the causes of occupational accidents and diseases and their remedies.
2. Drive home the fact to every designer or builder of industrial and other machinery and equipment that safety MUST be built into their products, else those products are unfit for use anywhere.

3. Step up our efforts to establish organized safety more securely in smaller plants, businesses and fleets, and at the same time continue vigorously our similar campaigns in the larger industrial plants.

Home Safety

1. Push a nation-wide and vigorous educational campaign to bring home to the housewives of the country the dangers and tragedy of home accidents, backing up this campaign with an intensive further study of the causes and remedies for home accidents.
2. Mobilize every interested agency in this drive for greater safety in the home and thus approach the housewife and other members of the household from every possible safety angle.

WHEREAS, This Twenty-sixth Congress and Exposition of the National Safety Council, convening in Kansas City, Missouri on October 11-15, 1937, promises to be one of the largest and most notable conferences in the history of the Safety Movement, an achievement made possible not only by the enthusiastic welcome of the entire citizenship of Kansas City and adjacent communities, but also primarily because of the forethought, careful planning and untiring cooperation of numerous civic organizations, trade bodies, technical and professional groups, prominent business and social leaders and others throughout this city, the State of Missouri and many neighboring States, together with the support of the press and of radio, all of whom have put into the elaborate preparations for this Congress a zeal and devotion inspired by a true appreciation of the vital importance of the Safety problem; and

WHEREAS, The membership of the National Safety Council, represented here by delegates from multitudes of communities in all parts of the United States, from Canada and from other countries of the world, is fully appreciative of the generous and thoughtful contributions of the citizens of Kansas City and its associates, and recognizes the great value of these contributions in furthering the Cause of Safety and in strengthening its protective influ-

ence for all persons, both in our own country and in other nations, wherever there is this lofty ideal of conduct for the preservation of human life; now, therefore,

BE IT RESOLVED, That a standing Vote of Thanks be extended to the Honorable Lloyd C. Stark, Governor of the State of Missouri; to the Honorable Bryce B. Smith, Mayor of Kansas City; to the Honorable Henry F. McElroy, City Manager; to Joseph H. Porter, Sr., General Chairman of the Congress Sponsoring Committee of the Kansas City Safety Council, together with all the heads of sub-committees and members of this Sponsoring Committee; to D. L. Fennell, President, and to all other officers and members of the Kansas City Safety Council; to Otto P. Higgins, Director of the Police Department of Kansas City, Missouri, and to all other directing heads and officials of Governmental Departments, the Courts and the various other units of the official life of this municipality where safety is a daily ideal; to Colonel B. M. Casteel and all members of the Missouri State Highway Patrol; to the Superintendent of Schools and other leaders of the educational forces of the community; to the Parent Teachers Association, the Women's Clubs, the Civic and Fraternal and all other societies and to the Churches of the city; to the Chamber of Commerce of Kansas City, and to all other powerful industrial, transportation and business interests of the city; to the newspapers, the magazines, the radio stations and other sources of publicity whose influence is incalculable in the Cause of Safety; and finally to the State Departments, Officials and others both of Missouri and of the neighboring States of Kansas, Oklahoma, Iowa, Arkansas, Nebraska and all

Chairman Watson then introduced Dr. Miller McClintock, Director, Bureau for

this great western country; and to each of them this Vote of Thanks is accompanied with the deep and sincere appreciation of the leaders of the Safety Movement throughout America, who understand the vast volume of work and of intelligent planning that preparations for this Congress have necessitated, and particularly because by this culmination of their efforts the true facts about accidents and the scientific methods for their control will be placed before the people of this city and State and of the whole nation, to which task this Congress of the National Safety Council is dedicated.

BE IT RESOLVED, That the sincere appreciation and thanks of the National Safety Council are due and are hereby extended to all the volunteer officers and to the Executive Committee of this body, who have given so generously of their time, their resources and their energies during the past year to the end that the Safety Movement shall be advanced, and whose counsel and active efforts have had such exceeding value in furthering the service and the prestige of the Council.

BE IT RESOLVED, That in recognition and deep appreciation of the long and distinguished services of Dr. Cassius H. Watson as President of the National Safety Council, during which this body has made such notable progress both in membership, in active service and in vital influence very largely through his personal devotion to the Cause of Safety, now therefore we join in extending to him a rising Vote of Thanks and herewith offer him the heartfelt good wishes of the entire membership of the National Safety Council.

Street Traffic Research, Harvard University, Cambridge, Mass.

Safety Today and Tomorrow

By MILLER MCCLINTOCK

Director, Bureau for Street Traffic Research, Harvard University

This great safety congress is not the manifestation of a passing and casual phase of human existence. It is prompted by motives

and instincts as basic as nature, itself, for it is said with truth that self-preservation is the first law of nature. But man, as an in-

dividual is no higher, in this respect, than the lower beasts for they, too, are endowed with this same instinct.

Man differs in that he has the intellectual capacity to band together for community action against common dangers.

Through all history there has been this unceasing warfare against the danger of the ferocious forest beasts, the danger of even more ferocious human enemies, of fire, famine and flood and those great and terrible powers of darkness. The race is old in its experience of self-preservation against the heat of the tropics and the numbing cold, the earthquake or the flaming forest or the deadly disease germ. By progressive knowledge, man has been able to wring a partial compromise from his environment. He may exist in the depths of the sea or in the heights of the sky. Famines and plagues less often invade his security. Acts of God are more benign.

But the battle has merely shifted to a new ground which has been chosen by man, himself. Herein lies the strategic advantage of the present safety defense. Increasingly, danger arises from man-made environment. With all of the age-old motives for common action and with all of the weapons provided by modern science, there is reason to hope that the time may come when man may live in peace with his surroundings. Let us, therefore, take new hope and redouble our energies.

Too much of our safety efforts in the past have been based upon pious but vague hope and upon furious though futile energy. The present enemy to safety is the product of our own scientific development and the instrumentalities for its defeat must be created in the laboratory.

To know a problem is half to solve it so let us turn our minds to an evaluation of our task and, thus, add knowledge to hope and energy.

Last year, more than 100,000 persons in the United States met a violent death through some form of accident—18,000 in their workshops, 38,500 in their homes—37,000 upon the public highways, and 20,000 in other public accidents.

To many, these are commonplace mortality figures, but to many millions still living they are the burning records of life-long tragedy. They mark the scope if not the depth of our problem. The very existence

of these statistical records is of the greatest significance for they not only measure the problem but, more importantly, show that we have thought it worthwhile to measure which is the first step in a scientific, factual approach.

Almost all of these accidental deaths were caused not by the powers of nature but by the ill-trained servants of mankind which we have not yet fully mastered.

It is not where we are, however, that counts so much as where we are going. What is the trend? In 1936 there was an increase of 11,000 accidental deaths over the preceding year, an indication, perhaps, of our increasing economic activity. There is a decrease in all classifications in 1937 save in those of occupational and highway deaths.

It is in this latter classification of highway deaths that one finds much that typifies all of the current accident problem. It is almost exclusively a product of our rapidly changing mechanical life. It has discounted the contributions of an otherwise good and faithful servant. It differs from other hazards in its inexorable quality. To a degree, one may avoid hazardous employment or recreation; he may use special caution in the protection of his home. But he must go forth daily to face all of the hazards of the public way. No active citizen can live a normal life without being a part of traffic and, cautious as he may be, he has little control over the actions of others. The problem, therefore, is not only universal but it is for community rather than for individual solution, with each citizen making his full contribution to the common protection.

There have been highway deaths through all the ages resulting from pedestrians being run over by wagons, by runaway horses or similar mishaps. The problem in its present form has become critical only in the last generation. It has arisen with such speed that there are inevitable maladjustments. In the first place, there was the change in velocity. Normal average speed of travel has been increased at least four-fold in the last 40 years. Protective reactions to the slow movements of a horse-drawn age are entirely inadequate for a motorized age. Split-second decision places greater demands upon attention and accuracy and greater penalties upon poor judgment. It is a great tribute to man's flexibility for environmental adjustment that he has succeeded as well as he has. This change, however, is only a small part of

the story. The real explanation of the traffic accident problem lies in the term "exposure."

In 1890 there were no automobiles, no automobile mileage and, therefore, no automobile deaths. The American people did travel, but in a very limited manner. Commodities and the major personal movements were by rail. Each year since the introduction of automobiles an increasing proportion of the nation's burdens has been carried over streets and highways. More and more of the total man-hours of the American people have been spent upon the highways. Today they own 28,000,000 motor vehicles, 40,000,000 citizens are regular automobile operators. Each year they pile up the almost unbelievable total of 500 billion automobile passenger miles.

The time of the nation has been increasingly withdrawn from other recreational and business pursuits onto the highways. One cannot imagine 40,000,000 people engaged in any pursuit, no matter how innocent and comparatively safe, for so many hours each day, without the inevitability of a larger number of accidental deaths each year.

This is not said to depreciate in any manner the seriousness of the highway accident problem. Any unnecessary or preventable injury or death from any cause is a challenge to the community whose first duty it is to protect its citizens. Nor does it matter that the motor car has so affected the character of American life that it has undoubtedly contributed to a more healthful outdoor existence, to longevity and to the actual saving of lives through the more expeditious handling of emergencies. Those who love automotive transportation and have devoted their lives to its advancement and the great majority of the citizens of the country who have so widely adopted it, will never be satisfied until it has been freed from all unnecessary hazard and inefficiency.

The goal of highway safety can be reached only by organized community action using all of the tools of our modern civilization. The expression "organized community action" should be taken with the utmost seriousness. Otherwise, failure is certain. Herein lies the real significance of the National Safety Council and this National Safety Congress.

So today we may view the public safety problem with greater hope for tomorrow than ever before, for never before has the

country been so well organized for effective action. One of the most significant steps ever taken in this field was the organization in June, this year, of the Automotive Safety Foundation under the leadership of Paul G. Hoffman. This organization places the full and potent influence of the great automobile industry in all of its parts behind the public safety movement.

This great civic leadership of the automobile industry is fortunately typical of the growing interest in public safety which is being manifested by other industries less directly concerned with the details of highway safety. Industrial executives are becoming increasingly appreciative of the fact that their efforts to protect their employees must extend beyond the factory walls. In many industries there are from two to six times as many injuries to employees outside of the plant as there are within. Organized national efforts such as have been made possible through the expanded program of The National Safety Council will inevitably have a deep effect in arousing a more intelligent attitude toward the entire safety problem.

It must be recognized, however, that national activities may provide only the leadership and the inspiration—as it were, the munitions. The actual fighting must be done by the citizens of each community. This they can and will do as has been proved so many times and with such great success, when they realize that they are participating in a civic activity that is of the highest humanitarian as well as economic significance.

With recognition of the problem, with an aroused public opinion and with effective organization the machinery for success is ready to work. What is it to do? How many great crusades have vanished in vague though sincere exclamations such as "The situation is serious. Something must be done about it!"

Here may be as good a place as any to examine the personal equation in our problem. Anyone would be quick to agree that if all street users were perfect we would have no traffic safety problem. But this is exactly like saying that if all human nature were perfect most of our human ills would disappear. For many years we have been laboring under the delusion that highway accidents are caused by a very small group of citizens; a small group characterized by physical infirmities, moronic intelligence, and vicious anti-social attitudes. This con-

clusion has been heightened by the fact that not more than about one-tenth of one per cent of our 40,000,000 drivers are involved in fatal accidents in any one year.

If it could be assumed that this same small group goes on year after year causing the trouble the problem would be simple. They would be quickly identified by their own acts as the "carriers of accident virus." The curable would be redeemed by educational or punitive processes and the incurable would be classified as hopeless and ruled off the highways. Vigorous action in any one year would thus give an almost complete solution. Put in this way one realizes that the assumption of a small band of malefactors is an impossible one.

No proper perspective of the problem can be had unless it is recognized that everyone of the 130,000,000 citizens of the United States is an accident-prone person, and that every active citizen is exposed.

Each of the 40,000,000 drivers of automobiles is in daily and almost constant potential conflict with each of the other 40,000,000 drivers and, what is more important with the 80,000,000 pedestrians who must make daily use of the streets and highways. One cannot read accident statistics year after year without recognizing that the problem is not limited to a small group but is universal in its implications. The escape of any individual is conditioned more upon good fortune than upon any special degree of skill or any particular righteousness of attitude.

This conclusion is enforced by a study of the records and personalities of those who are involved in accidents either the unfortunate victim or in many cases the almost equally unfortunate survivor. One finds in these records the occasional face of the degenerate, the brutal act of the reckless, the flagrant disregard of the rights of others, or the sordid tale of drunkenness. But, on the other hand, one cannot but be startled by the fact that those who make the great total of our street and highway victims are honest, normal law-abiding citizens going about their daily business with the exercise of reasonable caution.

Equally true, it is apparent that the great majority of those who are held blameworthy in traffic accidents can scarcely be classified as of the criminal class. Most of them are ordinary, average citizens, who have driven automobiles for many years without trouble

and to whom the idea of injuring a fellow human being would be entirely repugnant. Even though their fatal act may have involved some technical violation of the law, this violation is of the head rather than of the heart, and, in most instances, the worst that can be charged is an exercise of bad judgment rather than a fixed intent to jeopardize themselves or anyone else. If these conclusions be true and each year more fully substantiates them, then the entire public safety situation appears in a different light. If "Drive the fools from the highway" be a sound and honest slogan, then to a considerable degree all of the 130,000,000 citizens of the United States must stand indicted. Furthermore, the accident problem becomes a highly personal problem for every single individual. No one may feel apart and aloof from a relation to it because in normal respects he is a decent law-abiding person.

Let nothing said here create the impression that there should be any less vigor in the strong and firm punishment of those comparatively few who have proved vicious tendencies, but let us not be deluded into believing that they form an important part of our problem.

The principal difficulty in the drafting of automotive law, in the education of the public and in the enforcement of preventive measures is that the rules and regulations cannot be of a character involving specific question of moral right and wrong. A definite commandment, "Thou shalt not kill within the public way," would be concurred in by everyone as a sound moral principle, but it would have no effect whatsoever upon the accident rate this year or next. The great majority of the acts which would lead to a violation of these injunctions would in themselves create no sense of moral turpitude either on the part of the violator or anyone who might observe him unless they led directly to tragedy.

He who lifts his hand against his brother, or who steals his brother's wallet is conscious of a wrong doing, yet, despite this restraining conscience and legal penalties, the courts are full of such offenders each day. But he who drives with brakes a little less than good, or he whose lights are a little too blinding, or he who drives a few miles an hour faster than may be safe, or he who day dreams a little, has not even the warning hand of conscience to restrain him for he is conscious of no wrong doing.

Furthermore, except in the case of a flagrant violation under the eyes of an officer, and not always then, he is responsible to no man. He is a free citizen going about his lawful business upon the "King's Highway." He is no school child to be directed on his way home, and in most instances he is answerable to no employer should his acts involve him in difficulty.

In short we have not developed a set of good manners for our public streets and highways, controls of personal action without which almost any other phase of social relations would be intolerably difficult.

Safe and sound community habits and customs develop naturally by trial and error processes over many generations. Many of them become self-enforcing through social sanctions and others become embodied in the basic law of the race as witness the body of common law of the English speaking peoples.

But in a rapidly changing mechanical world we have no time to wait for such slow processes. We must act more quickly. Where shall we turn for speedy adjustment? Has not industry taught us the method? What has made it possible for the highly efficient and comparatively safe manufacturing processes of the present day to supplant older methods in scarcely more than a generation? Indeed, one may ask what has made it possible for an integral part of our problem, the automobile itself to be transformed from a rickety, converted huggy into the highly refined and inherently safe vehicle of the present day. These changes in practices and customs and resulting products have been brought about by the application of what may be called the scientific approach, that is, through research the application of every ounce of available technical knowledge.

This is the same type of approach that has brought about the degree of public health which we enjoy at the present time, which has entirely eliminated age-old scourges and promises to give humanity future surcease from such burdens as cancer and tuberculosis. Without the laboratory and the resultant preventive and remedial practices small pox, yellow fever, bubonic plague and typhoid fever would still stalk the land. Are these human ills more mysterious or complex than our public accident problem? The answer is obviously no, and thus there is every rea-

son to believe that it may fall before a similar attack.

Perhaps we have come to a turning point in our war on public accidents. Perhaps the time for solemn conferences, organization and the preparation of war cries is over. It is time to spy out the enemy's forces and his strength and to go to work.

The simple but astounding fact is that we have very little factual knowledge about the causal elements in public safety. Some of the elements of our ignorance will illustrate the point. Many people still assume the steering gear failures are the principal mechanical fault contributing to fatal accidents, yet this element is practically inconsequential. We talk boldly about speed as a cause of accidents but not a single competent study has ever been made of this element. There is no adequate knowledge of the so-called repeater class of drivers, yet much of the philosophy of safety activity has been predicated upon assumptions in this field.

Present statistical information though giving a broad knowledge of the scope of the problem gives no clear evaluation of causal elements in such a manner as to permit direct and specific remedial action. Each of the forty-eight States and the District of Columbia afford perfect laboratories for almost limitless scientific research, yet little or no use is made of the facilities.

These statements should not be taken as criticisms of past or current practices. Already the program of the National Safety Council is indicating the trend, and the activities of the United States Bureau of Public Roads show an enlarged recognition that broader and more accurate factual knowledge is required.

Education, Enforcement and Engineering must remain the principal channels of attack, but now one asks more insistently than ever before, "What shall we teach?" "How shall we enforce?" "What shall we build?"

With the fullest possible tribute to those who have labored so diligently in these fields they must be filled with a certain sense of futility and impotency. It is time to bring out the heavy artillery. But at best the siege is going to be a long one. We shall not achieve the objective tomorrow nor even the next day, but man's victory over his environment has always been a slow and patience-trying struggle.

Following Dr. McClintock's address Nicholson, Manager of Personnel, The Chairman Watson introduced A. A. Texas Company, New York City.

Industry Casts a New Safety Die

By A. A. NICHOLSON

Manager of Personnel, The Texas Company, New York City

The story of the National Safety Council is a fascinating story of hope, adventure, and romance in undertaking to build up an empire of human happiness through the complete understanding and the intelligent application of ever-changing environs related to American life. In addition to coming here and sharing in the fellowship of its personnel and in the fruits of its labor, we come to pay homage and tribute to this great international institution of safety service, which has been made possible largely through the whole-hearted and unselfish attitude of industrial and social leaders, and through their translation of the basic law of safety, which is the golden rule.

Starting without background or experience, and in a field beset by factors of resistance too numerous to mention, we find that the National Safety Council has grown into a service institution whose separation from modern living would closely approach the impossible.

This growth and development, so great as to surpass the understanding of even many who have been close to Council affairs, breeding its many angles of operation and its manifold complexities of administration, places it in the category of "Big Business," but its fundamental purpose and applied philosophy must catalogue it as the biggest business in the world, because of its importance to human life. This is the organization which gave to America and to the world the sound incentive for continuing life, unbroken and unmarred by accidents, and it has gone even further in that it has supplied, to a large extent, the necessary media through which this objective might be reached.

It has been my pleasure and privilege to observe the development of the National Safety Council during practically its entire career, and I believe it has effected as fine and as far-flung a selling job as the modern world has ever produced. In every organization, large or small, there is always projected

a shadow by some one individual, and as the shadow moves so moves the organization.

In the National Safety Council this shadow, in my opinion, has been largely its managing director, William H. Cameron, who, I think, should be accredited with being one of America's most successful salesmen. He has sold to America and to the world a philosophy of living that will not be equaled through the centuries to come. Imbued with a faith matched only by his courage, through years of painstaking effort, detailed explanation, primary education, and contagious persuasion, Mr. Cameron has brought into fruition the high ideals and lofty aspirations of managerial industry.

It was quite natural, some two decades ago when industrial America began to get into its longer stride, that the initial physical manifestations of the safety movement should have been reflected in the shadows of belching smokestacks. This, however, marked the beginning of a new concept of safety which occupied the 1440 minutes of every day around the face of the clock and which influenced every phase and angle of life.

It was quite natural that the need for practical safety and its consistent application followed the products that came from the factories and that were concerned with lightening the efforts of men and women, offering and opening new vistas of opportunity and recreation in the annihilation of distance and in the bringing of far places with the mere touch of a button.

Today the mental happiness and the material well-being of human beings in our country are influenced by a safety which begins in the maternity ward of a hospital and remains ever with them until they have been lowered into the grave. Its import, therefore, is beyond the understanding and appreciation of the human mind, for the road of life is obviously lined with peculiar contours of experience and a galaxy of colorful adventure.

Because of the pre-eminent importance of industrial safety and the fact that in the future, as in the past, much of this type of safety in modified form will be adopted for home, highway, and other phases of human life, it becomes imperative that the die which will stamp industrial workers "safe" as well as "efficient" be recast. Despite the discouragements of the last few years and the wails of many who have reached the end of the industrial trail, I prophesy that industry will move on through fields of romance and adventure and to greater objectives than she has ever dreamed of attaining before.

Let me take you back through the years to the crude manufacture of paint in southern France, and then on the magic carpet let me whisk you along the American highways and where busy factories employing more than twenty-seven thousand workers compete with the colors of the rainbow, in order that American homes and American lives may be made more colorful. Is this the end of the road?

Go with the archaeologists back to Egypt a thousand years ago, where the first crude images were cast in iron, and then step with me into the beautiful valleys of America where countless stacks emit flames from pounding furnaces that are melting and molding steel to build the bridges that span our rivers and make possible the highway for the iron horse—myriad stacks in the shadows of which labor more than half a million men engaged in this ever-growing empire of steel; and behind the men are more than three million women and children whose earthly happiness and material well-being depend upon keeping those smoke-stacks hot. Is this the end of the road?

Go back with me to a beautiful Chinese garden, four thousand years ago, when Si Ling Shi, the child bride of the third ruler of China, discovered the possibilities of creating beautiful fabrics from the silk-worm, and then span those forty centuries and follow the trail of textiles in America, from the coasts of New England to the cotton fields of the South, where millions of spindles never cease their whirring fabrication of commercial growth. Is this the end of the road?

Go back to the primitive jungles of Central America and trace the childish pastime of the inhabitants to the great rubber industry that has become so important to our social and business life—then stand by the side of any road and watch motorized America whip past

on its wheels of rubber, and ask yourself if this is the end of the road.

Go as far back as the building of Noah's ark, which was caulked with bituminous substances taken from the shores of the Red Sea, and then take a perspective of the gigantic oil industry from the Appalachian Valley to the shores of California, pouring forth its countless products which are so vital to the uninterrupted march of our industrial development. Is this the end of the road?

Listen through the past centuries to the prophet Nahum decreeing that chariots shall be made of iron and will travel close to one another, as brilliant as the sun and with the speed of light, and then visit the great automobile centers of America turning out the millions of beautiful and useful vehicles for rapid and pleasurable transportation, and even get into one of those cars and see it, in the course of your life, you can ride over the beautiful highways of America which are more than a million miles in length and which have been built at a cost of more than \$35,000 a mile—and see if you can find the end of the road.

Let's go out in that shower with Ben Franklin in 1752, when he drew lightning from the skies by means of a kite and confined it in a Leyden jar, and then close your eyes and think how many buttons you can push and how much can be accomplished through this hidden child in the universe which has been so ably harnessed through the desire of men to contribute to better conditions of living. Is this the end of the road?

Go back with me to that autumn day in 1830 just outside of Baltimore, when Peter Cooper made an attempt to beat a horse with a tiny Tom Thumb locomotive, and lost; and then, when you leave the congress to return to your homes, pause for a moment, as you are being whirled across the country at a terrific speed on wheeled luxury rivalled only by the most magnificent hotels in the country, and determine if this is the end of the road.

These comparative pictures may in a measure help to answer the question as to whether industry is stopping its march of development, or whether the accomplishments of the past are only an incentive to continue to greater things of the future.

And so I reiterate that largely out of necessity, and through the tremendous acceleration of mechanical life in America, coupled with a God-given desire to help others, safety was

born in the realms of mechanic; and safety will continue its primary development and expansion in this industrial empire. Through the munificent attitude of management, which recognized its responsibility for the physical well-being of the work force and realized that greater production was a natural corollary of contented minds and proper attitudes, coupled with the legislative experts from the industrial centers, who designed compensation laws in favor of more equitable relationships between industry and its workers, the safety movement has gradually assumed tremendous proportions.

It has been instrumental in bringing about harmonious relationships, representing today the most common ground in the whole realm of the industrial empire upon which men, regardless of their rank, vocation, or profession, may stand. And so it becomes quite natural that these forty-odd million workers, lost in the jungles of technocracy and bewildered by the chants and wails of the demagogues who sit in their high places, should be more impressed with the natural, inherent desire for security than ever before in the history of man.

Safety is a vital and integral part of that thing we call "security." It contributes to the security of being able to carry on at the bench or the forge, which makes possible the delivery of the paycheck; it affords physical security, which always reflects itself in a greater sense of human happiness; it affords greater continuity of employment, by adding to the economic possibilities of the organization of which the worker is a part; and assures him the opportunity of ever increasing his efficiency and productivity. Likewise, the modern safety program, which in truth is a translation of the ancient golden rule, has opened up to management new vistas of fertility in creating a sound and helpful attitude on the part of employees, an attitude devoid of any dominating or salvaging, and which is completely free from a spirit of paternalism.

Modern industrial safety presents to both men and management a sound economic platform in the unending campaign for more efficient production, and makes possible the establishment of a new kind of philosophy between those who guide and those who perform.

And so we shall find that industrial safety, emanating from the simple mold of a quarter of a century ago, will be cast into a new die which will stamp out better men who, in turn, will be able to build better business—men who are endowed with a strong sense of professional and vocational responsibility, coupled with a new sense of moral responsibility; men who will come to appreciate more and more that cooperation in safety is to be taken out of the category of sentiment and placed on a sound, practical, economic basis; men who will bring the smoke-stacks of the organization closer to the kitchen door of those who dwell therein; men who will be accorded the opportunity of continuing, with affection, to take care of their mothers; men who will be able to restrain young and happy wives from crossing the threshold of premature widowhood; and men whose children will be better fed, clothed, educated, and accorded opportunities greater than their fathers ever possessed in industry.

All of these conditions will be brought about by a well-conceived, practical safety program that will sweep aside the seemingly impossible and, on the clearing which emerges, erect newer factories and newer industries manned by better people.

This twenty-sixth congress will tell another chapter in simple yet forceful language with the hope of projecting clearly those primary principles and above all else of exposing its genuine human ideals and aspirations. Because of the intangible thing we call a soul, which in the final analysis makes us human, there will continue the consistent application of the common-sense fundamentals of safety, designed to conform to shifting conditions.

Regarding the trophies to be presented later to individual winners in the various sectional safety contests conducted by the National Safety Council, Chairman Watson said:

"I consider it in keeping with this auspicious occasion to pay tribute publicly to the

hundreds of member plants and millions of employees who participated in the sectional safety contests.

"One hundred and twenty-five bronze plaques and 90 certificates of merit will be officially awarded this week during sectional sessions to the group winners and

runners-up in the Chemical, Fleet, Inter-Council, Marine, Metals, Paper and Pulp, Petroleum, Public Utilities, and Rubber Section Contests.

"A display of the bronze plaques can be seen on the mezzanine floor of the Exhibition Hall. These trophies stand as mute evidence of the sincerity with which industry as a whole endeavors to conserve human life and limb.

"Even though each individual contestant cannot be mentioned specifically at this time, it is my pleasure and privilege, on behalf of the National Safety Council, and its Executive Committee, to extend congratulation and appreciation not only to the winners but also to all other competing units who are helping to improve the injury experience in their respective classifications."

ADJOURNMENT

Annual Banquet

WEDNESDAY EVENING SESSION

October 13, 1937

The annual banquet for National Safety Council delegates and guests was held in the main arena of the Municipal Auditorium with Dr. C. H. Watson, President, National

Safety Council, presiding. The results of the election of officers of the Council for 1937-1938 were announced. The list is as follows:

National Safety Council Officers 1937-1938

President—D. D. FENNELL, Consulting Engineer, Chicago, Ill.
Vice-President for Membership—HARRY GUILBERT, Director, Bureau of Safety and Compensation, The Pullman Co., Chicago, Ill.
Vice-President for Industrial Safety—FRANK H. HARRISON, Assistant Works Manager, International Harvester Co., Chicago, Ill.
Vice-President for Public Safety—HON. HAROLD G. HOFFMAN, Governor of New Jersey, Trenton, N. J.
Vice-President for Engineering—WALTER S. PAINE, Manager, Engineering and Inspection Dept., Aetna Life and Affiliated Companies, Hartford, Conn.
Vice-President for Safety Councils—A. V. ROHWEDER, Superintendent of Safety and Welfare, Duluth, Missabe and Iron Range Railway Co., Duluth, Minn.
Vice-President for Education—A. W. WHITNEY, Consulting Director, National Conservation Bureau, New York City.
Vice-President for Finance and Treasurer—C. W. DEMPSEY, Secretary and Comptroller, The Liquid Carbonic Corp., Chicago, Ill.
Secretary and Managing Director—W. H. CAMERON, National Safety Council, Inc., Chicago, Ill.

Among congratulatory letters and telegrams received and read at the banquet were the following:

"Please extend my hearty congratulations and warmest greetings to the National Safety Congress of the National Safety Council.

"I heartily commend the fine purpose which is drawing so many thousands of outstanding men and women to Kansas City—the militant, relentless battle to save human lives from needless slaughter and reduce suffering.

"We must not falter in our determination

to end this unnecessary sacrifice of human life. My earnest wish is that your organization will grow and prosper and become ever more successful in its fight for safety.

"Franklin D. Roosevelt,
 "President of the United States."

"Greetings and all good wishes to National Safety Congress of National Safety Council from almost 10,000 members included in our association.

"R. B. Morley, General Manager,
 "Industrial Accident Prevention
 Associations of Canada"

"Remembering with great pleasure your very interesting Congress in Atlantic City and regretting the impossibility to attend this year, I send on behalf of the Safety Service of the International Labor Office and in my own name best wishes for full success of your Twenty-Sixth Congress.

"David Vaage,
"International Labor Office,
Geneva, Switzerland."

Governor Harold G. Hoffman, of New Jersey, served as toastmaster.

Dr. Miller McClintock, chairman of the Motion Picture Traffic Safety Committee, announced that the committee's trophy for

the best theatrical film of the year carrying a forceful message of traffic safety had been awarded to "The Devil Is Driving," produced by Columbia Pictures, Inc. Carl Shalit, of Detroit, divisional manager for the film studio, accepted the David S. Beyer memorial trophy for the film company.

The address of the evening was made by Dr. James S. Thomas, president, Chrysler Institute of Engineering, Detroit, Mich.

The concluding address was made by the Honorable Walter A. Huxman, governor, State of Kansas.

Following the addresses a program of entertainment was presented.

ADJOURNMENT

After Work Accidents

THURSDAY MORNING SESSION

October 14, 1937

The session was called to order by Chairman Jolin B. Gibson, Publicity Director, Hawthorne Works, Western Electric Co.,

Chicago, and Vice-President for Community Safety Councils, National Safety Council, who introduced the speakers.

Getting Facts and Keeping Records on After Work Accidents

By A. G. BUNGENSTOCK

Director of Health and Safety, Western Electric Co., Kearny, N. J.

Production losses due to injuries outside the plant can be divided into two classes:

1. Injuries occurring to individuals whose daily output can be definitely measured.
2. Where the daily output of an individual cannot be definitely measured.

There are two factors which enter into the question of the effect of accidents outside the plant on production.

1. Production is affected in direct proportion to the number of days lost.
2. The incapacity of the employee after returning to work, as follows:

- a. Loss of skill due directly to the injury sustained.
- b. Loss of skill and rhythm due to inactivity during the period of incapacity.
- c. Additional costs due to time spent by supervisors in making out reports, loss of time and production by fellow workers, necessity for replacing the injured employee by one less skilled perhaps, with a corresponding decrease in output.

Obviously, if we could keep our people on the job every day with a minimum of time off, due either to accidents or sickness, we would save money, but there are several things that hamper such a program. First, every employee grants the right of industry

to insist that he work safely while on the job; but when we suggest that this safety be carried over after he leaves the plant, cries of paternalism result, and many of our employees think that we are interfering with their civil rights and liberties. Until industry can dispel these delusions, success in a plan of this sort cannot be achieved. But, if our employees can be sold to the idea that mutual benefits will result from a program of this sort, the battle is half won.

This selling job should be along the same lines as that employed in selling safety in the plant, stressing in particular, the monetary loss and the privations to which the family is likely to be subjected due to such a reduction in income. If care is exercised this question of paternalism can be forever squelched. Having established this mutual confidence, industry's next job is to determine a plan of action and that plan should be similar in many respects to the one now in use for the employees while at work.

Having determined that you are going to attack this problem of after work accidents the first thing to do is to supply yourself with ammunition, which in this case is represented by facts. The following are some of the things that you have to know if you are going to determine how this particular problem can be solved.

First, individual case records must be kept on which the following information should be recorded:

1. Name of Employee.
2. Country of Birth, or if American Born, Extraction. (Statistics have shown that certain racial types have more accidents than others.)
3. Department Number. (You will need this information to make a comparison between accidents at work and those occurring away from work. Is there a relationship between numbers of accidents and types?)
4. Home Address. (Is the geographical location in which the employee lives conducive to accidents? The type of home also may have a direct bearing on the number of accidents.)
5. Sex. (The increase in the number of women entering the field of sports has resulted in an increase in accidents.)
6. Occupation. (Does the person who is employed on a highly repetitive job during the day seek an escape after work by indulging in a greater number of outside activities than one who is glad to relax when he reaches home?)
7. Date of Birth. (What part does age play in accidents?)
8. Marital Status. (Insurance records indicate that married people live longer than single ones.)
9. Length of Service. (Which group of people is having the most outside accidents; the employees whose length of service is relatively short or the longer service employee?)
10. Rate of Pay. (What is the ratio of hourly rated to salary rated employees in your plant, and is there a relationship between this and the accidents which the two groups are having? The rate of pay of the employee will determine to a large extent the type of recreation in which he will indulge.)
11. Place of Accident. (Where are the majority of your accidents happening? If in the home, where in the home and what can you do about them? If on the street or on the highway, what sort of educational campaign can you conduct to reduce them?)
12. Time and Date of Accident. (Of the two-thirds of the day which employees spend away from work, at what hours do most of the accidents occur? Is there a

seasonal fluctuation, and if so, can you give any reason for it?)

13. Cause of the Accident. (Here we reach the crux of the whole situation. Are you getting true causes and not quasi-true? How soon after the accidents occur do you have an opportunity to personally interview the employee, or do you depend upon a written report? Does the employee's supervisor visit him to discuss the cause of the accident and the steps taken to avoid a repetition? Be sure to differentiate for the employee the difference between the cause and the responsibility for an accident. Have them analyze the situation and point out to you where the preventive measures should have been taken so that the chances of a recurring accident of the same type will be minimized.)

14. Was Employee Hospitalized? (This may not always be necessary, but certainly you want to see that proper medical attention is given so that the period of inactivity is reduced to a minimum.)

15. Nature of Injury. (What part of the body was affected by the injury? A study of the injuries received may influence the type of work the individual will do when he returns to work, and may even result in a transfer to a different type of work, due to his inability to adequately perform his old job.)

16. Did Permanent Disability Result from Accident? (In the case of a skilled employee, the nature of the permanent disability may influence his output for the rest of his life.)

17. Did Injured Report Accident Immediately? (If a successful campaign has been waged in the plant against the late reporting of injuries, then you should experience little difficulty in having your outside injuries reported at once. The dangers from non-reporting are obvious, namely, a high percentage of infection thus prolonging the term of inactivity.)

18. Reason for Not Reporting Immediately. (Here is a chance to do a two-fold job. If the employee is sold on reporting after work accidents immediately then certainly this should have a carry over when he returns to work, and you should experience no difficulty in having him report his at work accidents as soon as they occur.)

19. Date Returning to Work. (This is doubly important in the case of a prolonged

absence. Psychologists tell us that when an individual returns to work after a prolonged absence, our first job is to make sure that the initial job which the injured employee is given is a success. If the first job is a failure, we are told that there is built up in the mind of the employee an inferiority complex and this will very definitely hinder his progress on future jobs.)

20. Plant Injury Record for Past Two Years. (Is there a relationship between the accidents which an individual incurs at home and the ones which happen at the plant? Reams of literature have been written on the subject "The Accident Prone Employee." There is usually an underlying cause, either mental or physical in nature, which puts these individuals in this unfortunate category.)

You may think that all of the foregoing involves too much work, but if reliable results are to be obtained these records are necessary. From this wealth of information you can easily determine the comparison between company and non-company accidents in the following terms:

1. The number of cases occurring during any fiscal year.
2. If you have a benefit plan, then you will want to know the amount of money paid out to these individuals while absent due to accidents.
3. The number of calendar days they were away from work.
4. The amount of benefits paid per million hours of exposure.
5. Days lost per million hours of exposure.
6. The ratio of your non-company cases to company cases.
7. The ratio per thousand employees.

Then with these records you will be able to prove whether or not your rate is high enough to justify the expense involved in a campaign to reduce these after work accidents. Suppose that your statistics reveal that your non-company rate is from two to five times your company rate (this is the average for a number of firms which have been contacted and represents records dating back at least five years.)

In assembling this data your records will not be for comparative purposes of a great deal of value, until two or three years of experience have been recorded, but from then on they will become increasingly valuable and should be kept in as permanent a form as possible.

From this valuable data which you have compiled your next step is to analyze all of your after work accidents in order to determine the primary cause. This is necessary so that all of your energy can be directed at the focal points so that maximum results will be attained for a minimum of effort expended. I can almost predict the three primary causes into which the majority of your accidents will fall. My prediction would be that the three main classifications will be: automobiles, falls, and athletic injuries, in that particular order.

The gathering of all of these facts does not require a trained investigator, nor does the interpretation of them require that your staff include a statistician. But if you have in your organization an individual who is first of all really sold on this subject of safety and is by nature sympathetic he can be trusted to interview these people and with a little experience can soon gather and interpret all of the data that you will need.

What a Plant Can Do to Prevent After Work Accidents

By M. A. KOFFMAN

Secretary-Treasurer, Southwestern Portland Cement Company, Los Angeles, Calif.

Safety problems, insofar as industry is concerned, by and large, have been solved. Only 16 per cent of the number killed last year resulted from occupational accidents. This record is a tribute to the combined efforts of employee and management, who

hand in hand have successfully fought carelessness and who hand in hand have created better and safe working conditions.

Yes, I know, you think that when a man is on the job, he is under the direct supervision of management, and because of this,

the problem does not assume the complex nature as does the problem of preventing after work accidents. Then, again, you may be thinking, that a person trained in occupational safety is Safety conscious before or after work. Well, if you do think so, you are, I believe, twice mistaken, because in the first place the large majority of all of us are creatures of habit. This being true, it necessarily follows, some habits are good, some not so good, and some just plain bad. Chief among the good habits, is the Safety habit, and one of the worst among the bad, Unsafe habits.

So when management went in to make a plant a better and safe place in which to work, by means of well guarded machinery, stairways with handrails in place of ladders, supplying safety goggles, and well equipped first-aid stations, they did something—one of the biggest things ever devised—making better and safer plants in which to work. But they did not stop accidents until the bad unsafe habits were changed into good, safe ones.

And how was this accomplished? Not by control, not by threats, not by innumerable rules, nor by regimentation. It was accomplished through cooperation, salesmanship and understanding—understanding of right and wrong; discussion of problems, bulletins, contests and whatnot. It became necessary to invoke disciplinary measures, even to the point of dispensing with the services of a chronic unsafe actor now and then, the same as sufferers from infectious diseases are quarantined or isolated for the safety of others.

Now it is strange that a most excellent safe worker when on the job loses sight of his job safety habit when he leaves the plant. I came to know a very excellent fellow, whose life was wrapped up in making the plant a safe place for his fellow employees to work in, and he did a good job—but lo and behold—he bragged one day about driving a high speed car to cover a two and one-half hour trip in one hour and forty minutes, with a top speed of over eighty miles an hour! He risked his life, the lives of those in the car with him, and of unknown humans traveling the same highway. Why? Because he had not himself learned that Safety is a twenty-four hour job.

I had the pleasure of hearing Judge LeRoy Dawson of Los Angeles present his well

known, "Take your Time or I will." He hears traffic violation cases and has an opportunity to reflect upon this very important problem. He related the case of a school teacher who was stopped by a motor officer. She snapped, "What are you stopping me for?" "You drove through that stop signal," replied the officer. "There isn't any stop signal there," she retorted. "I have driven this thoroughfare for 10 years and I know." "Well"—said the officer—"let's go back and look." And there it was big as life, not only a signal with a Stop and Go flag, but lights and bells too. This same teacher, at work, was Safety conscious, but had not learned that Safety is a 24-hour job.

The housewife cleans a pair of gloves with gasoline. Static ignites the receptacle of liquid, and she is badly burned, marked for life. And just before the accident, she had accompanied her child to school to see that the kiddie safely reached her destination. A victim of not having the 24-hour safety habit.

The problems involved are not dissimilar to those industry meets and solves in plant accident prevention, except that these problems involve the employee and his family before and after work. Dubious are you? Well, don't be. It can be done—it should be done—and this is how I believe it can be accomplished:

Management should initiate the plan or program because employees look to management for leadership. Management, I take it, is interested in the welfare and success of their employees before work, when at work and after work. Why before work and after work, when not subject to supervision? Well, why Group Life, Accident and Health and Old Age pension plans? Why Loan and Legal advice plans? Why vacations with pay, and other plans, all of which have to do with before or after work, at least to the extent of sixteen hours out of twenty-four or, putting it another way, for two-thirds of an employee's time, management has sought to be helpful in the success and happiness of their lives, before and after work.

How should management initiate a plan? I am not going to give you a fixed method—because conditions vary in practically every case, and in different plants in as many different locations. Methods must be adopted to suit the individual problems encountered. In the second place, the obser-

vations made, assume that a plant has a reasonably successful Safety program in operation to prevent during work, or occupational accidents. So I shall not draft a "cut and dried" program, but will give you some observations based on experience: Any plan must not be overdone. It should be simple, but effective. It must find its way into the employees' homes. Routine or rule of thumb methods will fail because as time goes on, interest will lag.

Some few years ago I discussed Safe Driving with a group of interested men in one of our plants. Today, a large majority of the employees are members of a well organized "Safe Drivers' Club," in a city of a hundred thousand. These men are serious about this undertaking and their families are also much interested. Round table discussions of definite traffic problems, active interest and participation in Motor Vehicle Laws and Regulations are a few of the important subjects, among many others, in which this fine organization is interesting itself. The assistant sales manager was recently elected president of this club, succeeding the very efficient past president, the chief power plant engineer.

Just as I am preparing this paper, I am in receipt of a letter from the president of this Club, who says:

"At the present time, we are trying to extend Safety to the family, as well as to the individual members of the club.

"We are sending you Traffic Problem No. 1. This is being answered, and the answers will be opened at our next meeting. The blue print of the problem was taken to the chief of the county highway patrol and he answered the problem and sealed the envelope. His answer will not be opened until our meeting and we will then see how many members have answered this problem correctly."

A little over a year ago Jack Dempster talked to a group of some two hundred school children, ranging from fourteen to nineteen years of age. He spoke to them on a number of home and highway safety problems. Did he hold their interest? Were they impressed? You should have heard the thunderous applause at the conclusion of his remarks!

The fire department in a community where an industrial plant is located was given authority to inspect homes for fire hazards. Is this being effective in presenting ways

to eliminate fire hazards, thereby preventing accidents causing fires, with attendant loss of life, injuries and property damage? Of course it is proving effective.

The management of a middle western plant decided the monthly safety bulletin was becoming too much of a fixed routine printing press matter. He produced something new in the way of a smartly lithographed pictorial bulletin showing the kiddies and a motor vehicle, together with the attendant hazards. Did it go over big? Did it find its way into the employees' homes? Did the employees' families discuss and enjoy it? I'll say so!

Attractive safety calendars are effective. Why? Well, ask The National Safety Council why they continue to produce them? Demand for them—that's why.

Women's clubs afford a fine means to sell the after work safety idea.

Payroll checks present an effective medium. Yes, you are right—men don't keep payroll checks; they deposit or cash them. But they should be provided with a stub showing deductions, particularly those representing unemployment and old age pension. The stubs can be inscribed with a different home or highway safety message each payday, or even a small safety picture; a new one each payday—for example, a mother putting matches safely away out of the child's reach, and a simple title—"Protect children from fire."

And so we can make innumerable observations for discussion. Careful planning, diversified methods based on good advertising psychology, will produce results for twenty-four hours a day. Sell the idea in the same way you try to sell your products, and follow through—and I am sure you will be pleased with the outcome. Don't expect marvelous returns immediately; it takes time, horse sense and patience; and don't forget the follow through.

Yes, I know, management cannot force employees and families to observe after-work safe practices. Who wants to? All of us, I think, would like to prevent accidents, and management, having done its part in a fair, intelligent and sincere manner, cannot be expected to do more, so it naturally follows that the rest of the problem must be concluded by the employee and his family in co-operation with management.

But why and how? In the first place, I

think you will agree with me, that there are few men and women who do not believe in the law of self-preservation or who will not fight for their loved ones. This being true, then the employee's part in the battle to prevent after work accidents is to interest his wife and children in the work. His wife's job is to help him, and I am going to make this observation: Once a woman is sold the Safety idea, she will prove as good as her mate; in fact a better safety enthusiast. Why? Well, a woman's understanding, growing out of intuition, as a rule is much keener than a man, plus the mother instinct of sheltering and protecting the offspring, makes her an excellent subject to help carry out her part of the work. So the woman must discuss safety problems with her husband, and both help train the kiddies. They must observe home safety by following, yes, even suggesting accident prevention by offering means of eliminating hazards.

Well, mere words accomplish nothing—so Mister Employee and family here are

some observations for you to think about in order that you may accomplish your part in the prevention of before and after work accidents:

Subjects and suggestions presented by the management or included in their program, should be discussed once each week. If you think the idea a good one, act on it; if you don't think the idea a good one, tell the boss and tell him why.

Teach your children that Safety is as important as play. Crippled or dead children can't play.

Take an interest and when possible a part, in community effort to make the community a better and safe place in which to live.

When you drive a car, remember there are others driving the same highway, and that your dear ones may be riding in the car you are driving.

Observe moderation in all things.

Make up your mind the job of preventing after work accidents can be done—then do it, and follow through.

Highway Safety in Industry

By RALPH L. LEE

Public Relations, General Motors Corporation, Detroit, Mich.

Industrial accidents have been reduced to a point where it is said that workmen, as a group, are now safer at work than they are in their own homes or on the streets. It is perfectly natural, therefore, that those who have been so successful in reducing the number of accidental deaths and injuries *within* our plants should be much concerned over the increasing number of workmen killed and injured *outside* our plants on the streets and highways.

Recognizing this situation, the Detroit Industrial Safety Council, several years ago, appointed a committee to study the problem. Our committee decided to confine our efforts to stimulate among the employees of our members a desire to improve their driving skill and care. In other words, we decided to avoid finger pointing and blaming the other fellow for our present highway accident situation, and to concentrate the attention of our employees upon the safety measures each employee could do

something about, personally and immediately.

We concluded that if we could get each individual employee to take pride in his record of accident-free driving and walking, and as a member of an industrial organization, take pride in the highway safety record of that organization, we would do more for the safety movement in Detroit than we possibly could by meddling in the affairs of our city officials charged with traffic control and accident prevention.

In view of the fact that over 80 per cent of all industrial workmen in Detroit were employed by members of the Detroit Industrial Safety Council, it dawned upon us that we not only had a splendid opportunity of serving the members of our safety council and its employees, but we also had the most powerful means of tackling Detroit's growing highway accident problem.

Looking back over our experience in industrial safety, we knew the effectiveness

of safety contests, so we decided to organize a highway safety contest between the industrial plants of our membership. The contest was to be based upon reported accidents. At first we were inclined to include traffic violations with reported accidents, but the further we got into the matter the more impracticable it seemed to be, so we decided upon reported accidents only.

The difficulty of getting accident records from the police department at first seemed insurmountable, but we explained our objectives to the police and also the fact that we did not aim to meddle in their affairs, but hoped to help them with their safety educational problem. They were enthusiastic over our plans and went out of their way to cooperate—in fact, they changed their accident record cards in order to facilitate the work of the council, and put on the necessary help to handle the additional work our program caused them.

We knew from our experience with industrial safety contests, that the mere announcement of a contest, its rules, conditions and prizes, was not enough to gain the interest and support of individual workmen—promotional activities had to be carried on if the contest was to succeed.

Since employers have no legitimate right to control the activities of their employees after working hours, we decided that our whole safety promotional program had to be free from even the slightest taint of paternalism. We felt that since Detroit is the home of the motor car its industrial workmen were likely to feel that they understood automobiles and knew how to drive them, and would not receive the elementary safety precautions, cautions, admonitions, and corrections which burden so much of our safety propaganda today. So we decided to approach our employees as though they knew how to drive, knew something of the hazards of the road, intended to do right and were willing to adopt practical suggestions which would help them improve their driving skill and increase their safety.

We wanted the nature of our program to be positive instead of negative, to be conducive of efforts to improve, and above all to stimulate pride in safe driving as a sportsmanlike accomplishment.

Recognizing that the average industrial workman had been driving quite skillfully and safely for many years, and as a result

felt no great need for improvement, drivers such as these would not be inclined to spend much of their time and thought on the study of highway accident prevention. So we chose several basic themes for our program and decided to concentrate upon them, one at a time, for periods of at least three months each.

1. The fallacy and the danger of attempting to save any appreciable amount of time through reckless and illegal driving.

We understood from our police officers that most of the accidents occurring in the city were either directly or indirectly traceable to speeds out of keeping with conditions. Therefore, if we could prove to our contestants by facts and demonstrations that it was physically impossible to save enough time while driving through the congested traffic of our streets to justify taking even the slightest risk, we would be getting at the underlying cause of most of our accidents and prove the need for most of our traffic ordinances.

We staged what we thought a spectacular demonstration of this principle. Through the cooperation of the fire department, a fire truck drove three miles down Woodward Avenue from Grand Boulevard to the City Hall, through city traffic just as though going to a fire. The truck drove through nine red lights and disregarded most of the traffic ordinances. This racing trip took 7 minutes and 34 seconds, clocked on a stop watch by an official observer.

Later a safety car without any right of way drove the same route, but the safety car took the time to stop at all red lights, show others courtesy, give proper hand signals, and obey all traffic laws. This safety run was also clocked on a stop watch, and was found to take 8 minutes and 23 seconds. The fire truck saved only 49 seconds and proved conclusively that it was impossible to save enough time by reckless driving to justify taking even the slightest chance.

The lessons to be drawn from this test were many, and a project was started which will later develop into test runs over the most popular routes connecting our industrial plants with the residential sections. It is our hope that before we get through maps will be provided for our industrial employees indicating the best routes for men to use from home to work and work to home, and the safe driving time for each.

2. The second basic principle we decided

to advertise was the part inertia plays in starting, stopping, and turning a car, and the fact that this impersonal natural law is the foundation underlying all of our traffic ordinances.

We felt that if we were able, through stopping, starting, and turning tests, to demonstrate the impersonal nature of the physical laws which control all driving, we would remove the feeling many drivers have that many of our traffic rules and regulations were poorly conceived and designed by fanatics to interfere with personal liberty, and to prevent people from going where they want to go in a reasonable time.

3. The third and most difficult subject was pedestrian conduct. Difficult, because we knew that most pedestrians get into trouble as a result of doing the things they already knew were wrong, taking chances they had been taking for years without getting killed. We felt, however, that if we could bring out the relatively slow speed at which even the most agile person can walk or run as compared with that of the slowest speeds at which motor cars do run, we might visualize the helplessness of a pedestrian who carelessly places himself in the path of an oncoming car and the helplessness of a driver to avoid such a pedestrian. Here again we felt that if we could refrain from the usual hackneyed preachments, we might

cause our people to appreciate the chances they were taking.

The committee's plans were accepted and approved by the Detroit Industrial Safety Council, and the members of the Council, with few exceptions, accepted these plans and put them into effect.

The contest has run a year. A large portion of this time was taken in setting up the machinery and getting it into operation. In view of the fact that we have nothing in the past by which to judge the success of our efforts, and the short time the contest has been in operation, it is difficult for us to prove statistically the effectiveness of the activity. However, I am sure that the Council, its members, and the people of Detroit feel that the effort is well worthwhile, and will as time goes on help materially in the reduction of highway accidents in Detroit.

I will not relate the details of the program, as the National Safety Council has produced an attractive pamphlet on the subject including both the Detroit program and one similar now being carried out in South Bend, Indiana. In addition to this data I am sure the Detroit Industrial Safety Council, and the South Bend Safety Council, will be glad to furnish data and materials.

ADJOURNMENT

Agricultural Safety

FRIDAY MORNING SESSION

October 15, 1937

The session was called to order by Dr. David J. Price, Principal Engineer in Charge, Chemical Engineering Research Div., Bureau of Chemistry and Soils, U. S.

Department of Agriculture, Washington, D. C. Dr. Price spoke briefly on the subject under discussion and introduced the speakers.

Urgent Need for Program on Agricultural Accident Prevention

By DAVID J. PRICE

Principal Engineer in Charge, Chemical Engineering Research Division, Bureau of Chemistry and Soils, U. S. Department of Agriculture, Washington, D. C.

Large losses of life and property result from fires in the rural sections of the United States. The Farm Fire Protection Committee of the National Fire Protection Association states that at least 3,500 lives are lost each year as the result of fires on American farms—about ten every day. The annual property loss from these farm fires has been estimated at approximately \$100,000,000. This means a so-called "fire tax" of about \$16 on every farm in the United States.

When we add the annual loss of about \$125,000,000 for fires in the rural towns (2,500 population and under, non-farm territory) we have the enormous total of approximately \$225,000,000 as the annual bill for our farm and rural community fire loss. This fire loss in the agricultural sections of the United States in 1936 was over 70 per cent of the entire national fire loss.

Agricultural Accident Deaths

Although farm and home accidents outnumber all other accidents, they have not, up to the present time, received the attention given to construction, manufacturing, and similar lines of accident prevention. For instance, the American Red Cross reports that more persons are accidentally killed

while at work in agricultural pursuits than in any other occupation. During 1936, fatal work accidents in agriculture numbered 4,500, compared with only 2,300 in manufacturing and 2,800 in construction activities.

In general classification of all occupations by the U. S. Census Bureau, the relative number of persons engaged in farming is second in numerical order. The annual accident death-rate per 100,000 workers for the total of all occupations, including agriculture, is 32.8; but for agriculture alone the accident death-rate is 42 per 100,000 workers. This exceeds by 9 accidental deaths the total accident death-rate for all occupations.

Farm Accidents in Kansas

The State of Kansas has been outstanding in giving direct attention to the farm accident problem. A seven-year study (1930-1936) of fatal farm accidents in that State showed that 50 per cent of all the industrial deaths occurred in agriculture. The accident death rate was 50 out of every 100,000 engaged in that occupation. Over 6 per cent of all accidental deaths in the State arose out of farm work.

According to Kansas Health Department reports for the period 1930-1936, the causes

of the fatal work accidents on the farm during those years can be classified as follows:

Hazard	Per Cent Deaths
Machinery	29
Animals	20
Excessive Heat	12
Vehicular	8
Falls	9
Lightning	5
Other Causes	17
Total	100

There are several cases on record of loss of life caused by suffocation of persons entering farm silos. A recent accident of this type occurred on a Maryland farm in September, 1936, when a mother and nineteen-year old daughter lost their lives in attempting to rescue a nine-year old child who had been overcome by the gases present in a pit silo. The loss of these three lives attracted wide attention to this type of farm accident.

A study of silo gas accidents shows that in the gases present there is a depletion of oxygen and an increase of carbon dioxide due to the active fermentation of the corn ensilage. The oxygen content is usually very low with a very high percentage of carbon dioxide.

The greatest danger comes when large quantities of carbon dioxide gas are generated during the fermentation that always takes place during the storage of fresh material for ensiling. Because of the presence of this suffocating gas, care should be exercised on entering silos during the storage

period. This fermentation process, which begins immediately, may continue for several days. The increase in carbon dioxide, together with the actual lowering of the oxygen content of the air, often results in a mixture of gases that will not support life, and persons entering the silo are in danger of suffocation. The Chemical Engineering Research Division of the Bureau of Chemistry and Soils has available published recommendations and procedure for the prevention of silo gas accidents which can be secured upon request.

Safety for Rural Schools

The tragic disaster last March in which three hundred children and teachers were killed in the Texas schoolhouse explosion has definitely emphasized the need for safety in the construction and operation of rural school buildings. The modern consolidated rural school is rapidly replacing the little red country schoolhouse. The New London tragedy has shown that provision must be made for compulsory building and fire inspection of schools in rural areas to afford the same protection as in the urban centers.

The Department of Agriculture, at the request of Governor James V. Alfred, cooperated with Texas State officials in the investigation of this disaster, which created nation-wide interest. The final report of the investigation together with recommendations for the prevention of explosions of this character in schoolhouses and public buildings has been published as U. S. Senate Document 56. Copies can be secured from the Chemical Engineering Research Division of the Bureau of Chemistry and Soils, Department of Agriculture, Washington, D. C., as long as the present limited supply is available.

What Are the Outstanding Causes of Agricultural Accidents?

By J. C. MOHLER

Secretary, Kansas State Board of Agriculture, Topeka

Machinery and livestock are the outstanding causes of agricultural accidents, the two together accounting for approximately 60 per cent of all mishaps on the farm. Machinery is first by a wide margin, or more than 38 per cent of the total, and livestock next with 20½ per cent. Falls are listed third,

with close to 15 per cent, and the simple chore of getting in the winter's wood claims 7 per cent. The remaining 13½ per cent of accidents have miscellaneous causes.

Converting these percentages into numbers on the basis of the best and latest data, it would appear that the total of farm accidents

in the United States, as a whole, amounts to 109,000 annually, of which 4,580 result in death. Of these accidents, machinery is responsible for 41,420; livestock for 28,885; falls for 16,350; wood-cutting for 7,630; and various other causes for 14,715.

These findings and estimates are derived from a recent Kansas survey showing one accident to every 62½ farms, a death rate of .144 and permanent disability rate of .271 per 1,000 of farm population as applied to the national census of farms and rural population for the same year.

Inasmuch as the number of farm deaths arrived at by this method of calculation very closely approximates the report of the National Safety Council, it would seem that the accuracy of the process was pretty well verified and the fact more firmly fixed than ever that agriculture is the country's most hazardous industry.

The latest nation-wide summary of accidental deaths by industries, as reported in the 1937 edition of "Accident Facts," shows agriculture leading with 25 per cent; followed by trade and service, 23 per cent; construction, 16 per cent; transportation and public utilities, 14 per cent; manufacturing, 13 per cent; and mining, quarrying, oil and gas wells, 9 per cent.

But, a computation based on the Kansas census, which went into the farm end of the subject much more extensively, showed, in addition to the terrific fatalities, a tremendous annual national rural toll of 8,618 permanent cripples and a time loss, because of disabilities, aggregating the stupefying total of 5,368,000 days, or 14,707 years in a twelve-month, to say nothing of the vast expenditures for medical attention, doctors' fees and other services.

If permanent cripples and time lost are relatively higher in agriculture than in the other industries, as there is every reason to believe, then the farm accident problem is one of the most acute facing this country, and undeniably it is one of the most difficult to solve.

The same human element is there as elsewhere, but lacking is the influence of public sentiment and legislative enforcement, and absent is the penalizing force of rules that govern safety practices in other industries. With the farmer it is purely an individual problem, and greater safety within the bounds of his own holdings can be at-

tained only by making him more accident-conscious.

That there is ample room for improvement in the rural situation is indicated by the consensus of surviving victims themselves that a majority of farm accidents can be avoided because they are due to the principal cause of mishaps everywhere, carelessness.

Improvements Create Problem

It seems, too, that inventive genius is making farm safety a more complicated rather than a simpler problem. That is borne out by the analysis of the latest Kansas census, which shows that 23 per cent of all farm accidents were attributed to engine propelled machinery. Under this classification, injuries from autos come first, closely followed by tractors, to which the big majority of fatal accidents are ascribed, with trucks listed next.

Many mishaps occur in the operation of combines, corn binders, listers, threshers, silage cutters and small grain binders. The auto, the tractor and the combine most commonly inflict their injuries when the would-be operator attempts to crank the engine.

There is no doubt that the big opportunity for reducing agricultural accidents lies in better safeguarding farm machinery and in greater care and skill in its operation. The manufacturers of farm equipment and the users of it both have a heavy responsibility in making agriculture a safer industry.

In our survey in Kansas, a number of bitter complaints were encountered regarding lack of adequate safe-guards on machinery. Fault was found particularly with unguarded gears, chains and belts, lack of safety clutches and disregard for comfort of operators. This question was brought to the attention of the Farm Equipment Institute and the National Federation of Implement Dealers. The latter, at its next annual meeting, took a sympathetic interest as expressed by resolutions adopted, as follows:

"Realizing our responsibility and that of the manufacturer to our customer, the American Farmer, and that the use of more power-driven equipment has greatly increased the hazards of its operation, we most strongly urge upon the manufacturer the need for providing proper safety devices for the protection of the operator of such equipment."

The Farm Equipment Institute, the na-

tional organization of the manufacturers, went on record by formal resolution, thus:

"WHEREAS, Every manufacturer of farm operating equipment realizes fully his responsibility to safe-guard adequately his products and

WHEREAS, Farm machines are now so designed and built as to minimize the possibility of accident to the careful operator, therefore be it

RESOLVED, That we commend the efforts which have been and are being made to safeguard all farm machines. We suggest that all manufacturers and dealers use their best efforts to educate the users in the proper handling of farm equipment so that the farmer himself by exercising due action and diligence may avoid unnecessary and unfortunate accidents which are the direct result of carelessness or negligence."

In a serious matter such as this, neither side should pass the buck, but should carefully study the situation and mutually undertake to devise methods for its improvement. Manufacturers and farmers would do well to have their chosen representatives meet and go over this problem together. No doubt manufacturers are concerned about keeping costs down, but I have yet to encounter a farmer who would not willingly pay the additional price for safer machinery.

Negligence Is Factor

On the other hand, many accidents are due to incompetent and negligent operators. Everyone who presumes to operate power machinery should be thoroughly acquainted with it and know or be taught how to run it.

The idea has been advanced that manufacturers could greatly aid farm safety by sending their experts each year to selected points throughout the country to conduct schools of instruction for dealers in the operation of machinery; dealers in turn could conduct community schools for their customers. This seems an excellent practicable plan.

But farm hazards other than machinery amount to 62 per cent of all. These must be reckoned with. The kicking horse and mule seem the most dangerous of our farm animals; falls on the farm are most frequent from loaded wagons; gasoline is the most potent explosive handled on the farm; sodium chlorate used in the form of a spray

to kill noxious weeds when allowed to dry on clothes and materials is highly flammable; and there are countless other things that must be guarded against to reduce mishaps to the minimum.

One of the most shocking and tragic revelations of the Kansas survey has been the accident mortality of farm children, which is charged almost wholly to carelessness superinduced by over-indulgence of peculiarly fond parents. Children want to be grown-ups and do as grown-ups do. We coddle their ambition and often gratify their desires to please them, even though we know that the act of doing so is foolhardy. This has led to many sad incidents on the farm.

It should be everlastingly emphasized that in satisfying vanities of the little ones, the utmost care be used and extreme caution be exercised. Children have a way, too, of getting into the most unexpected places.

On the farm a close bond exists between father and son, and not uncommonly from his first step the lad is at his father's heels—boon companions. But it can hardly be argued that this should lead so far as to permit the son to ride with feet extended forward over the fender of the drive wheel of the tractor. Such a ride was fatal to a Kansas boy of nine the past year, and another lad of eight narrowly escaped a like fate.

A loss of life is always deplorable, but nothing in our Kansas surveys wrung our hearts as did the reports of accidental deaths of two baby girls, one killed by a tractor, the other killed by a truck. We volunteer here and now, and it cannot be urged too frequently nor too strongly, the admonition: *never start an automobile, tractor, truck, or even a horse-drawn implement, while children are about, until you have made sure that a life is not endangered.*

The prevention of accidents is not a matter of teaching safety to a limited number, but is something that must be drilled into everybody, for everyone is charged with a responsibility there is no escaping.

It is a rather melancholy fact, however, that many farm accidents are unusual.

Many Unusual Mishaps

It must be admitted that much of the unpredictable does occur throughout the seasons on the farm—a horse at normal gait may, without warning, go off stride and unseat his rider; a constantly used tractor may, for no good reason, become rebellious;

a bolt or rivet may shear off without a moment's notice, thus throwing an otherwise normal machine into disorder and endangering the operator's life.

Such simple things as a flapping coat tail, the presence or absence of a glove on the hand, the fraying of a belt, the rustling of a piece of paper or of some plant growth often are the direct cause of accidents and injuries.

But, it is clear that more than half of the farm accidents may be prevented by the exercise of vigilance and care.

In Kansas, we have gone far enough in our farm accident work to embark on a long-time agricultural safety program. We have taken two state-wide farm censuses, in a house-to-house canvass by township assessors who annually gather data as required by the State Board of Agriculture and in compliance with law. It is believed that what these censuses show may be typical of the experience throughout the prairie states region and indeed may also quite faithfully reflect the situation wherever modern agriculture is practiced.

The Kansas surveys were conducted with two principal objectives in view—first, to secure authentic information about farm accidents and their causes; second, to provide, conceivably, a sound foundation for prescribing and applying effective remedial measures.

The first objective has been attained, to our satisfaction at least. The principal facts given in this paper are from the Kansas census, supplemented by data particularly relating to accidental deaths from the National Safety Council and the Kansas State Board of Health.

The second of our objectives, therefore, now becomes of primary importance, and it is our opinion that adequate data are available to intelligently chart a course of action. At any rate, Kansas has undertaken to develop a systematic statewide program to promote farm safety and reduce agricultural accidents.

What is needed is to get the facts about accidents into the hands and heads and hearts of every farm family, an educational campaign that will reach every home. The question is, how can the individual best be educated and made accident-conscious and what are the most effective ways and means of accomplishing these ends?

In Kansas we have laid out a plan that we believe will get results. The State Safety Council, some years ago, made farm accidents a part of its program, and through Mr. Jesse Greenleaf, who has ably served as its president from the beginning, a special state farm accident committee was recently appointed to work out and put into effect a comprehensive program that will carry the message of farm safety to every rural family in Kansas. This committee is composed of the State Superintendent of Public Instruction, the State Leader of 4-H Clubs, the State Supervisor of Vocational Agriculture, the Managing Editor of the state's leading farm journal, and the Secretary of the State Board of Agriculture.

It is the intention to enroll the youths of the state in this undertaking, through the schools, the 4-H Clubs, Future Farmers and the Boy Scouts, believing in this that we can emulate the success that has been achieved in many other directions through energetic youths who have so profoundly influenced their family circles in amazingly helpful ways. Farm organizations and other available agencies are prominent in the plan.

Thus the step has been taken to place in every farm home an ardent champion of farm safety who is thoroughly posted as to the principal causes of farm accidents and qualified to safeguard against them, and with the further aim of having safety taught in every rural school.

From our experience, if I were called upon to make recommendations for an anti-farm accident plan, I would suggest:

1. A full-time paid state director.
2. A farm accident survey.
3. Prevention program based on best available information.
4. Organize rural youths to carry program to farm families.
5. Cooperation of farm organizations.
6. Teaching of safety in public schools.
7. Community schools of instruction in machinery operation.
8. Literature giving concisely farm accident facts.
9. Publicity—press, radio, movies, meetings, signs posted conspicuously.

It is incumbent upon all states to perfect the best possible safety organizations, for the tremendous annual toll of life, suffering, disability and economic loss taken by farm accidents is unwarranted. The majority of these losses may be prevented.

Farm Fires and Their Prevention

By W. D. JAMES

President, James Manufacturing Co., Fort Atkinson, Wis.

The United States Department of Agriculture estimates that in this land there are 6½ million farms with 48 million buildings. With their contents of produce, livestock, and machinery, the insurable value is estimated at more than 23 billion dollars.

The barn is the factory on the farm. This factory is to the farm what the manufacturing plant is to the city.

All farm buildings lend themselves to destruction by fire, wind, lightning, and deterioration.

Today 96 farm buildings will be destroyed by fire somewhere in the United States! Every 24 hours this devastating toll is exacted in this land. According to the National Board of Fire Underwriters, a farm structure succumbs to fire every 15 minutes.

The annual loss is estimated at upwards of \$100,000,000, or about one-third of the total yearly national fire loss.

This shattering of a farmer's hopes every 15 minutes destroys 2,880 buildings every month, 34,560 every year. Some 3,600 human lives are sacrificed in this funeral pyre. And that is not all. Tens of thousands of cattle, sheep, hogs, horses, and chickens are also destroyed each year. The blood lines represented in a lifetime of breeding and selection—whole herds of beautiful dairy cattle, and other animals—are wiped out. The farmer's livelihood, together with his hopes and ambitions, are sacrificed.

There is an estimated annual toll of fire caused by spontaneous combustion of \$30,000,000.

In fires due to lightning, the annual toll is estimated at \$12,000,000.

Fires in which the cause is unknown bring the yearly total well above \$100,000,000.

Because these terrific losses are scattered over wide areas, often in isolated places, the true extent of the tragedy is seldom fully realized. Due to the isolation, fire-fighting facilities are rarely available to farm people. There is an average of 7½ highly combustible buildings per farm. A barn or other structure which catches fire is usually doomed to complete destruction. Insurance rates are naturally high for ordinary farm buildings.

Because of this fact, seldom is a farmer protected with full coverage. Even if complete protection were carried, every burned-out farm structure represents its value in wealth definitely destroyed, never to be replaced. Insurance, though highly essential, replaces no lost wealth. It merely distributes the loss among many policy holders.

Water in sufficient volume is rarely available to fight farm fires. Even in case of an abundant water supply it has been proved futile to combat a raging hay fire. The doomed structure is usually a total loss, and all that water can accomplish, in most cases, is to confine the fire to the burning hay barn.

In addition to the above named farm hazards, there are cyclones and windstorms, which take an estimated annual toll of \$40,000,000.

Deterioration—sun, snow, sleet, rain, and weather conditions of all kinds—take their estimated annual toll of \$240,000,000.

The National Farm Building Destruction Company has as its proprietors Messrs. Fire, Wind, and Lightning, challenging Agriculture annually by collecting a toll of \$400,000,000 from our farmers.

What can be done to reduce this appalling toll? The old hay loft over the stable is responsible for a large share of this loss. Leguminous hay crops, to be of real value, must be harvested with a reasonable moisture content, if the delicate protein-bearing leaves are not shattered and left in the field. If placed into hay loft storage with too high a moisture content, there is always the danger of self-ignition due to overheating in the curing process. When a barn is thus spontaneously fired, the entire structure is doomed, often including valuable livestock, all crops, and equipment.

Aeration of the hay mow to liberate excess heat, gases and vapors, was never feasible where bulk hay was stored. The cost of providing ventilation flues for such large masses was prohibitive.

The modern way is to store the crops in iron ventilated containers and house the livestock in no-storage, one-story stables.

Chopping hay and blowing it into storage, a practice in use for many years, because it requires only about one-half the storage space needed for whole hay, offered new possibilities.

Chopping hay does away with the hardest, most disagreeable farm task, that of mowing hay in a hot, dusty loft. With distributing pipes, the placement of which is occasionally changed or re-directed, a loft may be easily filled. Because of the greater density of chopped hay, however, it is highly important that it be stored in small masses, to allow aeration. If the hay does not actually heat to the firing point, there is danger of nutrient destruction in a browning process.

Some years ago we were privileged in pioneering a new type of storage unit to handle forage crops. After diligent research our engineering organization used a cylindrical structure as the solution. This structure was built of iron, heavily zinc coated for long service and to eliminate the burdensome expense, oft recurring, of painting. This unit was so designed with inner compartments and ventilating flues there would always be an outlet for excess heat, gases, and vapors. The possibility of spontaneous firing was very remote in such a storage unit. If, however, due to careless operation or for any cause, fire should break out, it could be controlled and

confined, thus offering an opportunity of saving adjoining buildings.

The Crop Keeper, as we chose to call this revolutionary new crop storage unit, is usually connected by means of a short passageway to a no-storage, one-story stable for the livestock. Both the stable and the passageway are iron clad for fire resistance. This stable, completely iron clad inside and out, has no exposed combustible material, although framed with wood for purposes of economy.

There is a fundamental difference between iron and steel. Steel is iron, plus natural and added impurities—principally carbon—which causes a loss in ability to resist rust or corrosion. Where light weight combined with highest strength is required, steel serves best. Where resistance to rust and corrosion is the important consideration, as in the case of structural coverings exposed to atmospheric conditions, iron is far superior to steel.

It will be readily seen that a layout such as this offers a very reasonable protection against fire damage. Furthermore, when properly grounded, it provides excellent protection against lightning, the iron being a very effective conductor.

This system, with the safer storing of forage and grain crops, is the ideal way of reducing the farm fire hazard.

A Program for Farm Safety

By C. M. SEAGRAVES

Director, Department of Safety, Illinois Agricultural Association, Chicago

Agriculture is the largest, oldest, most fundamentally important of the nation's industries. Yet, this is the only major industry without a safety program of national scope.

The National Safety Council figures for 1936 indicate farm fatalities of approximately 4,500. Illinois newspaper reports covering farm mishaps for this same period substantiate this figure. The need for safety in this field is obvious. The way is clear; the possible, yes, the probable, results of a well ordered program are attractive.

We might well begin by pointing out some of the obstacles:

Isolation . . . the farmer is not subject to supervision; in fact, most of his work is carried on when he is alone.

Physical problems . . . the weather determines to a large degree the working hours and conditions. Excessive hours are the rule rather than the exception. The temperature and conditions under foot are beyond regulation. The almost endless array of tasks ranges from de-horning a bull calf to shingling a roof.

Personnel . . . the too young and the too old are commonly put to work beyond their abilities.

Lack of farmer organization . . . to those who evaluate relative needs for safety programs on the possible financial returns, this factor remains one of the outstanding objections.

In spite of the fact that on the farm nearly everything seems to be contrary to the best dictates of a safety campaign, agriculture nevertheless has about the same accident severity rate as the average for all industries, and this without benefit of safety educational efforts. So, in spite of all the factors militating against the farmer's well-being, something is tending to balance the scales.

Whether it is his native intelligence could be a moot question and one commanding attention; whether the conditions under which he works are natural and therefore conducive to mental physical health might also deserve consideration; a further thought is that a farmer grows up with his work, there is little or no "new man" problem.

Whatever the causes for this very notable trend, it would appear plain that this field is already conditioned to some of the fundamental tenets of accident-prevention work and is now awaiting some new material and direction to achieve signal results.

To date so little has been done in agricultural safety that anyone presenting a suggested program has little to guide his thoughts. It would, therefore, seem advisable that any contemplated campaign should undergo a somewhat slow, step by step process, pending the experience that will come only with the administration of a national agricultural safety project.

Such an initial program could very well contemplate the cooperation of every agency, official and private, having rural interests. This should include the federal and state departments of agriculture, farm organizations, farm publications, private businesses dealing largely or wholly with farm people, farm youth movements such as the 4-H Club and Future Farmers of America. These several agencies would work through their own contacts with farm people.

It is certain that nearly every farmer in the United States would at some time during each working season be exposed to the efforts of one or another. Undoubtedly, there would be some overlapping. It would, therefore, be advisable to have all of the material either issue from one source or be approved before release by some one clearing house.

It would seem advisable for the colleges of agriculture to encourage the teaching of farm safety to future county agents and vocational agriculture teachers. Rural Youth groups could to advantage have farm safety as one of the projects upon which they work. Farm machinery manufacturers could, by their use of farm equipment movies and institutional advertising, lay more stress on safety. Mail order houses, not only from the standpoint of good will but because of the interest of some of them in farmer insurance, could utilize some of the pages of their catalogues in appropriate safety messages. Farm organizations such as the Farm Bureau, the Grange, the Farmer's Union, and others, could, through their official organs and through the personal contacts with farmers made by their field men, advance the cause of safety in a variety of ways.

The material released by all of these groups should be in agreement and should stress in so far as possible both the seasonal and the sectional nature of farm hazards. To do this to advantage, it is felt that a coordinating unit is indicated.

Many occasions could be utilized in the promotion of rural safety. State fairs are becoming, more and more, well attended by farm people. County fairs, and county picnics, as well as husking bees and plowing meets, all furnish occasions when not only speakers, but exhibits on farm accident-prevention, could be presented with profit to everybody concerned.

Rural radio stations, if supplied material, have shown in one state at least their eagerness to cooperate by interspersing regular news and entertainment programs with so-called "farm safety flashes." Farmers, especially during the early morning hours, give careful attention to these broadcasts, especially where weather and market reports are concerned. This is before the day's work begins and is an ideal time to stress the hazards that will probably be encountered during the day's activities.

Press Will Cooperate

Most farmers have at least one county paper and one farm publication to which they turn for news and entertainment. These groups are largely sympathetic to the need for farm safety and would no doubt cooperate to this end.

To exhaust the list of all the hazards encountered on farms in all parts of the country would be a task of tremendous size. How-

ever, the principal hazards are more readily catalogued. The safe handling of horses and livestock has essentially the same problems no matter what the geographical location. Certain fundamental agricultural implements, such as tractors, plows, cultivators, discs, mowers, threshing equipment and axes, and a few others, are common to nearly all sections of the country.

Treatment of these could receive original emphasis, with gradual expansion of topics and treatment as the sectional and seasonal need crystallizes. Because of the familiarity of the farmer with nearly all of his tasks, there is little necessity for pointing out each step in doing each task safely; but emphasis should be placed upon the important parts that fatigue, poor repair jobs, and the limitations of human strength play in nearly all agricultural accidents.

When considering how to finance an agricultural safety program of the above type, it would seem clear that private and substantial support would be needed to get it started. However, there is some evidence to support the belief that ultimately a program of this nature could be made wholly, or largely, self-sustaining. The American farmer is becoming more and more organization conscious. On all sides he sees the benefits to be derived through unified effort. The farmer's interests no longer stop at his line fence. His youngsters are being educated in great state universities rather than in the little brick school house. The radio, paved roads, automobiles, are giving him a breadth of vision heretofore denied. It all points to more and more organization. Sufficient farm organizations could largely support an adequate national farm safety program.

ADJOURNMENT

Community Safety Organization

WEDNESDAY MORNING SESSION

October 13, 1937

The meeting was called to order by Chairman John B. Gibson, Publicity Director, Hawthorne Works, Western Electric Co.,

Chicago, and Vice-President for Community Safety Councils, National Safety Council. Mr. Gibson introduced the speakers.

Why Have a Community Safety Council?

By PAUL F. STRICKER

Director of Field Service, National Safety Council

I take the liberty of recounting a personal experience which I believe explains in a concrete way the advantages and reasons for the need of a community safety council.

A few years ago I was appointed director of safety of a large development which embodied a great variety of industrial hazards and included the commercial and passenger vehicle accident problems as well. The development was so organized that each project was conducted as a separate activity having its own distinct management. Although the central office exerted certain control and coordinated the entire development, the question of what was to be done about accidents, on each project, depended, practically, upon the attitude of the head of that project. The personnel had been gathered together from all parts of the country rather quickly, of necessity, and though entirely capable was highly individualistic. When I arrived on the job there was a general impression that the development had a good accident record.

My first task, therefore, was that of compiling records of the various projects and comparing these with the accident records of similar projects, over the country, to determine factually, what the accident record was. I found that the experience though not shockingly high was, generally, not as good as the average private concerns, engaged in similar activities, which had reported to the National Safety Council over a period of years.

The job which confronted me, obviously, was that of selling each individual project head an organized program of accident prevention, using the factual data, the accident records, as ammunition. Because this development was so large I recognized, in the beginning, that my personal efforts would be of little value on any project, in reducing accidents and that the 10 or 12 hours a day which I could devote to this job should be spent on convincing the project heads that accident prevention, to be effective, must constitute a definite part of operation; must be carried out through the regular line organization of the project and that the larger projects, at least, required the full time services of a safety engineer.

All of this had to be done without any authority, and my role was as distinctly that of a salesman. Naturally, I had some interesting experiences. I could not, over many months, get over the idea that safety had to begin at the top; that it required the backing of the top development executives and of each project. It had to be considered just as seriously, and as importantly, as the pouring of concrete on a dam. I tried personal visits which were often received with an attitude of pained tolerance and sometimes impatience; I attempted the writing of memoranda, where I felt that I was not very welcome; and of course, tried to get greater backing through the calling of a meeting of the project heads but was unable to get this

meeting called. On one project where the subject under discussion was the perfectly innocuous suggestion that a competition be set up between similar units—the project lent itself very easily to competition—the superintendent and about six of his assistants, walked out of the room and literally left me there talking to myself.

Many suggestions, of a detailed character, were made by various people in the organization for the conduct of short lived educational campaigns which would have taken the major part of my time and would have produced little or nothing in the way of accident reduction. There existed every opportunity to go up blind alleys and keep myself extremely busy doing the unimportant things which would have surely proved to management that there was little value in safety activities.

When I had been on the job three months the frequency, standard definition, of accidents on this entire development was over 100 and the severity, although not correspondingly high, was higher than it should have been. One project, employing about 3,000 men had a frequency of over 200, and as you might expect, this was the very project on which the management had walked out on me. This project then decided really to do something about accidents. From the superintendent down the supervisors went actively to work; a safety engineer was appointed; an intensive first aid course for all foremen, as an introduction to accident prevention, was conducted and the frequency rates, starting with about 210 were for the next four months, respectively, about 130, 60, 58, and 38.

At this same time the central office became convinced that accident prevention began at the top and that it was primarily management's job. Individual projects were being sold at the same time on the employment of a safety engineer and today with approximately the same employment as at that time they have 6 full time safety men. The frequency rate has gone down for the entire development, from the figure of better than 100 to an average during the last year of about 28, which is a good record for that type of operations. Severity too has been held down to a very reasonable figure.

I feel that I can recount this experience, without being accused of conceit, because the actual job of reducing accidents was done, for the most part, after I had left, and

through the efforts of an able man who followed me. My part consisted mainly of "sitting tight" and preventing the job from going wrong, until the time when understanding of the organized method of approach could be obtained.

Although we do not have, generally, the attitude in a community, that it has a good accident rate, as we did in the example cited, it is still true that the leading citizens, the officials and the citizenry generally are not convinced of the seriousness of the accident situation; do not understand its many ramifications and are not sufficiently impressed by the human and economic losses from this source. To a still smaller extent are the cities of this country convinced that the accident situation can be controlled by the application of tried and proved remedies. We know that if these two points were thoroughly established throughout the citizenry, that accidents take a terrific toll and that this situation need not continue, then each city would be entirely willing to spend whatever time is necessary learning what should be done and providing the facilities for doing the job.

Again, as in the case of the industrial example, because a comprehensive view of all the remedies required and of the organized approach still does not exist in most cities, many time consuming, short lived, and unwise activities are conducted by various groups and organizations because each has seen a small segment of the whole problem and attempts, without delving into the experience of others, to solve the problem in its own way. Much time and energy are wasted, duplication of effort exists, jealousies and bad feeling are generated between groups and organizations because there is no one unit in that city guiding aggressively this organized approach. There is no group, that is familiar with the remedies regarding each segment. No group that could do a coordinated job regarding the entire problem.

A few weeks ago I was asked, through correspondence, by the president of a small town safety council in New York state what the functions of a community safety council were. This man, the president of a very large and nationally known industry, said their safety council had conducted various educational activities in an attempt to get people to drive safely; they had distributed much material and had conducted a number of public meetings which had for the most part

been poorly attended. He had come to the not unusual conclusion that, unless adequate enforcement were provided by the city officials, he could not get very far in actual accident reduction, on the traffic problem. This meant, also, that the citizens had to be convinced that adequate enforcement must be applied. I explained to this gentleman that many, many things must be done in any community to effect reductions in the traffic situation alone, and went farther to state that a community safety council should be interested in accident prevention in all its elements, traffic, industrial, other public, and home accidents. I recounted the fundamentals of education engineering and enforcement and stated that, in my opinion, the responsibility of a community safety council lies in seeing that effective work is done in all of these fundamentals. In some cases, certainly, community safety councils have relied too much, or confined themselves too much, to educational measures and have not been sufficiently active in building public opinion and in exerting aggressive leadership in obtaining adequate engineering and enforcement measures.

The obtaining of adequate enforcement and engineering facilities and remedies requires, particularly from the staff, and from the voluntary leadership of the safety council, considerably more than shotgun and general promotional efforts. The best way to obtain real cooperation from city officials, for example, lies in rendering specific service and thereby convincing these people that the safety council leadership knows more about the general approach to accident reduction than anyone else in the city. This does not mean that police officials, should be told how to run their jobs and certainly that attitude should not be assumed. By pointing out, however, the methods which have produced results and establishing a relation of confidence with these people an educational job can be done which will, though sometimes slowly, step up more quickly the activities of these officials toward an effective job of accident prevention. In providing this type of service the safety council should, in turn, avail itself of the expert services of the various organizations which specialize in the different elements of this comprehensive job.

In the same manner that accident prevention, in industry, begins at the top; requires an organized and well coordinated program and must be made an essential part of the regular operating procedure so, in the com-

munity safety job the necessity for this approach must be gotten over to the community at large. In the same way also sound technical methods must be made available to those who are responsible for its accomplishment.

This difficult task can be accomplished only by an organization which is thoroughly representative of the whole community. It should be interested solely in the saving of human life and the elimination of the economic waste resulting from accidents. It cannot, if it is to be successful, be controlled by any political group, be guided by selfish interests or exist for the aggrandizement of certain individuals.

When properly organized and founded on just principles a community safety council cannot, even then, accomplish its task quickly. Again citing the industrial example, if it required six months to convince this organization, one of unquestionable integrity and also of more than usual intelligence, that it had an accident rate which could be reduced, and that the organized approach was needed, how much longer will it take, necessarily, to accomplish this on a community scale. Cities like Rochester, Milwaukee, Syracuse, Cleveland, and Kansas City, which have shown splendid results have been at this job in an organized way, from 14 to 20 years. And there still remains much to be done in all of them.

The community safety council, if it is to discharge its proper function in the community, must be the source of information and the concentration of aggressive leadership in all matters which pertain to accident prevention. It is the sales promotion agency for community accident prevention activities. It must do the continuous job of informing people of the extent and implications of the accident problem. It must convince them that this situation can be brought under control. It must then take advantage of this will to prevent accidents, by providing through its organization and through the help of national organizations, the detailed effective plans which will prevent accidents. It should follow through continuously in effecting some way, or some how, the application of these remedies.

We know, that, because this whole movement is relatively new, few cities have attained this ideal. We know also, however, that some cities are approaching it and that

where this ideal is approached outstanding results have been achieved and accidents have been brought under control to a considerable extent.

Without a community safety council, called by whatever the name may be, providing this

sales promotion, developing public opinion, supplying proved methods and practices and exerting aggressive leadership toward their application no city can hope to reduce its accident experience with maximum effectiveness.

The Officials' Part in an Organized Community Program

By WILLIAM C. KNOELK

Chairman, Milwaukee Safety Commission, and Assistant Superintendent of Schools

Milwaukee's traffic death rate was the highest in the United States in 1919. With 85 fatalities, the rate was 12 per 100,000 persons in Milwaukee County that year, the safety and sanitation division of the Milwaukee Association of Commerce reported, although only 33,000 automobiles were registered.

Chicago's traffic death rate in 1919 was 9.1 and New York's, 5.4 per 100,000.

Altogether, 337 persons were killed by accidents of all kinds; in traffic, homes, and industrial plants in Milwaukee that year, or one out of every 1,500 residents.

That was the situation which the Milwaukee Safety Commission was organized to remedy. Many groups were attempting separately to solve the problem, but were not getting far. The mayor asked 15 citizens to form a commission to correlate the disconnected safety activities of all groups, to try to discover the causes of Milwaukee's tragic record, and to seek ways to improve it. Members were sought from all groups concerned with safety.

The safety commission today contains representatives of the police department, fire department, traffic-engineering branch of the department of public works, of the schools, public utilities, operators of truck fleets, newspapers, lawyers and doctors, merchants and manufacturers, and just plain pedestrians and individual drivers.

The set-up is sufficiently unique to warrant a more definite description. There is no intent to convey that the same methods employed elsewhere will work out equally satisfactorily. The probability is that they may not. Even in Milwaukee certain imperfections in the administration of the work are beginning to be felt and are being studied.

The Milwaukee Safety Commission is charged with the responsibility of maintaining the safety consciousness of the city. This phrase, in Milwaukee, means that each and every individual must not only be aware of the problem and the facts, but must also sense his personal responsibility and act in the light of all these factors. There can be no feeling of "letting George do it," if satisfactory results are to follow.

Composed of 15 men appointed by the mayor, as has been stated, this group, without remuneration, has dedicated itself to the task of stimulating safety thinking. A modest appropriation out of the tax-raised funds makes its work possible. Meeting monthly, with an advisory group, most of the work is carried on in committees. An executive secretary with his clerical help constitutes the commission's personnel at the city hall.

Were it not for the loyal support given to the traffic safety movement by our newspapers, Milwaukee could not have reached the eminent position it now occupies. The enthusiastic and effective enforcement by our police, the energetic engineering of our traffic heads, as also the eager educational efforts in our schools, were kept before the public constantly. Maintaining public opinion on these matters is the essence of the job.

Most of the city departments concerned with safety are represented in the Commission. The police department through the captain of the traffic squad, the public works department through the director of the bureau of illumination, the fire department through the assistant chief in charge of fire prevention, the schools, the medical department, the legal department have membership. Additionally, the lay membership comes from the various lines of busi-

ness and professional life. Problems of safety are thus handled by a good cross-section of our city's population. Safety is, then, no longer the exclusive job of the police, of the engineer, of the teacher, or of the councilman; it is the joint task of the whole community. When the common council, for instance, wishes to secure the reaction of the public on items of safety, the commission is consulted.

This commission furnishes the safety posters, the school bulletins, the safety-teaching magazines, the films, the speakers to the schools. Home safety is stressed in monthly bulletins to the parent-teacher associations. Luncheon groups, civic organizations, and women's clubs are given every possible help in their safety programs. Motor drivers schools are organized and meet a great popular demand. Women drivers' schools, broadcasts, legislative meetings, brake and head-light testing campaigns, safety award conferences are additional activities that are sponsored to bring about the complete coverage in safety previously mentioned.

Through his activity in the field of the social subjects curriculum, one of the assistant superintendents of the Milwaukee Public Schools was appointed to the commission and was elected chairman. Through this channel the schools have been aided greatly in instituting adequate courses with proper materials, and the commission was given an opportunity to send its stimulating messages to the children and through them to the parents. For over a decade this relationship has existed and has prospered.

Some of the important standing committees of the Commission deal with traffic, the home, schools, legislation, and research and awards. The work of all of these groups is given space in the various bulletins and thus a stream of living, authoritative, well graded material is made available to the schools and teachers.

To indicate the type of information that is deemed essential for people to have in the field of safety, a brief glance at the high school course is interesting. Many of the available courses in the United States confine themselves, or give most space, to traffic safety; this, too, in the face of preliminary statistics which show that more fatalities occurred in the home accident field in 1936 in the United States than in traffic. Many perpetuate the idea that the presentation of a body of fact and information is sufficient. Some assume a total time allotment to be devoted to the sub-

ject, evidently on a par with history and civics.

Without any gesture of finality, the trend of the course in safety in the high schools of Milwaukee was built up and is being presented as follows. A year ago last September, a committee of the Milwaukee High School Principals' Association drew up a plan of safety instruction that was presented to the school board and adopted. After a number of consultations with the high school principals, it was decided to use these units in connection with the work in English, since all pupils are compelled to take that subject. Teachers who were to instruct in the safety work met with the assistant superintendent concerned and learned the method and procedure. A point that has been stressed consistently is that the units are not to prepare only for driving an automobile but are also to make the pedestrian aware of his responsibility.

The purpose of the course is to develop in pupils:

A knowledge of the causes of accidents and a disposition to want to avoid loss of life, limb and property, whether in the home, in the shop, or on the street;

A knowledge of the established laws and ordinances governing traffic, and an attitude of willing cooperation;

A recognition of society's right to demand cooperation and an earnest yielding of self for the group good;

A full realization of society's loss through fires and a keen appreciation of the need for instituting proper conservation principles;

And a willingness to help create and sway a wholesome public opinion.

The aim of our wider program of safety education in Milwaukee (the program that carries the work beyond the elementary and high schools) is one that the insurance man might call a plan of complete coverage. The whole field of safety is considered and all ages and groups are made aware of the general problems. Home safety, traffic safety, occupational safety, public safety other than traffic, fire prevention, recreational safety, seasonal hazards, first aid, and conservation are some of the topics that are covered. If some of these items are overlapping, the public is not disturbed about it for little of life is so logically ordered that there is no overlapping.

The safety division of our Association of Commerce accepts responsibility for promot-

ing industrial safety in the factories and shops. Through its excellent schools, attended by thousands of tradesmen and foremen, the message of industrial safety is sponsored and managed. Fire prevention work also comes within the jurisdiction of this division. The public and parochial schools, every year, join in the observance of fire prevention week.

In conclusion, there must be no misunderstanding on one essential point. The essence of the effectiveness of Milwaukee's work is

cooperation. Were it not for the excellent work of enforcement and protection of our police department, the alert service of our fire department, and the splendid engineering work done by our outstanding department of public works and the bureau of illumination, no "commission," alone, could have done the work. The commission is merely the coordinator; the effective work is done by our teachers, our policemen, our engineers, our drivers—by the citizens of Milwaukee.

Community Safety Organizations and the Public

By JUDGE LEE E. SKEEL

President, Cleveland Safety Council, Cleveland, Ohio

The safety movement is for the most part concerned with influencing human behavior. Its purpose is to develop in the individual the habit of thinking and acting safely. Human behavior does not respond naturally to restrictions; restrictions that become more and more necessary because of our intricate civilization which becomes increasingly complicated year by year. To accomplish results in our effort to prevent and avoid accidents, therefore, we must teach the individual not only to understand the need for conducting himself safely under all circumstances but also to develop sufficient self-restraint to act safely. For this reason we are concerned with influencing human behavior.

Without a true knowledge of the facts which justify the imposition of restrictive rules of civil conduct in the interest of safety it is difficult to procure voluntary submission to them on the part of the average individual. Organized self-control is the foundation of all democratic institutions. Self-government is possible only when the individual is willing to sacrifice some part of his own apparent individual interests, for the purpose of preserving the social order.

In other words, we must develop social character. The mere enforcement of the law is quite inadequate to accomplish the desired results. The voluntary desire to do justice and the development of the capacity to be loyal to fundamental obligations is necessary to preserve the social order. Public education with all other agencies, both public and private, engaged in accident prevention

work, is the only sure means of accomplishing such a result. We must therefore organize our activities to acquaint all with the true facts about accidents and the means by which they may be avoided.

It has often been said that safety is an individual matter. But the results of unsafe conduct of the individual have become so devastating not only to himself but also to those about him that the effort to prevent accidents is an activity in which the whole community has a very definite interest. Whether or not one will conduct himself safely under all circumstances, therefore, should not be a matter of his own choice. The individual must accept the responsibility of acting safely as a fundamental obligation of citizenship. The safety of the community is a community problem in which all must take an active part.

The proper kind of leadership, necessary in developing a broad community safety program, is more effectively developed by the organization of a community safety council. Progress in any civic undertaking will fail unless it be directed by competent leaders. A community safety council can call together everybody in the community whose vocation or avocation deals directly and indirectly with safety. When gathered together in an aggressive group, public officials, industrial safety leaders, school officials and civic leaders, all coordinating their efforts, can do a real safety job, and effective leadership will be developed.

The first benefit that comes from such a

safety organization is that it will provide a continuous and well-balanced program, building up and becoming more effective each succeeding year.

Sporadic campaigns are never helpful, particularly in safety education. What little gain is achieved from a temporary drive, no matter how intensive it may be, is soon forgotten. A campaign when discontinued leaves the impression that safety work is unnecessary or ineffective, otherwise the campaign would have been continued.

Fair dealing with those who become involved because of a safety drive is fundamental. In the stress of a sudden, intensive and temporary campaign this important point is very frequently lost sight of, and many acts of injustice result. Favorable public sentiment, so necessary to the success of any civic enterprise is alienated to some extent.

One other bad result of sporadic campaigns is that usually one phase of the problem is stressed to the neglect and detriment of all other safety activities. No safety effort will be permanently effective unless and until every avenue of approach is used in a correlated program; which in an orderly and logical fashion creates a solid foundation upon which to build a permanent safety structure.

The community safety council, when organized and directed by a competent director, is the best method by which such a program can be made effective. Unaffected by petty jealousies and selfish attitudes, sometimes to be found in industrial institutions, uninfluenced by political considerations, the safety council goes forward to achieve safety for the benefit of all mankind.

The great triumvirate of the safety movement, safety engineering enforcement of the law, and public education, outline the scope of the safety movement. The community safety organization in its relationship with the public is more directly concerned with the last two.

Without an effective, certain and equitable policy of law enforcement no community safety program can achieve outstanding success. Two elements are to be found in this field which are of vital importance—first, the determination of what the rules of civil conduct shall be, and second, the proper enforcement of the rules of law when they have been so established.

This field of the safety movement is al-

most entirely a governmental function. The fact that laws, as such, only become laws when enacted by the legislature, and that the enforcement of law is delegated to the judicial branch of the government, does not mean that the individual citizen is relieved from all responsibility with respect to these important governmental functions. It is the duty of every citizen to take an active part in the affairs of state. Men must either govern themselves or be governed. They must do their part in the interests of good government or lead subjective lives.

This duty of the citizen to support good government becomes more apparent year by year as our social structure becomes more and more complicated. Because of our ever-increasing interdependency, legislative bodies are called upon to formulate the rules of civil conduct with respect to a great variety of intricate social problems which require continuous research and profound and intelligent study. How can a legislator act wisely upon so many diversified social questions without the advice and counsel of his constituents, as well as well intentioned and unprejudiced specialists? Certainly this is true with respect to matters concerning the physical safety of our people.

In the early days of the horseless carriage an almost universal prejudice developed against it which resulted in restrictions upon its use imposed by legislators who thought they would meet with public acclaim. Subsequent attempts to regulate traffic were almost universally approached without a sufficient understanding of the traffic problem as it developed.

These are the primary reasons why so much legislation has been written upon our statute books retarding sincere attempts to accomplish safety and resulting in much of the disregard for law by both motorist and pedestrian. It has been aptly said that "facts are the least developed of all of our national resources." To deal justly with any problem every available fact must be considered to make possible its proper solution. The local safety council should, because of its continued study of all safety problems, be in a position to render valuable assistance in legislative matters which affect the physical safety of the community.

While it is true that the enactment of law is a governmental function, better results in legislation will be obtained when public sentiment is crystallized through the help of

impartial civic associations. The safety council should be prepared to take a leading part on safety matters.

Law enforcement is always difficult. All agree with the statement that society is better protected when the law is impartially enforced. Our difficulty comes when the individual finds himself in the net of enforcement.

It has been said that there is no one who is not forced at some time to compromise with his conscience in directing his personal conduct. The instinct for self-preservation is stronger than the passion for perfection.

There are three public offices engaged in the business of law enforcement. The police officer, the prosecuting attorney and the judge. To be effective in their duties the officers must have the loyal support of the public.

Law enforcement is something more than the simple making of arrests, trying cases and imposing penalties. The weight of public opinion must go with the work of the public officials, adding to the weight of such penalties as are imposed. Here the community safety council is greatly needed to lead public sentiment in the interests of public safety, upholding the hand of conscientious public officials.

The greatest evil which menaces traffic law enforcement is ticket fixing. This practice in many of our cities has been permitted to grow to such an extent as to result in an almost complete breakdown of law enforcement. The law enforcing officials are public servants, paid and maintained out of public funds because their work has been found necessary to protect society. To interfere with the orderly processes of law enforcement can be aptly compared with the circumstances of a man hiring an employee to do a particular job and then doing all he can to prevent his employee from accomplishing the desired results.

The most injurious thing about this abominable practice is not so much that it breaks

down the law enforcing agencies, but rather that many people, knowing that they can avoid the consequences of their misconduct, acquire an artificial feeling of being above the law. No social order can long endure under such circumstances.

It is the duty of the local safety council to lend every effort to stop this practice.

A safety program under the direction of the local safety council finds its greatest field of endeavor in sponsoring and promulgating public safety education.

The greatest force available to those who seek to motivate human behavior is to create interest in the thing to be done. This may be accomplished by extending information about it. The local safety council, in its relationship with the public, must be vigilant in developing and broadcasting facts of interest about safety.

Among the effective methods are the preparation of school lessons for teaching of safety in class, and the arranging of statistics and other safety information to be used by the press or in radio speeches or public addresses.

One other method when dealing with particular groups is effective—conducting contests to attain the best safety record. Here the individual is given the opportunity of taking an active part in accident prevention work.

Let me point to the department store fleet contest in Cleveland. This contest has been in progress for more than 10 years, and today the interest of the driver is just as keen as it was at the start.

The greatness of a nation is measured by the character of its citizenship. If we can instill in the minds of all the responsibility of citizenship, the giving up of the apparent inalienable rights of the individual in the interest of the safety of all we will have accomplished the result which it has been the purpose of the safety movement to accomplish.

ADJOURNMENT

Fire Prevention

FRIDAY MORNING SESSION

October 15, 1937

The meeting was called to order by J. I. Banash, Consulting Engineer, Chicago, and past president of the National Safety Council, who introduced the speakers.

Static Electricity as a Fire Hazard and Its Control

By E. E. TURKINGTON

Engineer, Inspection Department, Associated Factory Mutual Fire Insurance Companies

Static electricity is the cause of many fires and explosions. The fires may be the result of actual ignition of combustible material by static sparks, or static electric charges, too small to be a fire hazard in themselves, may indirectly result in fire by causing finely divided stock to adhere to parts of a machine to such an extent that excessive mechanical friction results.

Static electricity may also be the indirect cause of injury due to reflex muscular action of persons working near fast-moving machinery.

Static electricity is generated in a number of industrial operations, but in many cases it is dissipated or neutralized without becoming a fire or accident hazard. However, static charges may also cause inconvenience, slow up production, or result in an inferior product, and its elimination is of great importance. It is not possible to prevent this generation, but it is possible to prevent accumulations of such quantity and potential that sparks may result. This can be accomplished by humidification, bonding and grounding, ionization, or a combination of these methods.

1. Humidification

Fires caused by static electricity are much more frequent in winter when artificial heating is required and the indoor humidity is low. If out-door air at a temperature of 32 deg. F. and relative humidity of 50 per cent is taken into a building and heated to

70 deg. F. without the addition of any moisture, the relative humidity will be about 13 per cent. In order to maintain a relative humidity of 50 per cent at the higher temperature in a room 100 feet square and 12 feet high, for example, it would be necessary to add a little more than six gallons of water.

It has been shown that many substances, ordinarily considered non-conductors, will conduct electricity to some extent in an atmosphere in which the humidity is relatively high. This is undoubtedly due to a thin film of moisture on the surfaces of the so-called non-conductors. The surface conductivity of many materials changes through wide limits when the humidity is varied. For example, the surface conductivity of plate glass at 50 per cent relative humidity is about 1000 times that at 20 per cent humidity. It would thus appear that dangerous accumulations of static electricity could be prevented in all cases by maintaining a relatively high humidity.

Unfortunately it is not feasible to humidify all rooms because many substances are injured by moisture. Moreover, the minimum amount of humidification required under various conditions is not definitely known. A relative humidity of 40 per cent to 50 per cent in the rubber spreading room of a certain rubber factory, however, practically eliminated fires where previously 122 fires had occurred in a three year period. It is

believed that a relative humidity of 50 per cent to 60 per cent will prevent dangerous accumulations of static electricity in practically all cases. It should be remembered, however, that if parts of machines are operated at high temperatures the relative humidity near the heated parts may be dangerously low, even though the remainder of the room may be maintained at 50 per cent humidity.

Relatively high humidity has another effect in preventing fires in the textile industry in addition to that of preventing charges of static electricity. It has been shown experimentally that when the amount of moisture in cotton or other fibres is relatively high, the danger of ignition by static sparks is slight.

Humidification may be obtained by means of steam jets, unit humidifiers, or air-conditioning and ventilating systems, and unless it is automatically controlled it should be checked periodically with an accurate hygrometer.

2. Ionization

Ionization of the air is another method which has been employed to remove static charges from materials, such as paper, textile fibres and fabrics. Air is ordinarily a non-conductor of electricity, but when ionized it will conduct static charges to grounded parts of the machine. Static neutralizers are available which ionize the air by means of high voltage brush discharges from a series of points connected through small condensers with the high voltage winding of a small transformer delivering several thousand volts. The electric neutralizer is approved for use in woolen, silk, cotton and paper mills, printing shops, etc.

Ionization by gas flames is another method which has been employed in printing shops. The sheets of paper are passed rapidly through gas flames as they leave the presses and all static charges are conducted to ground. Obviously this method is limited in application and cannot be used where inks having volatile flammable thinners are employed, or in any hazardous location.

3. Bonding and Grounding

(a) *Metal Objects.* Grounding the metal parts of a machine to a water pipe or other low resistance ground is often the cheapest and most effective method of static elimination. However, a single ground wire connected to an all-metal machine at one point

may not be sufficient to ground all of its parts. Paint, rust, or corrosion may insulate one part from another and a film of lubricating oil may insulate a rotating shaft or roll so that dangerous accumulations of static electricity will occur. Metal parts which are isolated or insulated should be bonded together or separately grounded. Graphite mixed with the lubricating oil will sometimes serve as a satisfactory grounding method for revolving parts, but it is usually safer to provide a grounding brush or wiper, which makes contact with the surface of the moving parts.

Although small bare wires or solid metal strips may make satisfactory electrical connections, a copper wire as large as No. 6 or No. 4 B. & S. gage is advised for the ground connection, owing to its mechanical strength, and in insulated wire is less likely to be tampered with. The ground wire should be carefully maintained and tests should be made periodically to insure its continued effectiveness. A broken or improperly maintained ground wire may be a fire hazard. Where exposed to injury it should be run in rigid metal conduit and if protection from induced lightning effects is also desired the ground wire should be electrically connected to the conduit at both ends, or a pipe of non-magnetic material such as brass or aluminum should be employed.

Grounding connections may be made to wet sprinkler or other water pipes where available, but pipes which are liable to be disconnected or taken out of service and dry-pipe sprinkler system should be avoided. Metal plates or metal pipes buried in moist earth, may be used as ground electrodes, if water pipes are not available. Approved terminal lugs should be provided on the ground wire and connection to pipes should be made with approved ground clamps.

In 1915 the United States Department of Agriculture investigated a number of fires and explosions in threshing machines in the northwest section of the United States and it was found that static electricity ignited dust clouds formed during the operation of the machines. The relative humidity was low during most of the threshing season and high static charges were generated. They recommended that various isolated metal parts, including several revolving shafts, be bonded to a common wire and grounded to a rod driven into the earth. This measure effectively

prevented static electric fires and explosions in threshing machines.

The Department of Agriculture also investigated a large number of fires in cotton gins in the south and it was found that fires which were originally thought to have been caused by matches or incendiarism were in reality caused by static electricity. When the various metal parts of the machine were bonded together and grounded, the static electricity was effectually dissipated and the fires prevented.

Dust explosions in grain elevators, flour mills, starch mills and similar places may be caused by static electricity unless all metal objects which may become charged with static are effectively grounded. The grounding should include, machinery, shafting, metal bins, metal lining of wooden bins, as well as tie rods, metal ladders, gates, spouts, etc., of wooden or concrete bins, metal screens, driers, conveyor and elevator parts.

(b) *Non-Conducting Materials.* We will now consider the more difficult problem of grounding or discharging non-conducting stock, power belts, conveyor belts, etc.

Belts. Power belts and conveyor belts generate static electricity freely, potentials of 20,000 to 75,000 volts having been observed. In very hazardous places it is preferable to eliminate belts entirely by using direct drive, metal chain or metal gear drive. If belt drives must be used, the static hazard can be reduced by operating the belts at low speed, but in all hazardous places one of the following methods should be employed to discharge the static electricity which may be generated even on low speed belts: (1) apply a dressing which makes the surface of the belt a conductor, or (2) provide a grounded metal comb or collector rubbing on the belt or nearly in contact with it at the points where it leaves the pulleys.

Formulas for dressings have low electrical resistance for both leather and rubber belts have been prepared by the Bureau of Chemistry, U. S. Department of Agriculture, but the effect of the belt dressing is not permanent and repeated applications are necessary at various intervals depending on local conditions. In view of this uncertainty, the use of grounded collectors is frequently preferred.

Collectors of various kinds have been employed to eliminate static electricity from belts. Some are of thin metals and quickly

get out of order, especially those which are placed in contact with the belt. One of the best designs, and one which requires very little attention, consists of a row of sharp steel points mounted on 1-inch centers in a length of angle-iron which is grounded and rigidly supported close to the belt near the point where it leaves each pulley. The pulleys, which should be of metal, should be grounded, also metal guards and other isolated bodies of metal near the belt.

Stock, Fabrics, etc. Dangerous charges of static electricity are generated on various non-conducting materials, which are passed more or less continuously through processing machines. This includes rotogravure printing presses, coating and spreading machines, etc. All metal parts of the machines should be thoroughly grounded, but this will not remove the static from the non-conducting material passing through it.

One method of accomplishing this is by means of brass or copper chains attached to a grounded metal bar extending across the machine above the material and near the points where the static is generated. The chains should be spaced on about 1-inch center and should be long enough to touch the surface of the material. The links should be kept clean and free from corrosion to keep the electrical resistance low.

If the character of the work makes it difficult to keep the chains clean, thin bronze or aluminum strips, screen wire, or tinsel may be employed; or if contact between the collectors and the material passing through the machine is objectionable, fine bronze wires formed into a long "brush," which is grounded and suspended so that the ends of the wires are near but not actually in contact with the material, will effectually remove the static charges.

Workmen Hazards. Charges of static electricity are frequently found on the workman; especially at times of low humidity. The charges may be generated by the clothes, by rubbing the soles of shoes on non-conducting floor coverings, or by various industrial operations. The human body is a good conductor and in most cases the charges are conducted to ground through the shoes and clothing which are ordinarily moist enough to transmit them as fast as generated. Some people, however, have an especially dry skin and accumulate high static charges more rapidly than others, because there is little or

no leakage to ground through the clothing. Such workmen should not be employed where volatile flammable liquids are handled or where there is danger of dust explosions.

In especially dry weather, or in rooms where the relative humidity is low, static charges may accumulate on the bodies of workmen to a potential of several thousand volts. Some method of grounding them has thus been found necessary in many locations. Workmen should not be allowed to wear rubbers, rubber boots or rubber soled shoes in hazardous areas, and under some conditions it may be advisable for them to wear specially made shoes having copper nails or copper wire stitching through the soles. It may also be necessary to have them stand on grounded non-ferrous metal plates. Care must be taken, however, not to allow the soles of the metal floor plates to become covered with any insulating substance.

Increasing the relative humidity, as previously described, is helpful where conditions are not particularly severe.

(c) *Storage and Handling of Flammable Liquids.* Static electricity is generated when liquids flow through pipes, when they are poured or discharged from one container to another, when they are filtered or when solid streams flow through the air and are broken up into drops. The charges are neutralized or conducted to earth as fast as they are generated unless the liquids have a high electrical resistance. The resistance of some liquids, such as water, alcohol, and glycerine, even though considered high in the ordinary sense, is low enough to prevent dangerous or objectionable charges. On the other hand, gasoline, benzol, and carbon bisulphide have very high electrical resistances and cause dangerous charges on their containers and on conducting objects which may be in contact with them.

Wherever flammable liquids of high electrical resistance and low flash point are used, handled, or stored, thorough bonding and grounding should be employed. It should include storage tanks, stills, pipe lines, churns, mixers, auto-claves, etc. Pipe lines handling such liquids should also be electrically bonded together and to tanks and other receptacles to which they are connected. Bonds should be connected around all joints which may be insulated by packing materials or gaskets.

Special methods are required for grounding and bonding portable containers. At loading and unloading stations for tank cars, the track should be grounded and bonded to the filling or discharge pipe. There should also be a temporary bonding conductor between the filling or discharge pipe and the car. This conductor should be connected before any filling or discharge connections are made and should not be disconnected until after these pipe or hose connections are removed. Similar temporary bonding conductors should also be provided for tank ships and for tank trucks as well as for small metal cans and containers which are filled from larger ones.

Tests

Although ample ventilation should be provided in rooms where flammable gases, vapors, or dusts are present, it is advisable to make tests for static electricity in these hazardous places. Tests made during periods of relatively high humidity are not conclusive and should be repeated when the relative humidity is low. Tests should be made with great care in dangerous locations since the person making the test, or the instrument used, may become charged and cause a fire or explosion. The person, as well as the instrument, should be brought to ground potential frequently during the process of testing by making connection with a good ground. This grounding, however, should be done in a non-hazardous area where a static spark will do no harm.

Tests for static electricity can be made with an electro-static voltmeter, neon tube tester, or gold leaf electroscope. The electrostatic voltmeter can be calibrated to indicate the potential of the charge but it is not well adapted for portable use in a manufacturing plant. The neon tube tester, originally designed for testing automobile spark plugs and more recently used in modified form as a circuit tester, makes a very satisfactory, inexpensive, and portable instrument for detecting the presence of static electricity in manufacturing plants. However, it does not show the amount of potential of the charge.

The gold leaf electroscope is very sensitive and in its ordinary form is too delicate for general use in a manufacturing plant. However, its electrostatic capacity is so small that there is little danger of a spark when it is charged and discharged.

The following discussion took place after Mr. Turkington's address:

In grounding to prevent the accumulation of heavy static charges, does the ground resistance have to be low?

No.

What is meant by "electrically bonded" type lines?

A common pipe joint ordinarily offers sufficient electrical bonding, but gaskets and flanges that may insulate one section from another should be guarded against. The liquid passing through the pipe line cannot be depended upon to maintain a ground.

Is there great danger from static in spraying operations?

Theoretically such operations would gen-

erate static electricity, but actually no trouble has been experienced from this source. It is quite probable that the object being sprayed carries off the static charge.

Should not a differentiation be made between an intermittent static discharge and static flow?

Yes. An intermittent discharge, or one which occurs only occasionally, will not ordinarily ignite fibrous or dusty materials. But in static flow, where the discharges are continuous, the first few charges will dry out the material sufficiently so that a subsequent discharge might ignite it.

What is the best way to test a ground?

Check it with an ohm meter or a ground tester.

Spontaneous Ignition and Its Prevention

By A. H. NUCKOLLS

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The source of heat causing ignition may be a flame, spark, radiation, a hot surface, friction, or chemical action. When the primary source of heat is chemical action due to the combustible itself (exothermic decomposition), or between the combustible and supporter of combustion, the process is known as "spontaneous heating," and if the ignition temperature is reached, as "spontaneous ignition."

It is of interest in this connection to note that recently experiments have been recorded indicating that the ignition temperature in the vapor or gas phase may be materially lowered under certain conditions by injection of drops of water, and also by other small particles, which appear to act as reaction centers. This phenomenon has been termed "nuclear ignition." Accordingly, a substance may be said to have two ignition temperature curves, first the "self" or "autogenous ignition temperature," also known as the "apparent ignition temperature," and second, the "nuclear ignition temperature," which is lower, and may be found later to have an important bearing on spontaneous ignition.

The primary reactions causing spontaneous ignition may be preceded by other

sources of heat such as microbial action, as in the fermentation of hay. Further, products of many reactions leading to spontaneous ignition may be autocatalytic. The presence of a catalytic accelerates the reaction.

No sharply defined or scientific classification of substances subject to spontaneous ignition has been worked out, but for convenience those substances which have been found to cause or undergo spontaneous ignition may be divided into four groups:

Group 1—Substances not themselves combustible, but which may cause ignition, such as lime.

Group 2—Substances having ignition points below ordinary temperatures, as for example the hydrides of phosphorus and silicon in the presence of air, sodium and potassium in the presence of water, turpentine and ammonia in the presence of chlorine, and hydrogen and chlorine in the presence of light. Included in this group also are substances which when alone are not acted upon by oxygen but which may simultaneously undergo oxidation with another compound which is capable of oxidation at ordinary temperatures.

Group 3—Combustible substances which may undergo sufficient oxidation at ordinary temperatures to reach their ignition point, including easily oxidized vegetable oils, fats, certain metals in finely-divided state, metallic sulphides, charcoal, and coal.

Group 4—Organic combustible substances subject to microbial thermogenesis, including agricultural products such as hay and grain.

Noncombustible Substances

This group represents spontaneous heating in its simplest aspect. Calcium oxide (unslacked lime) is the outstanding member of this group. Many fires caused by the wetting of lime in the presence of combustibles are on record. It is of interest to note that the reaction of 1 pound of lime with water evolves 124,000 calories (493 Btu).

Included also in this group are barium oxide, sodium peroxide, and other chemicals which in contact with water may evolve sufficient heat to cause ignition of common combustibles.

Investigation of a fire of unknown origin indicated that barium oxide was the source of ignition. It appeared that when a wooden keg containing the barium oxide was opened, enough moisture was present to cause a reaction, which resulted in ignition of surrounding combustibles.

It is evident that as a measure of safety chemicals of this group should be kept away from combustibles.

Substances of Low Ignition Temperature

A well-known member of the second group is often called "spontaneously inflammable phosphine," which, however, is not pure phosphine. It is stated in the literature¹ that the pure gas does not ignite below 100 C (212 F) but is highly flammable and is easily ignited by friction. It appears that the spontaneous ignition of phosphine at ordinary ambient temperatures is due to the presence of the vapor of hydride of phosphorus (P₂H₄) which is very likely to be produced in reactions yielding phosphine.

It has been claimed² that the hydride of phosphorus may be produced by the putrefaction of damp sawdust, resulting in ignition, but available data on this are meager.

Silicon hydride as ordinarily prepared is also spontaneously flammable in air at ordinary temperatures. It is stated in the litera-

ture³ that the pure gas does not take fire at ordinary temperatures but ignites if slightly warmed. The hydrides of silicon and phosphorus are met with in chemical laboratories but are not likely to be encountered in the field.

Of more practical interest are the reactions of sodium and potassium with water, the latter being decomposed with the evolution of hydrogen. In the case of potassium, the evolved hydrogen is ignited in the presence of air by the heat of the reaction even at ordinary ambient temperatures. The reaction of sodium with water is less violent than that of potassium, and ignition of the evolved hydrogen does not occur as readily. The reaction of rubidium with water is similar to that of potassium.

Although the combustion of cellulose compounds such as paper is extinguished by chlorine—turpentine, ammonia, brass, and a number of other substances ignite spontaneously in atmospheres of chlorine even at ordinary ambient temperatures.

As to the prevention of spontaneous ignition of this group, it is clear that chemical training is necessary for the safe use of such substances. In general it is necessary to store them in cylinders or hermetically-sealed containers.

Oils

The best known members of the third group are linseed, soya bean, and olive oils, which in the presence of air at ordinary room temperatures undergo oxidation with the evolution of heat. Although their ignition temperatures are comparatively high, the heat generated by the oxidation is sufficient to cause ignition under favorable conditions.

The reaction is promoted by exposure of a relatively large surface area of the oil to the oxygen of the air. This is readily accomplished by the impregnation of a fibrous material such as cotton with the oil.

The form in which the oily fibrous material is exposed to the air also influences the reaction, and affects the rate of dissipation of heat. If the oily mass is compact, the oxygen supply from the atmosphere is necessarily restricted, and if in thin layers or exposed to air currents, the heat loss may prevent a rise in temperature.

Further, it is clear that the ambient temperature also influences the reaction. There is some experimental evidence indicating

that the ambient temperature within certain limits may be a critical factor.

Finely-divided Metals. It was previously mentioned that exposure of a relatively larger surface area of an oil (in the liquid phase) promoted its reaction with the oxygen of the air. This principle is even more strikingly illustrated in the case of a number of solid substances, including iron which in very finely-divided or porous form ignites spontaneously on exposure to air. Metals in this condition are said to be "pyrophoric."

Metallic Sulphides. It appears that the cause of the spontaneous heating of metallic sulphides is primarily oxidation, but the exact conditions under which their ignition occurs in the air are not well known. As a measure of precaution, they should be protected from moisture and acids.

Charcoal. If the carbonization or destructive distillation of wood, cellulose, and certain other organic materials is carried far enough, charcoal is formed. Like many porous substances, charcoal has the property of absorbing comparatively large volumes of gases, a process attended by the generation of heat. It has also been found that the absorbed oxygen in charcoal is capable of oxidizing certain other absorbed gases, and it seems probable that oxidation, particularly in later stages of the process, is also a factor in the spontaneous ignition of charcoal.

It seems probable that fine particles of carbon remaining from the carbonization of wood and other organic matter under certain conditions may be pyrophoric, but available data on this do not appear to be conclusive and further investigation is desirable.

The first practical step in prevention of the spontaneous ignition of newly-made charcoal is to cool and thoroughly air it before bagging or storage. Definite requirements for air exposure and other factors relating to the prevention of the spontaneous ignition of charcoal are given in Regulations by the Interstate Commerce Commission.

Wood. Available evidence indicates that wood when subjected to prolonged exposure to temperatures of a low order (steam pipes) may ignite spontaneously. The formation of porous carbon or charcoal on the surface of the wood exposed to the heat may be the underlying cause of ignition.

As a measure of prevention, fire under-

writers require that steam pipes should be 2 in. clear of wood, or 1 in. when metal sleeves are used.

Coal. With the possible exception of anthracite, all grades, particularly bituminous and lignitic coal, are subject to spontaneous heating and ignition under certain conditions. It appears that the underlying cause of the spontaneous heating and ignition of coal is oxidation.⁴

There is much difference of opinion as to the effect of moisture and sulphur. Available data indicate that the presence of sulphur compounds is not essential to the reaction although pyrites when present may be a contributing factor.

Increase in the fineness of the lumps,⁵ as would be expected, appears to promote the reaction. Further, the degree of ventilation is a factor. Currents of air retard the reaction by conducting away the heat.

It is significant that spontaneous ignition occurs usually in comparatively large masses of coal containing a large amount of slack. This is in accord with the oxidation theory.

Probably the safest method of storing coal is under water, but this has its practical disadvantages. Limiting large piles so that points in the interior are not over about 10 ft. from the surface, appears in general to be effective. The bulk of coal in a carload is not usually large enough to result in ignition. It appears to be especially dangerous to pile coal on or around timbers as the open spaces permit access of oxygen and thus promote the reaction. Airing finely pulverized or ground material several days before shipment or storage appears to be of advantage.

A new method of protecting coal from spontaneous ignition has recently been developed. It consists in spraying the coal with a high flashing point mineral oil, which reduces the tendency to spontaneous ignition by protection of the surface from oxidation.⁶ It has the added advantage of reducing the dustiness of the coal. The process is apparently meeting with success but experience with it in the field is limited. Owing to the fire hazard of the process,⁷ precautions against ignition of the oil are necessary.

Agricultural Products

There is a wide divergence of opinion as to the underlying causes of the spontaneous ignition of hay and other plant products.

There are theories that ignition is caused by bacterial heat, enzymic heat, oxidases, pyrophoric carbon, and even pyrophoric iron. It is clear that the subject is complex, and further experimental data are needed.

It appears that the spontaneous ignition of these products is a two or more stage process. The first stage of the spontaneous heating (up to about 70 to 80 C, 158 to 176 F) is caused primarily by fermentation or other microbiological action, it being well known that such processes generate heat. When the temperature, however, exceeds about 80 C, the life or activity of microorganisms and enzymes is supposed to cease. The rise in temperature in later stages of the process is considered to be due to chemical oxidation. It is thought that unsaturated and intermediate products may be formed in the first or microbial stage, the subsequent oxidation of which is a factor in causing ignition.

Data compiled by the Bureau of Chemistry and Soils* (U. S. Department of Agriculture) indicate that spontaneous ignition of hay is more likely to occur from 2 to 6 weeks after storage.

It appears that conclusive data are not available as to practical methods of safeguarding hay with certainty against spontaneous ignition. The U. S. Department of Agriculture has conducted many laboratory and large scale experiments, the results of which indicate that as a safety measure the moisture content should not exceed about 30 per cent by weight of the hay. Further, the hay should be cured before being placed in storage. The mows should not exceed about 10 tons. The division of large mows into small compartments by means of alleyways or open-work partitions would facilitate drying and aid in dissipation of heat.

Salt (sodium chloride) may retard fermentation but evidence available indicates that salting of hay cannot be relied upon to prevent its spontaneous ignition.⁹

Despite efforts made to safeguard against spontaneous ignition, fire losses on farms

caused by the spontaneous ignition of hay amount to millions of dollars annually. The loss would be greatly reduced if hay was stored in isolated structures separated a safe distance from farm buildings.

Hemp, Jute, and Sisal. It has been reported from time to time that hemp, jute, and sisal ignite spontaneously. While losses occur from spontaneous heating when the fibers are wet, there appears to be no data available showing that spontaneous ignition occurs.¹⁰ If impregnated, however, with oxidizing oil, there is danger unless the oily fibers have been subjected to an effective drying treatment.

Sugar. It has been claimed that sugar in storage is subject to spontaneous ignition, but available data are not conclusive and further research on this is needed.

Other Organic Compounds. There are a number of products met with in practice, as for instance fertilizers, that are mixtures of a wide variety of ingredients, some of which are organic compounds similar in hazard to substances of Group 4, while others have oxidizing properties like substances in Group 3.

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- ⁴ Report of Committee on Spontaneous Heating and Ignition of National Fire Protection Association (1935)
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- ⁶ U. S. Bureau of Mines' Information Circular No. 6932
- ⁷ Harry E. Roethe—*Agricultural Engineering*, April, 1933
- ⁸ Harry E. Roethe—"Results of Recent Investigation of Spontaneous Heating and Ignition of Hay," pamphlet—*American Society of Agricultural Engineers*, 1937.
- ⁹ L. S. Stuart and L. H. James—*Journal of Agricultural Research*, Vol. 42, No. 10, 1931
- ¹⁰ Underwriters' Laboratories, Inc.—"Report on Sisal"

Following Mr. Nuckolls' address, the following question was asked:

The spraying of coal with oil to prevent

spontaneous ignition has been mentioned. What should be the flash point of such oil?

It should be 300 degrees F. or higher.

Explosion Hazards of Common Flammable Liquids

By CHARLES R. MILLER

Consulting Engineer, White Star Ohio Division, Socony-Vacuum Oil Co., Inc., Detroit

It is a universal rule that safety is best promoted by acquiring a thorough knowledge of the problems involved. Ignorance and carelessness are usually the basis of all accidents.

Practically all of us are carrying on some activity in every-day life which carries with it the element of danger; the more hazardous the activity the more care should be exercised.

The most common flammable liquid known is gasoline. Approximately 23 billion gallons of gasoline are made and consumed yearly in this country. Gasoline is handled at least seven times from the point at which it is manufactured until it reaches the tank of the customer's automobile. Every time this occurs, it presents new and additional safety problems, and one must admit that the relatively few accidents which do occur are a tribute to the skill with which this material is handled.

Before going deeply into this subject, let us understand what is meant when we speak of liquids being flammable. Strictly speaking, liquids as we think of them, are not flammable. This statement may be surprising but, nevertheless, it is true. Before the material composing a liquid, such as gasoline, can become flammable, it must be converted into a gas or vapor. This is usually accomplished by the application of heat, the amount depending on the relative vaporizing point of the constituents of the fuel.

Gasoline is easily vaporized; it produces vapors at normal room temperatures. On the other hand, kerosene, even though it is manufactured from the same crude oil and contains the same basic chemical constituents, requires the application of considerably more heat to cause it to vaporize in corresponding quantities. Even after vapors have been produced, there is still another condition which must be accomplished before actual burning is possible.

The vapors must be mixed with air in rather definite proportions; and after this mixture of vapor and air has been produced, a means of ignition is required to raise its

temperature to a point where the chemical reaction involved in combustion takes place.

These fundamental facts can be demonstrated if we place a small quantity of gasoline in a glass beaker, allow it to stand exposed to the air and apply a burning match above the surface; then, flammability is accomplished.

Liquid Doesn't Burn

It will be noted, however, that burning is taking place above the surface of the liquid and the liquid, itself, is not burning. It is only the vapors emanating from the surface of the liquid and becoming mixed with air in the beaker that are flammable. If we shut off the source of air by placing a cover on the beaker, the fire is extinguished.

Another illustration of these facts is the common process by means of which gasoline is produced. In distilling gasoline from crude oil, the oil circulates through a series of tubes or a pipe still, where it is heated to very high temperatures. The gasoline content of the crude is converted to vapors, and even though they exist at a very high temperature, there is no burning because all air is excluded from the still.

In the laboratory we test gasoline by placing a quantity in a glass flask, and apply a gas flame to the bottom of the flask, causing the gasoline to vaporize and pass off through a condenser. Even though the bottom of the glass flask becomes red from the heat, still the gasoline directly in contact does not burn because air is excluded from the flask and, therefore, combustion is impossible.

Let us try an experiment with kerosene instead of gasoline in the beaker. It is possible to introduce a match directly into the kerosene and instead of the kerosene igniting and burning, the match is actually extinguished. This, again, is due to the fact that kerosene at ordinary room temperature gives off no flammable vapors and, under the circumstances, combustion cannot take place.

These demonstrations bring out the fact that the formation of vapor is necessary be-

fore we can have combustion. Understanding these simple fundamentals, we are able to apply the laws involved to the handling of liquids. When we do this, the chances of dangerous explosions will be greatly minimized.

The term "flammable" involves the more or less continuous and orderly combustion of the material being used. This type of reaction is usually described as the process of combustion. A chemical reaction is taking place in which there is a union of certain elements resulting in the formation of new and different compounds.

Gasoline is made up of the elements of carbon and hydrogen. When it burns, the carbon unites with the oxygen in the air to form carbon dioxide and the hydrogen unites with oxygen in the air to form water. The chemical action involved results in the evolution of heat, and heat, we know, is a form of energy.

The complete combustion of various substances of known chemical nature results in the formation of certain definite quantities of energy or heat units. The number of energy units can be measured and the results of the combustion of definite quantities of material can be calculated. These units of heat are usually expressed in terms of British Thermal Units or calories and have certain definite values. For instance, a British Thermal Unit is the amount of heat required to raise the temperature of one pound of water through one degree Fahrenheit. There is a very definite relation between these units of energy and the amount of useful work that can be performed when burning a given fuel.

We introduce into an automobile cylinder a definite mixture of gasoline, vapor and air; we ignite it; we control the combustion of it; we can speed it up or slow it down simply by the pressure of our foot on the accelerator and we can obtain speeds ranging from five to one hundred miles an hour from the average automobile. In this case, the rate of combustion is very much under control.

Fuel burning under a boiler will generate steam which, in turn, will run machinery which transports us from one part of the country to another, across the ocean, lights our homes and provides us with many of the comforts which are so essential in modern life. These things can only be accomplished, however, by the orderly control of the process

of burning and this process, under these conditions, is generally relatively slow.

On the other hand, uncontrolled combustion may result in a tremendous dislocation of surrounding media. It is this situation with which we are most interested in dealing in this paper.

It is only proper that we understand thoroughly the conditions which are more or less ideal for an explosion when considering the common liquid—gasoline. First, we must have the same conditions involved in combustion because, after all, the only difference between combustion and explosion is the element of control.

Liquid Must Be Vaporized

To begin with, the fuel must be in vapor form; it then must be mixed with the proper amount of air to form a combustible mixture; the mixture so formed must be ignited. Vaporization is usually related to the temperature at which the gasoline is being handled and the mixture of the vapors forming with air is accomplished by the movement of the turbulent vapors in the presence of air.

An interesting illustration of this nature occurred a number of years ago in one of the southern states. A tank car of casing-head gasoline was placed on a siding and exposed to the heat of the sun for a considerable time. Some workmen then proceeded to unload the car and their first step was to remove the dome cover without gradually reducing internal pressure through the safety valve. When the cover was loosened, the contents of the car actually boiled over and huge quantities of vapor escaped in the air.

There was a slight wind blowing from the car toward a group of negro shacks some one hundred yards away. The vapors were rolled along by the wind, picking up and becoming mixed with air as they moved along. When this cloud of vapors struck the shacks, it was ignited by fire in a stove and a terrific explosion took place—not at the tank car but actually at the row of shacks. Eventually the fire flashed back to the tank car and ignited it, but there was no explosion there, simply a violent combustion off the top of the dome, which was finally extinguished. The explosion actually took place fully 100 yards away from the tank car, and most of the damage resulted at this point.

Some years ago, a tank car of gasoline

was spotted on a siding in Detroit, and the operators attempted to unload it by attaching a line to the leg or outlet on the bottom of the tank. When the cap was removed from the leg, it developed that the inside valve was not seated, and the contents of the car began to pour out on the ground and, eventually, down a sewer. This sewer led into a main which entered into the Detroit River a few miles distant. Something ignited the vapors in the sewer and a series of explosions took place which blew all the manhole covers into the air all along the line of the sewer to the river.

More recently, two serious accidents occurred in Michigan which resulted in fatalities. A large gasoline and tire station in the City of Flint was completely demolished by an explosion and several persons were killed and injured. Investigation showed that in checking some pumps, gasoline was poured down a pipe which the operator thought led back to the storage tank but which actually led back to a basement in which was located the heating plant. About twenty gallons of gasoline were emptied down this pipe and spilled into the basement where it became vaporized and formed a highly explosive mixture, which eventually was ignited, causing the explosion.

On another occasion a delivery of gasoline was made to a building in Detroit and because of a leaking line some it escaped into an elevator shaft in the building. Here, again, an explosive mixture was formed and ignition took place.

Precautions Are Simple

The simplest way to prevent explosions and insure safety in the handling of such liquids is to minimize as much as possible—

1. Vaporization of the liquid.
2. Inclusion of air with the vapors, as formed.
3. Possibility of some form of ignition.

In the intelligent handling of gasoline on the part of refiners and distributors of this liquid, every precaution is taken to guard against such conditions.

Under all normal operating conditions where a container is only partly filled with gasoline, the space above the liquid level will contain gasoline vapor. In many such cases air will also be present in the so-called "vapor-space" of such containers. However, it is only in rare cases that the air and

vapor will be in such proportions that the mixture could be ignited.

The so-called "explosive range" of mixtures of air and gasoline vapor is very narrow and its limits are well illustrated by the difficulty of starting an automobile engine on a cold morning when the operator first has to choke off the air supply in order to get a mixture rich enough to burn and then almost immediately after the engine starts he has to open up the air supply in order to prevent the mixture from becoming so rich that it will not burn.

This narrow explosive range, covering as it does less than 5% of all possible mixtures of gasoline vapor and air, provides an inherent factor of safety in the case of a partially filled container; in other words, an air space of 100 cubic feet containing less than 1½ cubic feet or more than 6 cubic feet of gasoline vapor cannot be ignited.

With the volatile gasolines in use throughout the country today, the air space in partially filled tanks will usually contain from 15% to 50% of gasoline vapor; therefore it is impossible to have an explosive mixture in a partially empty tank except under two conditions, namely—First, where the tank is so nearly empty that the volatile constituents of the gasoline constitute less than 6% of the volume of the tank; usually this would mean a tank containing less than 1% of gasoline. Second, where gasoline is discharged from a tank in such quantity and at such rate that the vapor-air mixture will be diluted by indrawn air to a point within the explosive range. Such a condition occurs infrequently and then only persists for a short time unless the tank is practically empty.

The gasoline tank which is "practically" empty represents a distinct explosion hazard regardless of its size or location because of the probability of a combustible air-vapor mixture. The only remaining element needed to produce an explosion is a source of ignition. I know of at least two cases where small children were injured or killed because of their curiosity to determine what was in "empty" steel drums which previously had contained gasoline.

Empty tank cars used in hauling gasoline and empty tank wagons used for the same purpose may be correspondingly hazardous. "Empty" gasoline containers are always more dangerous than full ones, and the first law of safety demands a thorough under-

standing of the principles involved if we are to avoid destruction of property and loss of life in handling such equipment.

Empty gasoline drums should never be allowed to reach a place where they are accessible to the public. Tank cars, tank wagons and storage tanks should be thoroughly steamed out before repairs or cleaning are attempted.

A gallon of gasoline introduced into a motor of an automobile weighing two tons will drive that vehicle 15 to 20 miles along the highway. Even on this basis, less than 10

per cent of the available energy in a gallon of gasoline is utilized for propelling the vehicle. Relatively small quantities of related liquids, such as fuel oil, burning under the boilers of great ships, drive these huge masses across the ocean.

Because of the tremendous energy stored in these liquids, intelligence and care should be exercised in their use. And we, who make them available to the great masses of people, should exercise the care and intelligence that are essential in the prevention of serious accidents and fatalities.

ADJOURNMENT

Health Service in Industry

TUESDAY MORNING SESSION

October 12, 1937

The meeting was called to order by Dr. Hart E. Fisher, Chief Surgeon, Chicago

Rapid Transit Co., Chicago, and Vice-President for Health, National Safety Council.

Industrial Dermatitis and Its Prevention

By LOUIS SCHWARTZ

Medical Director, Dermatoses Investigations, U. S. Public Health Service, New York City

Of prime importance in the control of industrial skin diseases is the knowledge of their incidence. Various English writers estimate that from 50 to 84 per cent of all occupational diseases in England are skin diseases, and R. Prosser White states that at least 18,000 to 19,000 cases of industrial skin diseases occur in England each year.

In Germany, in 1930, there were 7,000 cases of occupational dermatoses recorded.

In the United States, statistics gathered from California, Connecticut, Massachusetts, Mississippi, Minnesota, Missouri, New Jersey, New York, Ohio and Wisconsin, show that about 65 per cent of all occupational diseases are dermatoses, and from these records it is estimated that there are at least 20,000 cases of occupational skin diseases, of sufficient severity to lose time from work, occurring in the United States yearly.

Actual studies made by the United States Public Health Service in various basic industries show that more than one per cent of the workers engaged in these industries suffer some time during the year with an occupational dermatitis. If we take into account the fact that there are about 25,000,000 workers engaged in industry, this gives us a conservative estimate of about 250,000 cases of occupational dermatitis of various degrees of severity occurring yearly in the United States.

From available records of compensation boards of the various states, it is estimated

that the average case of industrial dermatitis coming before them receives a compensation of about \$100 and that the average cost of medical care per case is also about \$100. Multiplying this by the estimated number of cases losing time from work each year, gives us a total estimated cost of \$4,000,000 for occupational dermatitis in the United States.

Causes

All individuals are not susceptible in the same degree to skin irritants. Individual differences in the anatomical structure and the physiologic secretions of the skin are factors in susceptibility to external irritants. The cornified cells of the outermost layer of the skin and the secretions of the glands of the skin constitute a defense against external irritants.

Abnormalities in these structures and in the secretions may predispose the skin to the action of external irritants. Normally the cornified cells are tough and withstand the action of many chemicals—even fairly strong acids, but they are attacked by alkalis. The perspiration acts as a diluent of irritants which are water soluble and the sebaceous secretions consisting of liquid waxes and cholesterol form a protective coating against water soluble irritants.

The pigment of the skin also acts as a protective factor against certain skin irritants, especially against light. The perspiration, however, if excessive, may so macerate the skin as to render it vulnerable and the sebaceous matter, if excessive, may act as a

solvent for certain chemicals which, if they are not in solution, can not injure the skin. The vulnerable portions of the skin are the openings of the ducts and hair follicles through which chemicals may enter. Of course, thinning or breaks in the skin act as portals of entry for external irritants.

Blondes and thin skinned individuals are said to be more susceptible to certain irritants than those with thicker, darker and more oily skins. For this reason many chemical factories will employ only negro labor for certain jobs in which irritants are handled as, for instance, the filter presses, driers and grinders in synthetic dye manufacture. Individuals with oily, thick skins withstand the action of solvents, such as turpentine, naphtha, etc., better than those with dry skins. Individuals having much hair on the arms and legs and those who have excessive sebaceous secretions are more likely than others to develop folliculitis and trade acne when working in oils and greases.

For the same reasons the various portions of the skin of the same individual differ in susceptibility to external irritants. Those portions of the body which are exposed and have the thinnest skin, such as the inner surface of the forearm and the anterior surfaces of the body are more apt to be irritated than are other parts of the body.

The diet also seems to have an influence on susceptibility to external irritants. Experiments have often proved that the diet influences the secretions of the skin and in this way renders it more or less susceptible.

Age too seems to exert an influence on susceptibility. Most of the workers affected with acute industrial dermatitis are new workers and young, whereas the chronic, eczematoid type of industrial dermatitis usually occurs in workers of middle age or beyond.

The presence of other skin diseases, especially of the itching type where scratching tends to rub in any irritant which may be deposited on the skin, also predisposes to industrial dermatitis. It has been noted also that those workers suffering with seborrhea and mycotic infections are more prone to develop industrial dermatitis than are others.

The most important predisposing cause of industrial dermatitis is to my mind the lack of cleanliness. Not only the lack of personal cleanliness, but the lack of cleanli-

ness in the work rooms, the machines and the air.

Hypersensitivity in the sense of allergy, that is, the production in the system of an antibody in response to a contact with an external substance which acts as an antigen, plays but a small part in the causation of industrial dermatoses. Most of the cases can be explained by changes in the defense mechanism of the skin or by increase in the vulnerability of the skin, or by an excessive amount or concentration of the external irritant. However, the fact that there is a specific hypersensitivity present in certain individuals cannot be denied. I have seen cases where the mere presence in the same room with certain nitro compounds has produced itching in the hypersensitive individual.

Allergy can be acquired by exposure to certain substances. This exposure may be through the skin, the respiratory or through the gastro intestinal tracts.

Classification of Causes

The actual causes of industrial dermatitis in the United States are chiefly alkalis, oils and greases, solvents, acids, corrosive chemicals and plants. A simple classification of the actual causes is as follows:

1. *Physical Agents*—such as burns, scalds, extreme cold, radiation friction and trauma.
2. *General Irritants*—that is, substances which will irritate any skin. These can be subdivided into Organic and Inorganic. The Inorganic General Irritants can be subdivided into Acids, Strong Alkalis and Corrosives. The Organic General Irritants can be divided into Acids and Solvents.
3. *Specific Irritants*—These do not affect every individual, but cause dermatitis on a considerable percentage of hypersensitive persons. The Specific Irritants can be divided into groups:
 - (a) *Oils and Greases*—such as lubricating oils, vegetable oils and essential oils.
 - (b) *Dyes and Dye Intermediates*—Certain of the aniline dyes, such as paraphenylenediamine, Malachite Green, Crystal Violet, Bismarck Brown, Auramine, Amido-azo-benzene and Amido Azo-Toluene and their intermediates and decomposition products. Some of the irritating intermediates are dinitro-chlorbenzol, phenyl hydrazine, phenyl glycine, anthracene and benzidine.

(c) *Certain explosives are Skin Irritants*—such as Tetryl, T.N.T., Lead Azide, Lead Styphnate, Fulminate of Mercury.

(d) *Rubber Compounds and S. A. Para and Smokes Sheet*, Balceta, Gutta Siaz are impure rubbers and may cause dermatitis. Rubber accelerators and Antioxidants often irritate the skin of workers. Some of the irritating accelerators are hexamethylenetetramine, trimene, tetramethylthiuramdisulphide, etc.

(e) *Plants*—Many plants are irritating to the skins of certain individuals and gardeners and florists may suffer from dermatitis from them. Among the most common plant irritants are Poison Ivy, Sumac, Poison Oak, Pyrethrum, Cocobola, Brazilian Walnut and Primrose.

(f) *Biologic Agents*—These are often the cause of industrial dermatitis and may be divided into three classes:

- (1) *Parasitic Insects*—such as may cause grain itch, straw itch and linseed itch.
- (2) *Bacterial Infections*—Such as erysipelas caused by the bacillus of swine erysipelas and occurring among butchers and carcass handlers; anthrax among hide and wool handlers and pyogenic infection.
- (3) *Fungus Infections*—such as monilia infections, occurring on the hands of fruit packers.
- (4) *Ringworm Infections*—occurring among barbers, wool sorters, fur handlers, animal handlers and bath attendants.

The actions on the skin of these various irritants may be classified as follows: Some act as

1. *Keratin and Fat Solvents*, such as mild alkalis and soaps.
2. *Desiccators, or Hygroscopic Agents*, which take the water out of the skin, such as sulphuric acid and powerful alkalis.
3. *Some are Protein Precipitants*, such as heavy metal salts, which form albuminates in combining with the skin.
4. *Some are oxidizers*, and by their strong affinity for the hydrogen in water, liberate

oxygen. Such are chlorine gas, peroxide of hydrogen, chromic acid and its salts.

5. Then there are substances which tend to hydrolyze when coming in contact with the moisture of the skin and form irritating compounds. *Hexamethylenetetramine*, which on hydrolyzing, first forms formaldehyde and then later goes on to formic acid, is an example of this class.

6. There are certain substances which act as stimulants to the keratin forming cells of the skin and are apt to cause new growths. *Arsenic, petroleum products and aniline compounds* are examples of this class.

7. There is still another group which is known as *Sensitizers*. After exposure to them for varying lengths of time, the skin becomes sensitized to their action. These substances may be called anaphylactoid in their action. The *nitro and the nitroso compounds and certain vegetables and fungi* belong to this class.

Hypersensitive workers may not, upon coming in contact with an irritant, immediately develop a dermatitis. A period of time usually elapses. This period may vary from a few hours to a few days. Some workers develop only a mild dermatitis and are able to continue working and finally become immune. Others develop so severe a dermatitis that it necessitates their discontinuing work.

These usually do not develop an immunity. The immunity, if developed, usually lasts only a short time—from a week to a month after stopping work. There is one class of worker, and fortunately this type is rare, who after working without any trouble for many years, suddenly becomes sensitized to the materials which he formerly handled with safety and develops a severe dermatitis. These workers never become immune. They may even develop a polysensitivity to many of the ordinary things of life and as a result suffer from chronic, incurable eczemas.

Symptoms

The usual symptoms of an acute industrial dermatitis are itching, followed by erythema, oedema, papules and vesicles. The clinical appearance does not, except in a few instances, such as oil acne and keratoses due to paraffin and arsenic, offer a clue to the irritant. Only the exposed parts are as a rule affected, but the covered parts of the body may also be affected by the action of penetrating dusts, fumes and liquids.

It is characteristic of a typical unaccompanied case of industrial dermatitis that it appears a short time after the person is exposed to the offending material, that it tends to disappear after exposure has ceased and that it reappears on re-exposure.

The best proof that a dermatitis is one which a person is suffering is due to his occupation is that it appears when the man goes to work, goes well if he stops work and reappears when he goes back to work again. This, of course, is a typical picture and is not always met with. Some workers have alternating remissions and exacerbations while at work. In these cases it may be possible that the conditions under which they work are not always the same, or the dermatitis itself may exhibit a periodicity due to variations in the sensitivity of the person.

Infections on top of an industrial dermatitis can complicate the picture of the disease, so that it may be difficult to prove whether the infection or the occupational dermatitis is the original condition.

Diagnosis

The greatest difficulty in differential diagnoses of industrial dermatoses is offered by dermatitis caused by substances not encountered at the place of occupation and by fungus infections and their allergic manifestations—the so-called "tids." The appearance of an acute contact dermatitis is the same whether it is caused by substances met with outside of industry or whether it is caused by substances met with at work. Fungus infections and their allergic reactions may occur on portions of the body which are exposed to external irritants and may resemble acute contact dermatitis, that is, they may show erythema and vesicles on the hands and fingers and as a great many people have fungus infections and as these fungus infections often open avenues of attack for external irritants, the differential diagnosis from a contact dermatitis is often difficult.

To differentiate an occupational dermatitis from one due to contact with substances encountered outside of industry, patch tests with the materials which the worker handles during his work are of great value. In doing patch tests, it is necessary to know the dilutions of chemicals which can be placed on the normal skin for a period of time without causing a reaction. You can readily see that

a patch test with a general irritant, such as strong acid or alkali, is of no value because it will burn any skin.

The reaction to a patch test depends on the degree of sensitivity of a patient, the concentration of a chemical with which the test is made, the actual amount of the chemical applied to a given area of the skin and the length of time it is allowed to remain on the skin, and also whether the substance wets the skin, that is, whether it is soluble even to a small degree in the secretions of the skin.

In performing patch tests in industrial cases, it is best to have controls, usually fellow workers who are doing the same kind of work as the patient but who do not show skin eruptions. One must also be on the lookout for delayed reactions, that is, reactions which manifest themselves some time after the removal of the patches.

Patch tests must not be the sole criterion for a diagnosis of industrial dermatitis. A positive reaction shows that the person is sensitive to the material at that time. A negative reaction does not show that the person was not sensitive at the time he developed his dermatitis, nor does it show that the person would not become irritated by the substance under actual working conditions, because friction, trauma and heat are not present in the patch test. If patch tests are performed after the dermatitis has disappeared, the reactions may be negative because the person may have developed an immunity to the irritant.

Patch tests are only links in the chain of evidence which determines the diagnosis of industrial dermatitis. The history, the appearance and location of the lesions, must also be considered.

Cancer in Industry

Cancerous changes in the skin may occur in wounds or scars caused by industrial accidents, such as burns and wounds. Cancerous degeneration also occurs in so-called sailors' and farmers' skins, supposedly due to over exposure to the ultra violet rays of the sun. Radium and X-ray cancers among technicians and physicians you are familiar with. Certain chemicals are also said to cause cancers of the skin. The soot cancer of chimney sweeps described in England has not been described in America. Certain oils and petroleum products predispose to the development of cancer.

In our studies in oil refineries we have verified this fact. Workers in arsenic also tend to develop skin lesions on the exposed parts. Such lesions have been reported by European observers, but in our studies in factories where arsenicals and insecticides are manufactured in this country, we have failed to note their occurrence. We have, however, seen such lesions occurring as a result of the internal administration of arsenic over long periods of time.

An unusual number of papillomata and carcinoma of the bladder has been found to occur among synthetic dye workers both in Europe and in America. Workers exposed to such dye bases as Anthracene, Benzidine and Alpha-Naphthylamine, are said to have cancers of the bladder occurring amongst them thirty times more frequently than the average population.

Aniline and its derivatives are also said to cause the occurrence of cancer. Cancers of the liver have been experimentally produced in rats by feeding them certain aniline dyes (amido azo toluene) and also by rubbing certain of these aniline dyes into wounds of the skin. Other substances said to cause cancer are Toluidin, Xylol, Sylofin, Cumidin, Anisidin, Dyphenylamin, Naphthol, Kongo-Red, Safranin, Benzopurpurin and Blue-Rosanilin.

Treatment of Industrial Dermatoses

A person who is so sensitive to the material with which he works that he cannot develop an immunity, should seek some other occupation. Most of the cases of industrial dermatitis develop on new employees and are usually mild in character. Such workers should be given a protective ointment to put over the parts, proper protective clothing, such as rubber gloves, aprons, etc., and be allowed to continue on the job. Most of them will develop an immunity. Those who do not, should be given other work to do where they will not come in contact with the irritant. This usually effects a cure.

In applying medication to lesions, only the mildest form of ointments or lotions should be used, such as boric acid or calamine.

Desensitization has not met with any encouraging results.

Prevention

The ideal prevention is to so safeguard the operations that injurious chemicals do not come in contact with the skin. This can be done by installing totally enclosed proc-

esses. Modern factories are being built so that the worker need not come in contact with any of the chemicals used from the start of the manufacturing process to the very end. Raw chemicals are brought to the factories in enclosed railroad cars, emptied by section hose into enclosed storage containers from which they are sent by turning valves to the various retorts and kettles through a closed system. From these kettles the finished product is processed in totally enclosed machinery, such as filters and grinders, and placed into closed shipping containers by means of hose or pipes.

In some industrial processes, where this is not possible, or where there is old equipment, the worker must be protected by being compelled to wear suitable protective clothing, such as rubber gloves, aprons, masks and goggles. This protective clothing should be frequently cleaned and laundered. Over processes from which are given off irritating dusts or fumes, a special suction ventilating apparatus should be installed so that these irritants cannot come in contact with the worker. The work rooms themselves should have proper and adequate ventilating equipment so that dusts and fumes have no chance to accumulate in any concentration. Rules for the use of protective clothing should be enforced. When respirators or gas masks are furnished, the men should be compelled to wear them.

Cleanliness is of prime importance. The floors and walls of the work rooms should be kept scrupulously clean as should all machinery. Convenient shower baths should be installed and the workers should be compelled to take baths after work. In factories where there are special skin hazards, a double set of locker rooms should be provided, that is, one for street clothes and one for depositing the soiled work clothes.

In this way, the worker coming to work will enter the first locker room where he will strip and leave his clothes in the locker. From there he proceeds through a hall to the second locker room where clean work clothes are waiting for him. From this locker room he proceeds to his work. At the end of the work shift he enters the locker room in which he had put on his clean work clothes. Here he deposits his soiled work clothes and goes to the shower baths. From the shower baths he proceeds to the locker room where he had left his street clothes and then goes home.

There are many protective ointments on the market designed for the prevention of industrial dermatoses. These ointments are supposed to act by forming a protective film over the skin and thus to prevent the irritant from coming in contact with the skin. Many of them imperfectly perform their function. They may be easily rubbed off during work or may be washed off by the perspiration. Some may offer protection against a particular chemical. There are very few of them, however, which can protect against strong alkalis. In some instances a protective ointment may be of value, especially if used during the time pending installation of the more permanent protective measures which I have described. They should never be relied upon as preventive measures, but only as temporary expedients pending the installation of proper safety appliances.

New applicants for work should be carefully examined and those having such predisposing skin conditions as previously stated should not be employed in occupations where there is a skin hazard. In occupations which present serious skin hazards, all applicants for jobs should be stripped during the medical examination and should be patch tested with the materials with which they are to work and if found to be hypersensitive, they should be rejected.

The workers should be encouraged to report to the medical department all irritations of the skin, no matter how trivial. There

should be frequent medical examinations of the workers to discover the presence of skin diseases which have not been reported. The physician in charge should have a working knowledge of dermatology and give proper treatment for these cases, or if he does not have such knowledge, dermatological cases should be sent to a consulting dermatologist.

It is not always necessary to remove the worker from his job in order that he may get well. Indeed, it is sometimes better to allow him to work. If he has a mild dermatitis, and treat him while working in the hope that he will develop an immunity or become "hardened," as the workers themselves call it. A great many workers will become "hardened" and the immunity thus acquired usually lasts while working and sometimes will continue for a considerable period after contact with the chemical has ceased so that the worker may stay away from his job for two or three weeks and come back and still be immune. If, however, he stays away for a few months, he will in most cases lose his immunity and will again have to go through the process of becoming "hardened."

Those workers who develop such a severe dermatitis that they cannot get well while working, should be removed from the job and when they have become well, they should be placed in some other portion of the plant where they will not come in contact with that irritant.

Facts Revealed from Studying the Causes of Absenteeism

By A. J. R. CURTIS

Assistant to General Manager, Portland Cement Association, Chicago

Most of us recognize potential danger in the present wave of almost hysterical concern for the health of our workers.

No industry, however free from real hazard it may be, can successfully defend itself from uninformed public opinion without having at its command unassailable facts. This is particularly true of industries producing appreciable quantities of fumes, vapors or dust which, although actually harmless, may work on the imagination of uninformed observers. The portland cement

industry provides a good illustration of this kind.

On the other hand, no industry possessing a real hazard can hope to survive the flood of legislation and officially sponsored investigation by an ostrich-like attitude of refusing to recognize the existence of trouble.

So, I say, the situation requires unassailable facts. Many techniques are available for gathering the facts which so many industries should have. On the engineering side, dust counts and analyses of the air in

the working environment are valuable. Clinically, physical examinations with necessary laboratory tests and X-ray views will help establish the existence or absence of a health hazard.

Another valuable index of the general health of a group of workmen is frequently overlooked, namely; studies of the amount and severity of disabling illness. Comparisons with absentee and mortality rates of other industrial groups, and of the community, often can be made. Insurance companies and the U. S. Public Health Service are generous in providing available comparative statistics. Some of the state health departments are in a position to help.

By making these comparisons, and taking into account possible variations due to different known factors, a practical picture of the effect of working environment on employees' health can be secured. Even if a hazard is not specific enough to produce occupational disease, most employers will want to be aware of, and to remove, any possible hindrance to the health of their employees.

It will be of interest to point out general factors which may affect the interpretation of morbidity and mortality statistics. Dean K. Brundage, Senior Statistician of the United States Public Health Service, lists the following as the more important factors:

A. Marital status (particularly of female industrial employees).

B. Extent of addiction to alcoholic stimulants.

C. Length of working day or week, including extent of part-time employment.

D. The type of workers from the physical standpoint who live in the community and from which labor draws its supply; i.e., whether a preponderance of sturdy, robust workers such as are found in steel manufacturing centers or the more frail, anemic type, which tends to concentrate in communities which afford a multitude of light employments.

E. Finally, the self-selection of workers for particular jobs for which they are physically fitted.

Mr. Brundage explains the omission of "climate" from this list, by the fact that climate does not affect mortality rates. However, he specifically points out that it does affect morbidity, or absentee rates.

Note that three of the five factors listed

are industrial. Even climate, interpreted as atmospheric working conditions, might be considered as an industrial factor, especially as it relates to indoor workers or to workers who are alternately in cold and warm temperatures. A recent decision of the New York Appellate Court allowed an occupational disease claim of a meat market clerk for tuberculosis on the grounds that there was a direct causal connection between the employment which required him to enter a cold storage room ten to thirty times a day and the activation of tuberculosis. The court further ruled that under the New York law a disease does not have to be peculiar to, or characteristic of, the employment in order to be classified as an occupational disease. It needs only to have been shown to be a disease suffered because of the nature of employment. Is it not evident that industry ought to be on the alert to avoid all possible health hazards of any type, whether or not they are obviously occupational?

Adequate absentee records imply adequate attendance records. These are usually available. Few companies today will tolerate a casual attitude toward attendance at work, and, of course, enforcement of discipline in this regard demands that employees explain the reasons for their absence. If records of the explanation are kept, all necessary data for an absenteeism analysis are at hand.

The first step in the analysis of absenteeism, if the results are to be properly interpreted, is the separation of illness into minor and major types, based on length of absence. Where only two classifications are used, the division is usually made between illnesses of less than 8 days' duration and illnesses of 8 days' or more duration. This is the natural dividing point, since most sick-benefit associations begin payment for absence on the eighth day.

By far the greater number of illnesses will be in the first class, but the most significant index of trends will be the eight day or over illnesses because (1) they represent the really serious disabling illnesses and (2) more comparative data are available in this group.

Incidentally, an extremely high absentee rate in the one and two day illnesses may indicate, among other things, laxity of discipline in attendance.

Each of the above classifications should again be divided according to the nature of

the disease. The United States Public Health Service's classifications are (1) Respiratory Illnesses, (2) Digestive Illnesses and (3) Non-Respiratory, Non-Digestive Illnesses. These should then be analyzed further into the specific illnesses of each classification. Analysis both by number of employees affected and number of days lost is important.

I want to emphasize the importance of using a standard method. If each organization devises its own system, the results will not be comparable, and much of the value will be lost. Our first study of the cement industry was handicapped in this way. Member companies reported only man-days worked as a base. We calculated our absentee rates on this base, only to find that other statisticians were using the average number of employees as a base. We also, in some instances, placed certain illnesses in a different classification from that usually followed.

There are endless ways in which absenteeism information can be used by an alert interpreter. Just how any individual plant or industry would use its own statistics must be determined by the peculiar conditions present in each case.

I am going to illustrate a few of the outstanding facts brought out by our study. Many of you have seen cement plants, and all of you have seen cement handled on construction. You know it is a finely ground, dusty material. To some casual observers this dustiness is synonymous with health hazard. But many clinical and roentgenological studies in the last two years have demonstrated that this is not the case. Such proof is very important, but by itself it is not sufficiently convincing to the average person.

It is fine to be able to point out that the lungs of workers have not been permanently affected; it is still better from the non-technical viewpoint to be able to prove that the amount of acute illness is no greater than the average for all industrial workers, after adjustments for variable factors (Section of the country, age, etc.) have been made.

Here is what our absenteeism study demonstrated about the relation of disabling respiratory illness to cement workers:

If cement dust were in any sense harmful to the respiratory system we should expect that the normal reduction of respiratory

illnesses in the summer months would be inhibited by the increase in exposure to the dust. Actually the descending curve is not affected as cement production increases.

Pneumonia is usually a good index of the trend of respiratory illness, although authorities agree that this disease has nothing to do with the breathing of dust. In 1936 the death rate from pneumonia in the cement industry was 0.89 per 1,000, or approximately one death in every 1,125 employees.

I mentioned earlier that the evaluation of these statistics must take into consideration local conditions. At first glance the pneumonia rate for the cement industry seems rather high. However, at least 75 per cent of cement mill workers are in the unskilled labor class. Since this is true, it is apparent that the pneumonia death rate in the cement industry is not greater than would be expected for the type of labor preponderant in these plants.

In ten selected states, in a survey made by Jessamine D. Whitney, statistician of the National Tuberculosis Association, the death rate for all gainfully occupied males was 9.07. In the cement industry, the rate was 8.42.

A curious phenomenon, which has been verified in several clinical studies, is the very low tuberculosis rate of the industry. There were less than one-sixth as many deaths from tuberculosis in the cement industry as Miss Whitney found among gainfully occupied males, generally. We have a rough check of the comparability of these figures in the suicide rate, which could hardly be influenced by occupation. It is essentially the same in the cement industry and in Miss Whitney's studies.

The foregoing shows clearly that respiratory illnesses as such are not sufficiently exaggerated in the cement industry to warrant the conclusion that the process of cement manufacture affects their incidence.

In the interest of the employees most employers will want to go farther than this. Regardless of occupational causation, they want to know what illnesses are causing serious loss of time. Such knowledge will point the way to the type of preventive service which will be most helpful.

In this phase of the problem the absentee study will give much better information than a clinical study. The clinical study shows health conditions at a specific time;

the absentee study shows trends and makes possible effective preventive measures.

We do not yet have sufficient comparative material to know whether our experience is different from other industries. Nevertheless, some illnesses do loom rather high, and we feel that in the interest of the employees specific educational work should be undertaken to help them avoid these illnesses.

There is nothing unusual about the fact that respiratory illnesses affected the largest group of employees. This is natural. The common cold causes a large amount of disability not only in industry but in all walks of life. Nevertheless, the incidence of respiratory illness in the specific industry being studied is worthwhile knowledge. It demonstrates the need for applying every approved educational or scientific preventive method.

More significant to us is the frequency—and even more especially—the severity of rheumatism. Again comparative figures are lacking, but whether or not the incidence of rheumatism is above or below average, it is high enough to deserve attention.

On the other side of the picture, we see that tuberculosis is a relatively unimportant cause of absence in the cement industry, as also are high blood pressure, nervous diseases, eye trouble and acute sinus infection. Tuberculosis ranks high in number of days lost, but that is to be expected since recovery is always relatively slow from this disease.

So far, we have considered illness absenteeism alone. The question will occur to many: "How important is illness absenteeism in relation to other reasons for absence?"

The answer to this question will, of course, vary somewhat with the rates for other reasons for absence, but I think that any study of this sort will show conclusively that, entirely aside from consideration of occupational disease, illness absence is the most important class of absenteeism in industry. In the cement industry occupational injury, on which we have concentrated so strongly, has become the least important cause of absence. Illness, in which we are only beginning to be concerned, has replaced injury as the outstanding absence cause. I am certain that we are not unusual in this respect. One large manufacturing concern,

with an exceptional reputation for accident prevention, was found to have a sickness absence rate twice as high as the cement industry's, although the exposure to weather conditions is not nearly as great in that company. Obviously there is a large and profitable field for improvement in control of absence due to illness.

There are, then, two important reasons for the development of adequate absenteeism and mortality records:

First, these records will reveal any trend toward an occupational hazard, or, if no hazard exists, will furnish conclusive proof of that fact. I cannot emphasize too strongly the importance of this reason. The trend of all industrial thought today is toward more protection for the worker. It is certainly a very backward industry that does not wish to give its employees the advantage of all possible protection. Even the backward industries are being pushed into the van of progress by legislative action.

The second and more direct reason for absentee studies is that they reveal so well the general health of employees outside of the strictly occupational hazards. Thus they afford a means of determining accurately how important it is to both employees and management to introduce a health service. Absentee studies also demonstrate clearly the indirect effect of environment on the workers' health.

I do not think that very detailed reports need be done each year for an indefinite period. After three or four years the trends will be pretty well established, and less frequent surveys, taken to demonstrate the effectiveness of preventive measures, will be adequate.

The success of any efforts along these lines is directly proportional to the care with which the work is done. The knowledge gained will in itself be worth the effort expended. Even more valuable will be the results of careful application of that knowledge. Mr. Brundage states the case most effectively:

"The relatively high sickness and death rates found among the skilled, semi-skilled, and unskilled workers in industry indicate a need for the extension of industrial hygiene measures. Tentative estimates indicate that savings obtainable through the elimination of occupational health hazards would to a large extent offset the cost of

providing more adequate health protection for industrial workers. Industrial medical service, for example, even if financed by employees, could reduce the amount of time lost on account of illness so that the net cost to the workers would be no more than they now spend on the average for medical care."

Classification of Diseases as Used by U. S. Public Health Service in Morbidity and Mortality Studies. Numbers Refer to Classification in the International List of Causes of Death

Respiratory diseases

Bronchitis—acute and chronic (106) chest colds included
Diseases of the pharynx and tonsils (115a) sore throat included
Other diseases of upper respiratory tract (104, 105) head colds included
Influenza, grippé (11)
Pneumonia—all forms (107-109)
Tuberculosis of respiratory system (23)
Other respiratory diseases (110-114) hay fever, pleurisy, asthma, etc.

Digestive diseases

Diseases of the stomach except cancer (117, 118) indigestion, etc.
Diarrhea and enteritis (120) colitis included
Appendicitis (121)
Hernia (122a)
Other digestive diseases (115b, 116, 122b-129) intestinal disorder, gall bladder, dental disorder, jaundice, etc.

Nonrespiratory, nondigestive diseases

Infectious and parasitic diseases (1-10, 12-22, 24-33, 36-44) contagious, infections, malaria, etc.
Cancer and other malignant tumors (45-53)
Acute rheumatic fever (56)
Chronic rheumatism, osteoarthritis (57)
Diseases of the blood and blood-making organs (70-74) anemia, etc.
Chronic poisonings and intoxications (75-77)
Neuralgia and neuritis (87a)
Neurasthenia and the like (part of 87b)
Other diseases of the nervous system (78-85), part of 87b, paralysis and apoplexy, included
Diseases of the organs of vision (88)
Diseases of the ear and of the mastoid process (89)
Diseases of the heart (90-95)
Diseases of the arteries (96-99)
Diseases of the veins (100) hemorrhoids, etc.
High blood pressure (102)
Other diseases of the circulatory system (101, 103) low blood pressure, gland disturbances,
Acute nephritis (130)
Chronic nephritis and nephritis unspecified (131, 132)
Diseases of the genital organs—nonvenereal (138, 139) menorrhagia, etc.
Other diseases of the genito-urinary system (133-137) prostatitis, urinary inf., bladder, ureteral
Diseases of the skin and cellular tissue (151-153) boils, carbuncle, abscesses
Diseases of organs of locomotion except of the joints (156b)
Ill-defined diseases and unknown causes (200) fainting, headache, etc.
All other diseases (54, 55, 58-69, 140-150, 154-156a, 157, 162) diabetes, tumor, etc.

Industrial Burns and Their Treatment

By DR. R. D. MUDD

Medical Director, Chevrolet-Grey Iron Foundry Division, General Motors Corp.,
Saginaw, Mich.

A brief résumé of the types and causes of burns and what happens when a burn occurs will be helpful in understanding the treatment. The classification of burns into first, second and third degrees is not really important because the pathology and treatment are quite similar for all types. This classification is important however inasmuch as it materially affects the length of disability and the death rate.

First degree burns are characterized by redness of the skin; second degree by blistering and third degree by charring. The main feature of third degree burns is the destruction of all epithelium making skin grafting usually advisable and often a necessity. The general principles of treatment make it unimportant to distinguish burns by fire or thermal, by hot liquids or scalds by chemicals, by sunlight or by friction. X-ray burns need not be discussed here.

Burns of more than $\frac{1}{2}$ of the body are said to be usually fatal, but a burn of $\frac{1}{2}$ of the body is always serious.

The sequence of events in a burned patient occur in the following order. Primary shock occurs immediately due to pain, loss of heat and an upset of the vasomotor mechanism by nervous impulses from the injured area. It is uncommon, tends to pass off spontaneously and is rarely serious.¹ Secondary shock follows the primary shock. A number of writers subdivide secondary shock into a stage due to blood concentration and another due to absorption of toxin but there appears to be little excuse for this as it has been shown that toxin formation and absorption begin almost immediately after a burn occurs² and it may reach fatal proportions in 8 to 12 hours though it practically ceases by the 24th hour. There appears to be no doubt that blood concentration begins immediately. The damaged blood vessels in the burned area release in increasing amounts the plasma of the blood which goes to form blisters, edema of the part burned and adjacent parts. As the plasma of the blood continues to pour out into the burned and adjacent areas, the blood absorbs the fluids from other organs

and tissues and they become dehydrated but the fluid absorbed continues to pour into the burned area with the result the blood becomes enormously concentrated—thick. The amount of plasma lost may be 70 per cent of the total. Coincident with this concentration of the blood, the blood chlorides are reduced, blood glucose percentage is increased, the plasma fibrin and globulin are increased and the albumin shows a fall in concentration.³

If the patient escapes death due to initial shock, blood concentration or toxemia due to burn toxin, he still has to cope with the infection that almost always followed the older methods of treatment and occurs also quite frequently with modern treatment. Infection may overwhelm the patient especially following third degree burns and any of the complications which can result from infection can occur. After infection is controlled and only then does healing really get under way. If the patient survives the first three phases of his burn he may suffer a long disability during the healing stage and end up with large contracting scars, adhesions of one part of the body to another, sluggish ulcers, and be forced to undergo an extensive ordeal of skin grafting. Even after all this his entire future may be dulled by an ugly appearance or a functionless member.

The symptoms and signs of a burn which I have related are remarkably and surprisingly less conspicuous with the tannic acid treatment. Drs. R. D. McClure⁴ and C. I. Allen found on studying the figures of five groups that the tannic acid treatment reduced the mortality in severe burns from 30.8 per cent to 12.6 and that the mortality at the Royal Hospital for sick children in Edinburgh was reduced from 35.4 per cent to 4.8 per cent. While these results are important, almost equally important are the large number of other advantages which will be enumerated after the tannic treatment is described.

I will not describe Davidson's original method as in my opinion there are a number of more or less recent modifications

which I found to be more useful. I refer to the Fantus and Dyniewicz⁴ modification of the Bettman⁵ tannic acid-silver nitrate treatment of burns. This treatment is as simple as any of the old lard, oil or ointment therapy.

Outstanding disadvantages of Davidson's method were that the tannic acid solution had to be prepared at the time of the burn, the solution was not antiseptic, tanning was slow and the patient's skin was kept moist for many hours during the tanning process.

These disadvantages are overcome by using Fantus and Dyniewicz tannic acid solution which is 10 per cent tannic acid with potassium, calcium and sodium chloride and salicylic acid. This solution keeps indefinitely and does not clog the atomizer that should be used. Any burn that needs treatment, with the exception of burns near the eyes, can and should be treated in the following manner. If there is much pain give morphine sulphate in doses of gr. $\frac{1}{4}$ to $\frac{1}{2}$ in adults and codeine in children. Keep the patient warm with blankets, hot water bottles or other available means. The burned area and surrounding skin is washed with soap and warm water and grease and oil removed with benzine. The patient will be fortunate if no oil or greasy dressing has been applied prior to the time you see the patient for if so this oil or grease will have to be removed. All blisters and devitalized skin should be removed with sterile instruments. The sooner the tannic acid is sprayed on to the burn the more chance the patient has to live, the less shock, toxemia and blood concentration there will be. A delay of one hour may mean the loss of life. It is an emergency measure almost as much as is artificial respiration when it is needed. An atomizer is the handiest method of spraying the tannic acid.⁶ Spray once and generously and then use an electric dryer to dry and drive in the tannic acid. Being 10 per cent instead of Davidson's 2.5 to 5 per cent the tanning is faster and deeper. In a few minutes the surface is dry and then 10 per cent silver nitrate which should be on hand is swabbed on to the tanned surface and again dried. The local treatment is then complete except that as small unsuspected areas of burn occur on the next or succeeding days, the spraying of these areas should be done.

Pay particular attention to what this tanning does. It coagulates the burned tissue

holding in place the toxins it might release, the bacteria that might be present and seals off the damaged blood vessels preventing loss of fluid, but the most amazing thing is that pain stops almost completely, thus lessening shock and saving the patient's strength. Patients shocked into unconsciousness by pain, loss of heat, regain consciousness sooner and are able to take life saving fluids, without which most patients with severe burns would die, and making it unnecessary to give fluids by vein through the skin and elsewhere.

The after treatment is just as important as the application of tannic acid. The more serious cases should be hospitalized. The burned areas are left uncovered. A canopy sometimes called the "Covered Wagon" is placed over the patient and electric light bulbs placed inside to keep the patient warm and the skin dry. Fluids are forced, the patient being given a quart (1,000 cc.) of fluid in any possible way per 25 lbs. per day. The need for salt is so great that some normal saline solution should be given by vein. In the severest cases early blood transfusion should be resorted to and special nursing is a necessity. Urinary examination and blood hemoglobin determinations should be done at least daily for several days. After several days the coagulum should be watched carefully for areas of infection and if found it should be incised freely to allow the escape of pus.

The use of the method I have outlined will reduce tremendously the incidence of these infections prior to Davidson's method. The profuse discharge and the dressings heavily soaked with pus, odorous and often green leave a picture not to be forgotten.⁷ If the burn is first or second degree there is even less likelihood of infection occurring. We usually find that when the coagulum is ready to come off the skin is often healed underneath. The reason is that in burns not exceeding the second degree groups of epithelial cells are present either on the surface or within the glands and hair follicles of the skin and infection not interfering, these cells grow rapidly and form new skin. But in burns of third degree, while the tannic acid method carries the patient past the dangerous primary and secondary shock stages, infection usually occurs to more or less extent and since tannic acid does not stimulate epithelialization we are faced with the necessity of clearing

up the infection, and if the burn is of any size even as little as 2 inches square, the area should be prepared for skin grafting.

I like antiseptic wet dressings such as 1 to 5,000 metaphen solution, but normal saline solution does very well in most cases. Each one has his own method of preparing the area to be grafted. Because we have mentioned Bettman's method local treatment I should add that he prepares the area for skin grafting by use of what he calls oxy-quinoline sulphate scarlet red ointment⁸ which is applied to gauze in such a way as to keep the interstices only. This gauze is applied over the wound and stimulates epithelialization if any epithelial cells remain and rapidly clears up infection in those areas which are to be prepared for skin grafting. For a thorough understanding of his method you are referred to his excellent article in the Journal of the American Medical Association, December 19, 1931.

If skin grafting must be done it should be done early. The type of skin grafting to use would require a talk in itself and I will not attempt to go into it. I like pinch grafts the best but they are not satisfactory for the exposed parts of the body because of their appearance.

The above is more or less typical of the care of a burn due to hot liquids or fire but is just as useful for chemical and even sun burns. Burns of the face should be treated with tannic acid jelly, in order to avoid getting tannic acid solution in the eye. The lips and eye lids should be treated with small amounts of sterile vaseline. Acid and alkali burns should be neutralized with water.

Doctors' offices, roadside and industrial aid stations and fire department first aid stations should be stocked with tannic acid and the solution be made up when needed. They should have a suitable spray with the tannic acid in it and ready to receive sufficient water. It would be better if such a solution as Fantus and Dyniewicz suggest were on hand. The use of any grease or oil for the first aid treatment of a burn is as obsolete as a horse and buggy on Fifth Avenue.

No burn is too small to warrant the use of the tannic acid method or one of its modifications. On the smallest type of burns, tannic acid jelly is acceptable either alone

or with some form of antiseptic. It would be well if every home had tannic acid powder or jelly on hand and a solution of proper strength made up whenever needed and applied with gauze or small towels wrung out in the solution.

I do not wish you to think that this is the only treatment. Many other types have strong advocates. I will but mention the other types: 1 per cent aqueous solution of gentian violet (Fior), gentian violet jelly treatment, the cod liver oil crude or refined alone or in combination with allantoin, the immersion treatment either in tannic acid solution or water, the ferric chloride coagulation method. All of these are reputed to have advantages of various sorts. I am particularly interested in the use of cod liver oil in the late infected stages of burns and believe the last has not been said about it. The use of gentian violet and ferric chloride is based on the same principles as the tannic acid treatment. Any of the modern methods of treating burns mentioned above will give good results if thoroughly understood and if the principles of general treatment are adhered to.

In conclusion my plea is to discard the outlawed out of date methods of treatment of burns and learn to use one of the coagulation methods, the simplest of which I feel is the one I have outlined. The savings in dressings, hospitalization, human suffering, deformities and life itself will amply repay you for your efforts to learn and use proper modern treatment of burns.

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ADJOURNMENT

7149 Fantus & Dyniewicz, and Supply Co
 2400 S. Kedzie St. Chicago
 See also on p. 80

Industrial Dusts

WEDNESDAY MORNING SESSION

October 13, 1937

The meeting was called to order by Chairman A. S. Regula, Executive Secretary, Industrial Relations Counselors, Inc., New

York City, and Vice-President for Engineering, National Safety Council, who introduced the speakers.

What Industrial Dusts Are Harmful? Why?

By SENIOR SURGEON R. R. SAYERS

Chief, Division of Industrial Hygiene, U. S. Public Health Service

While dusts exist everywhere in the atmosphere, it has been recognized for centuries that workers in certain dusty occupations are less healthy than those not so exposed. The number of persons exposed in dusty occupations comprises one of the largest industrial groups. The occupational diseases of workers in dusty atmospheres have been found to be due to entrance of dust into the system by inhalation, by ingestion, by direct absorption through the skin, by irritation of the skin, or by a combination of the foregoing.

The suspensions of particulate matter in air have been broadly termed dusts, fumes, and smokes. Such a classification is necessarily arbitrary, since the line of demarcation between them is not very sharp, and the chief differentiation is based on the size of the particles. Investigations by the Public Health Service in dusty industries¹ revealed that about 70 per cent of the dust particles examined were between 1 and 3 microns in size, only about 20 per cent were less than 1 micron, and the median size was 1.3 microns. Industrial dusts are mainly less than 10 microns in size. However, fibrous dusts in the air, such as asbestos, have been found to contain particles as large as 200-400 microns in the greatest diameter.

While, generally speaking, according to Collis, dusts are more injurious as their chemical composition differs from that of the human body, or from the elements of which the body is normally composed,² it

is difficult to establish a comprehensive definition for *toxic* dusts. Sollmann,³ after analysis of various definitions for poison, felt that it is very difficult to give a definition which will not be ambiguous in some cases, but believed that the following covers most of the points which must be considered in classing a substance as such:

"A poison is any substance which, acting directly through its inherent chemico properties, and by its ordinary action, is capable of destroying life, or of seriously endangering health, when it is applied to the body, externally, or in moderate doses (to 50 Gm.) internally."

Some dusts are known to be poisonous, while others, in the concentrations usually encountered, are comparatively harmless. However, it may be stated that *breathing* dust in high concentration is not desirable.

According to Fairhall, the damage arising from the inhalation of toxic dust may be either local or remote, and depends upon whether the material is a protoplasmic poison, whether it is caustic in reaction, or whether it is absorbed into the blood stream and carried to other centers which are in turn affected.⁴

It is now well established that exposure to certain kinds of dusts, such as those containing considerable quantities of free silica, has increased the morbidity and mortality rate from respiratory diseases; while metallic dusts, such as lead and its compounds,

have been associated with general systemic poisoning.⁴ Dusts may be swallowed with saliva, water, or food, and direct poisoning has been traced to absorption by this method; other dusts may act as irritants and produce affections of the skin, irritate mucous membranes of nose, eyes and throat, often causing inflammatory diseases of these organs.⁵

Some inorganic dusts are able to penetrate the deep lung tissues and are sufficiently insoluble to be retained there. Some of these may be active in the human tissues, causing definite and permanent injury, while others are inert and may be retained for years, apparently without serious damage; some are gradually absorbed without causing pathological changes.⁶

All inhaled particles are soluble, at least to a small extent. If harmless, cell activity is stimulated so that phagocytes remove the dust. If the solute is toxic, the viability of the phagocyte is affected and an ineffective accumulation results. At the same time, further solute may diffuse into neighboring tissues, setting up an irritation and subsequent fibrosis. The nature as well as the solubility of the solute is an important factor, but of two substances of approximately equal toxicity, the more soluble form causes the greater damage. However, substances of such low solubility as silica may ultimately produce extensive injury.⁷

Kettle has stated that harmful dusts, if inhaled into the lungs, may activate a latent tuberculous infection; they may exaggerate an active tuberculous lesion or a coincident infection. If sufficient quantities of a harmless dust are inhaled, some of it remains in the lungs and causes a mild degree of fibrosis merely through mechanical irritation, but such fibrosis is never sufficient to interfere with the function of the lung.⁸

Some writers state that while the influence of nonpoisonous dusts on health is a debatable subject, abnormally high death rates from bronchitis and pneumonia are sometimes attributed to chronic exposure to nontoxic dusts. Large amounts of dust are occasionally found in supposedly normal lungs, at autopsy.⁹

According to Drinker, there are four different types of reaction produced in man by the inhalation of dust. The first and most important are the pneumoconioses, such as silicosis and asbestosis, which cause specific lung pathology and often are followed by

pulmonary tuberculosis. The second type of reaction is caused by toxic dusts like lead, cadmium, and radium. A third type of malady follows the inhalation of finely divided metallic fume particles such as zinc oxide, and is known as metal fume fever. The fourth reaction, allergic in character, is caused by breathing organic dusts such as pollen and certain types of pulverized wood and flour. In all four cases the sole cause of the disability may be dust inhalation, but the reactions from toxic dusts result from swallowing as well as from inhalation.¹⁰

For various reasons it is difficult to set up an absolute classification for dusts. Opinion is rapidly changing regarding so-called inert or harmless dusts and further investigation may prove some of them to be injurious. Some dusts may have both a toxic and an irritant action; while on the other hand, the poisoning resulting from exposure to a dust may be the combined effect of more than one mode of entrance into the body. However, the following classification of dusts, according to physical characteristics and physiological effect, is used for convenience.

I. Organic Dusts

Organic dusts are those which contain carbon, and were originally supposed to come from organized substances derived from animal or plant life. Living dusts come under this classification, and are thought to be of the same order of size as industrial dusts, with which they are frequently associated. Bacteria are usually between 0.5 and 3 microns, except in a few cases, such as the anthrax bacillus, which ranges from 1 to 1.25 micron in breadth and 4.5 to 10 microns in length and 10 or 12 microns in diameter. However, it is possible that the larger and heavier varieties, like the larger and heavier dust particles, settle due to gravity, and do not remain suspended in the air.

Many thousands of organic substances, carbon-containing, are made synthetically by chemical processes, such as dyestuffs, explosives, etc.

1. **NONLIVING ORGANIC DUSTS.** As the name implies, these are comprised of nonviable particles, which may or may not be inherently toxic or irritant, but which nevertheless produce untoward effects in the human organism. "Allergic" dusts, or those to which only certain persons are or may

become hypersensitive, with resulting asthma, rhinitis, or other disturbances, are included in this classification.

a. **Toxic and/or Irritant.** Toxic or irritant dusts are all organic dusts which produce untoward symptoms, either systemic or local. Those producing local symptoms are usually described as irritant; those producing general or systemic symptoms are termed toxic. A dust may be both toxic and irritant.

In reported cases of injury or death following inhalation of dust from organic compounds, among the chief offenders are paranitraniline, the dinitrobenzenes, chlorodinitrobenzenes, trinitrophenol, and nitronaphthalene. Eye damage due to inflammation of the cornea has occurred among workers exposed to methyl violet dust. The dust from paraphenylene diamine derivatives is particularly irritating and dangerous, causing not only a severe form of dermatitis where the dust comes in contact with the skin, but also producing acute inflammation of the mucous membrane of the respiratory passages.¹¹ Toxic dusts may be generated during the handling of powdered dyes and in preliminary dyeing operations, particularly the hydro-extractor process, where particles are disseminated in all directions.¹² Coal tar and indigo dyes are substances most frequently used.

Cases of amblyopia have been reported from exposure to inhalation of tobacco dust.¹³ It has been found that inhaled tobacco dust exerts a nicotine action on the organism fifteen times greater than that produced by the same quantity of smoked tobacco with an equal nicotine content.¹⁴

Severe dermatitis is experienced by many workers handling powder containing T.N.T., which is used in making high explosives. Picric acid, which is also used for this purpose, requires drying, and in this latter state has been found to produce a dermatitis. Picric acid is also the oldest synthetic organic dyestuff.¹⁵ Dermatitis occurs among handlers of silk with varying frequency. Salls determined that a rash occurring among workers in a silk factory was due to dust from silk cocoons imported from Africa.¹⁶

Persons engaged in the manufacture of quinine and quinine preparations suffer from skin phenomena, which occur for the most part on exposed parts of the body, and may be caused by ingestion or by quinine

dust, or powder form of the preparation, exerting a direct irritating effect on the skin.¹⁷ Dermatitis due to other vegetable dusts such as vanilla, powdered arnica, pyrethrum, etc., have been reported.¹⁸

Dental lesions, of occupational origin, have been reported among workers in sugar. The gingivitis caused by sugar dust is classified as purely mechanical, with later-developing caries. Digestive disorders, respiratory conditions, and cutaneous conditions (especially of the face) were also found.¹⁹

Dock workers, transporters of grain, workers in grain and flour mills, etc. are exposed to dusts during their work. Dusts from cereals may contain many impurities, which may cause an irritating action on the respiratory passages, as well as inflammation of the skin. Digestive disturbances, dental defects, diminution in hearing, and conjunctivitis have been observed among millers, and have been attributed to the dusts to which such workers are exposed.²⁰

b. **Allergic.** Many apparently innocuous substances may produce reactions in persons of peculiar personal susceptibility. The term "allergy" is used to describe this condition of hypersensitivity or susceptibility, and allergic phenomena most frequently manifest themselves in skin reactions. However, they may cause acute reactions elsewhere in the body. When the respiratory tract is involved we have such well known diseases as hay fever or asthma. These diseases may develop as a result of hypersensitivity to such substances as pollens from plants, horsehair, rabbit's fur, furs, feathers, etc.

For instance, furriers, workers in clothing industries who are exposed to wool dust, etc., may suffer from hay fever or asthma.²¹ It is unnecessary for the offending dust to reach the depths of the lungs—giant pollens for example are reported to produce their effect after being caught in the upper respiratory passages. Should such an offending substance be finely ground it could reach the alveoli and as a result probably all physiologic reactions would be accelerated.²²

In a survey of a plant where resin is mixed, ground, and molded, it was found that 80 per cent of the occupational dermatitis there was due to hypersensitivity to hexamethylenetetramine and formaldehyde contained in the dust to which the workers were exposed.²³ During the first processes

of cotton spinning, cotton-strippers are exposed to dust arising from cotton husks and debris, which produces a typical form of asthma.¹

Ordinary wood dust has been of interest due to its purely mechanical action, but still greater care is required in handling certain kinds, especially woods coming from abroad, because of the essential oils impregnating them, which when freed in the dust may affect the health of the workers concerned. Some of the woods capable of causing skin lesions are Brazil wood, satinwood, teakwood, cumaru or tonka wood, black ebony wood, West Indian mahogany, Japanese tagayasan, coccoloba, chestnutwood, olivewood, California sequoia, etc. All persons who handle these woods are not injured, only those particularly susceptible to the substances they contain becoming affected.²

2. LIVING ORGANIC DUSTS. These contain particles capable of exhibiting the phenomena of life (especially the property of reproduction or multiplication), such as bacteria and fungi. They are usually found in low concentrations and are associated with nonliving dusts in the air.

a. Bacteria. One of the most important among these is the anthrax bacillus, which is contained in the dust from skins, furs, wool, and animal hair, horns, hoofs, bones, etc. This disease may occur in two forms: *cutaneous* (in which the organism affects the skin), and *pulmonary* (when it is inhaled, as in the form of anthrax known as wool-sorters' disease).³

Cases of tetanus, reported in connection with jute manufacture, were traced to the raw material, the bacillus having been found in the factory dust.⁴ Diphtheria, tuberculosis, smallpox, typhoid, or other bacillus-produced diseases, may result from exposure to infected dusts.

Bacterial sensitization can be the cause of any of the allergic diseases, namely, asthma, perennial hay fever, urticaria, angioneurotic edema, eczema, or migraine headaches.⁵

b. Fungi. Dusts containing the mycelia and spores of parasitic fungi give rise to annoyance and discomfort. "Maltster's" itch from the dust alone has been reported. In Provence, reeds used for ceilings are stacked while still wet and undergo fermentation; they become covered with a white powder (a dry fungus of the *Mucor* family: *Sporo-*

trichum dermatodes), which is scattered when the bark is stripped off. This powder is irritating to the skin and mucous membranes. Mycelia and spores of moulds are commonly found to cause rashes: for instance, the black powder coming from macerated sugarcane stalks. Among basket-makers, the mycelium and spores, in the form of a white mould (*hyphomycete*) from the rattan canes used, get shaken out when the canes are split, hammered, and cut, causing painful fissures to develop on the skin where they alight.⁶

A form of asthma or spasmodic cough, suffered by cotton weavers and known as aspergillosis, has been considered due to inhalation of spores of a mildew which sometimes occurs on the threads.⁷ In a study of silicosis among miners, made by the Public Health Service, a number of cases of typical military calcification were encountered. Unstained smears of those cases examined were positive for fungus, two types of *Aspergillus* fungi being identified. All of the subjects but one were farmers, teamsters, feedmill workers, or residents of small agricultural towns where grain is marketed. Farmers are exposed to fungi in threshing wheat, baling hay, or handling various small grains.⁸

Some other fungus diseases such as actinomycosis and blastomycosis are associated with occupational exposure to dust. The former occurs among workers handling straw, hay, grass, vegetable debris contaminated with mould, etc. Actinomycosis is likely to affect people engaged in commercial handling, storing, and cleansing of grain (grain distilleries, flour mills, grain crushing, breweries, and malting houses, etc.).⁹

II. Inorganic Dusts

Inorganic compounds are of mineral origin, not requiring a living organism to produce them.¹⁰ A number of dusts not usually classed as toxic may, under some conditions, produce untoward effects on the human organism. Classified under inorganic are toxic and/or irritant, fibrosis-producing, and nonfibrosis-producing dusts.

a. Toxic and/or Irritant. Toxic dusts are those which are inherently toxic when inhaled, ingested, or otherwise absorbed. Among those which produce systemic poisoning, some of which are also irritant, are the dusts from heavy metals and their salts, such as lead, mercury, arsenic, cadmium,

zinc, etc. Irritant dusts are injurious by reason of their strong irritative or corrosive properties.

As a rule, inhaled irritant substances immediately cause a reaction in the upper respiratory tract of such severity that they are prevented from reaching the lungs, although they may cause lung damage by extension of inflammation if the mucous membrane is corroded. Lime, calcium oxide, and the di-chromates are examples of irritant dusts. An inorganic dust may possess both toxic and irritant properties, and the poisoning produced may be the combined effect of more than one mode of entrance into the body.

Of the directly poisonous dusts, the most widely prevalent are those of certain lead compounds, particularly the oxide, carbonate and the chromate. The dust is readily absorbed by the mucous membrane; some dust passes into the stomach and is dissolved by the gastric juice.¹¹

According to Fairball, perforated nasal septum is a common occurrence among workers with bi-chromate dusts.¹² In a study made by the U. S. Public Health Service it was found that continuous daily exposure to concentrations of chromic acid mist greater than 1 milligram in 10 cubic meters is likely to cause definite injury to the nasal tissues.¹³ It is believed that a similar concentration of the dust would be equally toxic.

In the case of poisoning from some heavy metals, exposure may be to both dust and vapor. For instance, investigations have shown the safe limit of total exposure to lead oxide dust and fumes to be less than 1.5 mg. per 10 cubic meters of air, except for prolonged exposure.¹⁴ In exposure to mercury dust and vapor, it was shown that the incidence of chronic mercurialism increases rapidly with increasing mercury concentration, after such concentration exceeds 2.0 mg. per 10 cubic meters.¹⁵

Alkalis and metallic oxides are common causes of dermatoses. Lye, potash and lime are known to cause irritation to plasterers, cement-makers, bricklayers, masons, stonecutters, modellers, and metal platers.¹⁶ Ulceration and perforation of the nasal septum occur among workers exposed to the dust of soda ash; systemic poisoning also occurs from inhalation of calcium cyanamide dust.¹⁷

Cases of dermatitis, scleroderma and can-

cer are reported to have been caused by exposure to dust of arsenic compounds. Certain aluminum salts are skin irritants and aluminum dusts may contribute to the infection of skin and mucous membranes, through mechanical action.¹⁸

b. Fibrosis-Producing Dusts. The most important of these are the inorganic, slightly soluble dusts which cause fibrous changes in the lung tissues, some of which are serious, and some of which cause little or no disability.¹⁹ So far as is known, no inorganic substances other than silicon derivatives cause more than a very moderate degree of fibrosis of the lung. Moreover, there seems to be no evidence that any other constituent of ordinary dusts can influence so unfavorably a pulmonary infection.²⁰

Although other dusts, when inhaled in sufficient concentrations over a long period of time, have been shown capable of producing a pulmonary fibrosis, nevertheless, the pneumoconiosis characterized by nodular fibrosis has to date been shown clinically and experimentally to be associated only with the inhalation of dusts containing free silica.

Since this dust, to exert its harmful action, must enter the finer divisions of the lung, the particle size of the atmospheric dust may bear a definite relationship to the injurious effect produced. The silica must be present in the air in particles small enough to enter the finer air spaces and of such dimensions that the phagocytic cells may engulf them. The greater majority of particles found upon microscopic examination of the lung fall within the limits of from 1 to 3 microns.²¹ Examples of siliceous dusts are granite, quartz, sand, pumice, slate, etc.

In a recent study among anthracite miners, the correlations between exposure to dust (which contained silica) and the evidence of constitutional changes left little doubt as to the etiological significance of the dust in the air breathed. Like correlations were found between the silica exposure and the extent of pulmonary changes.²² When the inhaled dust consists of silica combined with bases, silicates, some degree of change in the pulmonary tissue may result. In this respect asbestos dust seems to be unique among silicates in the prevalence and severity of the disease it causes.²³

The chief distinction between silicosis and conditions due to simple reactions caused by other dusts is the active proliferative

reaction in the tissues which results in progressive nodulation. Silicosis, when once established, strongly predisposes the lungs to infection, especially with the tubercle bacillus. Chronic interstitial pneumonia, chronic bronchitis, and emphysema are frequent complications of advanced degrees of silicosis.

The relation of the acute respiratory infections to the reaction due to dusts other than free silica has never been established, though a heightened incidence has often been shown statistically in workers in dusty trades. It is fairly certain that a dust damaged lung, whatever the cause, fares much worse if an acute infection does supervene upon it.

In a study conducted by the U. S. Public Health Service among marble finishers in Vermont, it was found that marble dust when inhaled in the concentrations found in the examined plants produced a mild, bilateral, linear fibrosis in some cases, but no serious lung changes were noted and there was no disability due to the dust, even after years of exposure.²⁴

c. Nonfibrosis-Producing Dusts. These are inert, that is, they do not cause fibrous tissue to be produced, but may become encapsulated or lie free in the tissues; or they are absorbed without production of fibrous tissue. Included among them are alundum, coal, corundum, emery, limestone, magnesite, marble, plaster of paris (gypsum), and polisher's rouge.

Dust Control

Engineering and medical control are the two most important factors in combating the industrial dust hazard, and are to a large extent complementary.

Engineering Control. As Lanza²⁵ has stated in a recent paper, "It is a basic principle in dealing with a dust hazard that the dust should be attacked at its point of origin and thus prevented from being disseminated into the atmosphere." After the dust has been spread throughout the air it is difficult to deal with it, and reliance must be placed on individual protection, which is never wholly satisfactory.

Lanza further cites various methods used in controlling dust. These will be reviewed but briefly, since a paper dealing with the subject of dust control in detail, will follow on this program.

Dust may be entrapped at its source by suction devices and thus removed and collected. Familiar examples are exhaust hoods in grinding operations, and the devices used in rock drilling.

Generally speaking, the exhaust ventilation method, where applicable, is to be preferred in controlling a dust hazard. Water may be used to entrap dust and prevent its dispersal, and under certain circumstances it may be of advantage to combine the use of water and the use of suction. Sometimes a dusty process can be completely enclosed in a sealed room or compartment. It must be remembered, however, that any mechanical device of this kind offers adequate protection only if it is properly designed, installed, and maintained.

A great deal of attention has been given the subject of individual protection from dust, and there are many types of respiratory protective devices now available. These are generally of two types: those which provide fresh air from an uncontaminated source and those which rely upon a filtering medium for removing dust from the air breathed. Where the use of such a device is indicated, only one of the types approved by the U. S. Bureau of Mines should be used. As a rule, it may be said that masks, respirators, or other such protective device should be used only where exposure to the dust is intermittent and brief, or where some unusual condition makes a more adequate dust control impracticable.²⁶

Where bacteria or other living dusts in the air are associated with a process, sterilization methods such as increased temperature, ultraviolet radiation, and chemicals like chlorine or other bactericidal substances, may be of use. Pasteurization temperature (about 140° F.) will kill most organisms except those bearing spores. Steam disinfection is used for horseshair, and proves to be practicable if the temperature does not exceed 230° F. Wool fibres, however, lose their elasticity by steam disinfection, and the "Duckering" process now used in England includes soaking of the wool in a formaldehyde solution, and drying in a current of air at a temperature of 160° F.²⁷ There are few occupations in which there would be a sufficient concentration of dead bacteria to cause untoward effects in man.

In the case of dusts producing external irritation, auxiliary protective measures may include the use of protective clothing,

gloves, goggles and aprons; as well as protective salves, ointments, or other compounds to delay or diminish the irritant action. General rules for hygiene and good housekeeping should also be observed.

Medical Control. Equally important, and closely interrelated with the engineering phase, is medical control of occupational hazards. In addition to directing the proper placement of new workers, and guarding the health of all employees, medical control is a check on the efficacy of the engineering control methods already instituted, or a measure of the need for new protective devices.

It has been stated that "Industry has found that the best way to treat industrial injuries and illness is to prevent them,"²⁸ and medical control, through preemployment and periodic physical examinations, is one of the most important factors in such prevention.

The preemployment examination is made to determine the employee's physical and mental fitness for work. It serves to disclose the presence of any contagious disease, reveals any minor physical defects which might later become serious, or whether the examinee's condition precludes his employment in certain or in all types of work. It should be remembered that such preemployment examinations are not to be made for the purpose of eliminating an employee, but rather for allocating him to the type of work for which he is physically suited. A worker should be given employment unless totally unfit, or unless his disability, even though slight, would cause him to be a hazard to himself or his associates. Furthermore, the practice of preemployment examinations should be extended to include executives and officials of industrial organizations.

"The purpose of periodic physical examinations is to secure and maintain physical fitness and thereby lengthen work spans."²⁹ Reexamination of employees sometimes results in the discovery of defects and disabilities which were not observed at the time of employment. In such cases, an occupational adjustment should be made to provide continued employment, but remove the risk of permanent injury.

Reexamination of employees is required by law in certain occupations in which the handling of poisonous or otherwise deleterious substances may result in the contraction

of disease.³⁰ Since some occupational diseases tend to clear up and recur, records of previous occupations should be included in the physical examinations. The frequency of examinations should be determined by the medical director, unless otherwise specified by law. Those exposed to known occupational disease hazards may have weekly or monthly examinations.³¹

"It should always be kept in mind that the basic principle of physical examinations in industry is to keep men on the job and not allow the physical examination to be merely a weeding out process."³²

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The Engineer's Part in Eliminating Dust Hazards

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When one realizes that control of the dust hazard depends upon the combined contributions of the physician and the engineer, he appreciates that the solution requires scientific treatment. By scientific treatment I mean the technical analysis of the hazard to discover the causes which contribute to injury or ill health, and the development of control methods which obey physical law and physiology, and which will be directed at causes that admit of most immediate and economical treatment.

That goes for handling the dust hazard in a given plant. It goes double for acquiring knowledge to the end that the whole problem may reach ultimate solution. Right now our knowledge of the problem is in big chunks, loosely put together and largely empirical.

There are estimates only to judge the magnitude of the dust health problem, and it is so closely associated with other health problems that a clean-cut estimate of it alone is impossible. We do know that it is great in the aggregate, and for the individual plant it may be very bothersome and expensive.

What actually makes quartz dust cause silicosis is not known. It does, so the air breathed by workmen must not contain harmful quantities of respirable quartz dust. Inex-

¹⁸ Sayers, R. R. and Jones, R. R. "Silicosis and Similar Dust Diseases." National Silicosis Conference, Washington, D. C., April 14, 1936.

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pensive methods for making the air clean are still in the realm of dreams. Much work must be done to know more about silicosis and more how to make atmospheres safe *inexpensively*. As an accident prevention job, dust control lies almost entirely within the administrative responsibility. The control measures are capital expenditures of considerable size.

A plant with a dust hazard is sick, it needs an expert diagnosis and scientific treatment, which may include expensive major operations. Home remedies are seldom much good, and supervision and employee safety consciousness alone cannot accomplish anything. There may be observed in countless shops installations for exhausting dust which are derisively called "tin knocker" jobs in which the horsepower dissipated is out of all proportion to the air-borne dust moved. Tonnage efficiency of material moved may be the proper yardstick for pneumatic conveyors but if the material to be moved is air, contaminated with nearly weightless particles of dust, the entire health hazard can lie in the half of one per cent of material not moved.

I do not mean that unless a dust suppression job was engineered it can be no good. There are many good installations that were never figured at all but grew like Topsy. The re-

sulting freedom from dustiness was so satisfactory that efficiency held little interest to the owner. This is exceptional, however, and I offer the opinion that dust suppression jobs should be engineered.

A dust-suppression installation is a safety device, designed and operated to provide protection against possible disease and provide a sense of security which must be absolute. Its safety is not rushing air and rattling chips but a minimal residual dustiness. There is no more pathetic defeat for a dust control job than to find faith in its effectiveness so low that workers must wear respirators to find the reasonable safety that was expected from the hoods, ducts and fans.

Diagnosis and Control

Let us examine some of the features by which we recognize this dust hazard problem, leaving out the socio-legal aspects.

In order to develop more fully the engineer's place in this dust control program, it seems desirable to separate as sharply as we can the diagnostic considerations from those which deal with control. In the first compartment we can place all the analytical components which describe the hazard and its exposure, the probability of its producing ill health and all the rest of the medical and industrial hygiene facts which make out a case against the existing dust. In the second compartment place the knowledge of physics and engineering necessary to plan the dust control program and so design it that when installed its performance follows prediction that the probability of industrial disease is reduced to insignificance.

The Industrial Hygienist

Our first feature of interest would naturally be the specific and relative toxicity of silica, silica-bearing and other dusts which make up the dust health hazard. Much might be said to advantage about the quality and quantity of hazard in many dusts. The acquiring of this knowledge has been, and must remain a medical problem. It involves gross and microscopic pathology and x-rays, and experimental animals. Engineers do not talk that language. Industrial hygienists do; they are a happy combination, half doctor and half engineer. Many of them are quite capable of handling the dust health hazard in all its phases of investigation and control. For the purpose of this discussion I throw their interest in with the doctors.

I want to go so far in my opinion as to state that the engineer should not attempt to define the quality of health hazard in a given plant or industry, nor should he establish threshold limits of safe or permissible dustiness. This may be debatable, but I shall contend that the engineer who writes the specifications of hazard and dust tolerance is really an industrial hygienist, and is using a very much broader knowledge than engineering alone.

In the first case the quality of the health hazard is an opinion arrived at after studying all the environmental conditions including the general sanitation, occupational analysis and a scientific analysis of the dust exposures. In the exploration of dust exposures, the nature of dusty operations must be viewed from physical, chemical and mechanical aspects, the determinations of dustiness must be not only counted and classified by particulate sizes, but chemically and mineralogically analyzed. The plant layout must be studied with respect to dust production and distribution, and the housekeeping and existing dust control equipment evaluated. The presence of specific hazards, such as toxic gases, abnormal temperature and humidity conditions, etc., must be explored for their complicating effect upon the whole picture. This is distinctly an industrial hygiene job, and some of the most critical data requires only medical viewpoint. This is absolute in the case of tuberculosis study and the qualifying of men for employment.

So far, not one atom of engineering to suppress dust is involved. It is entirely analysis of hazard. The diagnosis must be that the dustiness is hazardous to health or that it is safe. If it is hazardous, it must be brought down to a specified residue. If it isn't, leave it alone. On the second point, if the hygienists can not specify threshold limits graduated upward for relatively less hazardous dusts, let the engineer not worry about it. The diagnosis is dust which is harmful and too much of it. The remedy is control of the dust. The engineer designs controls which will produce the lowest practical residual dustiness. He should not attempt to write his own specifications of threshold limits or permissible dustiness. This may be an important goal in the study of dust health hazards.

Safe Limits

At the present time the medical men and hygienists believe that quartz dust is safe

below five million particles. They seem willing to graduate upward to 20 million for medium silica and 50 million for low silica percentages. Five million particles is virtually dust free, and is very difficult and expensive to achieve and maintain. The declaration of safety of the installations must remain in the hands of the medical and hygiene groups in whose hands now lies the responsibility for determining the hazard.

We now enter the chapter of our discussion intended to demonstrate that dust control is an engineering job, that it must be given scientific treatment, not guess work, applying engineering methods which are based upon a knowledge of physical law, the behavior of dust, the performance of air-moving machinery, etc.

Prerequisite Knowledge

Let me recite briefly, a few of the things which, in my opinion, the engineer should know to do this job correctly. He must know how to make a survey. Surveys depend upon sampling, and sampling is not a catch-as-catch-can proposition. It involves the place, the time, the frequency, the amount in a sample, and the number of samples so that maximum, minimum and average data mean something, so that credibility can be given them.

For the type of sample involved he must know how to weigh or count respirable dust, as distinguished from large masses of non-respirable dust which complicate the picture. He must know how to observe the sources of dust floods as distinguished from conditions of normal dustiness. He must know the sources of dust and the principles involved in the dispersion of dust. He must determine how much dust enters the problem because it is part of the material, and what dust is created in the process by the fracturing of the material.

Any less survey cannot tell the engineer what his task of dust control is. To visualize that task intelligently he should know the physics of Brownian motion, laws of resistance to the motion of particles moving in air, both when the air is in turbulence and for stream-line motion. He should know terminal velocities, movements due to centrifugal motion, flocculation and the effects of air motion and the effects of humidification on it. He must know all about the difficulties of wetting and what is known about overcoming these difficulties. He should know the several elec-

trical phenomena which bear upon dust behavior.

Those are all principles of physics which explain the behavior of dust and upon which engineering practice must be based. They must be understood and be taken into account. Dust control is not a matter only of general ventilation; the engineer must study the production as well as the dispersion. The problem should be analyzed to determine the applicability of segregation, enclosure, wetting, local exhaust and general ventilation.

In some instances, substitution of non-hazardous material, or non-dust-producing operations may have specific application, and they should be explored first. This implies plant engineering. I am convinced that many bad installations are bad because plant engineering was not used. In the designing of exhaust systems installed to capture the dust at the points of generation, the physical behavior of air moving toward hoods and in ducts must be known, and that knowledge used. Each system must consist of collection hoods, piping, air-cleaning plant and a source of suction. Before selecting a hood for a job the engineer must know dust dispersion by dynamic projection as well as dust dispersion by air currents, and design the hood accordingly.

Knowledge Needed

The aero-dynamic characteristics of suction hoods appear to be little known because little thought was given to them in designing thousands of hoods which can be found everywhere in industry. All the possibility for entrapping dust and much of the efficiency of the system lies in this factor. Air velocity, static suction, and rate of air flow are all related, and they must be known. It is essential to use high velocity of air in certain types of exhaust systems to entrain dust projected at high velocities as in the case of a granite surfacing machine, and low velocities must be used in others, as in the case of cleaning asbestos fibre of dust to prevent wasting material.

Quantity of air and its velocity must be determined, then the piping should be designed to take into account the behavior of air-flow through pipes at low and high velocities. Where the problem is complicated by the large sized particles which go along with the fine dust, how these behave must be taken into account. Pressure losses are very important elements in the design of an exhaust

system. Loss at the hoods, loss at the bends, and loss in the ducts must not be guessed at. Pipe design must take into account the gage of the metal and reinforcing to withstand pressures and erosion.

The selection of a fan and its motive power is a matter of calculation, not guess work. Power consumption in the system is calculable, fans follow certain laws, so the engineer must know the behavior of axial flow, propeller type, radial flow, paddle wheel and other fan performance.

More physics and engineering calculation goes into the air-cleaning apparatus. The selection of gravitation, inertial or filtration method depends upon what the dust is, the calculation for any methods requires knowledge of discharge through stacks, the determination of sizes of settling chambers; the behavior of cyclones. The use or non-use of a filter, and if so, what type, how it should perform, how big it should be, what kind of resistance and how much each kind offers, to say nothing of their proper location with relation to cleaning, accessibility, etc., are all items for accurate engineering determination.

Apparatus to check the behavior of installa-

tions must be known and used. Performance cannot be left to guess work. Supplying sufficient air to be exhausted is part of the problem. The same may be said of heating.

Do I give the problem too severe a build-up? I think not. Remember these two things:

1. You are dealing with hazardous material so small in size and so little of it by weight that it is as invisible as the air that bears it.

2. Physical laws involved in the behavior of dust and air do not permit inexpensive methods of control. I am acquainted with budgets set up for this purpose which amount to more than a quarter of a million dollars, and I know of many where 60 to 80 thousand dollars is involved.

The need for this much engineering is recognized by men who know. Already much has been done toward getting the knowledge into handbook shape. Perhaps the best job of this sort to date is "Fundamentals Relating to the Design and Operation of Exhaust Systems" developed under American Standards Association procedure.

The Doctor's Part in Controlling Dust Hazards

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Considerable confusion has existed in the past as to just what is the physician's function in the prevention of dust diseases, and just what is the engineer's. It is very obvious upon even casual thought that the two sciences must work hand in hand in their efforts to solve the problem.

The physician through his special training must be able to tell the engineer what dusts are dangerous and what are not. He must know how those dusts enter the body and the manner in which they do their harm. He must be trained in the examination of persons who are to be employed to work in dust, and to discover those who are already diseased, or are peculiarly susceptible to dust disease. He must be able to detect the first signs of disease in workers who are exposed to dust, and must be prepared to

recognize the disease when it is fully developed.

It is not necessarily the physician's function to analyze dust. That is a task for the chemist and the petrographer. It is not the physician's function to count the particles of dust in a given industrial atmosphere. That, in reality, is the function of the engineer. It is not the physician's function to devise ventilating equipment for the removal of dust, nor even to be more than an adviser as to the means that must be adopted to render the atmosphere safe.

The physician nevertheless must correlate with his medical knowledge and with his studies of the industrial worker the findings of the engineer. A diagnosis of silicosis, for example, requires not merely characteristic occupational history and characteristic physi-

cal findings, but the knowledge as well that the patient has been exposed to hazardous dusts in dangerous concentrations.

All dusts when inhaled in excessive quantities may be considered as harmful, but only a few can be regarded as dangerous. From the standpoint of their dangerous properties, they may be divided into three general groups.

1. Those which are dangerous because of their poisonous action, such as lead, arsenic, mercury, and similar substances.

2. Those which cause only irritation in the respiratory tract, resulting in such conditions as bronchitis or local inflammation; such substances as vegetable fibre, cork dust, flour, starch, and other relatively innocuous organic or inorganic materials.

3. Those which tend to produce fibrosis of the lungs, thereby predisposing to respiratory infections, especially tuberculosis, such dusts as asbestos, silica dioxide or magnesium silicate.

I shall confine my remarks chiefly to dusts occurring in the latter category.

It has been generally believed that the harmful effects of dusts inhaled into the lungs depended more upon their physical structure than upon their chemical. It was believed, for example, that silica dioxide, or quartz, was particularly harmful because of its crystalline structure, and the hardness and sharpness of its particles. This conception is now known to be faulty. The dusts which cause their damage by mechanical interference with function are the dusts which are relatively innocuous, whose symptoms are transitory, and which subside upon removal from exposure to the dust.

Chemical Effect Is Harmful

The disease of particular interest to us today, silicosis, owes its harmful effects very largely to a harmful chemical reaction occurring between silica dioxide and the body tissues. It so happens that silica dioxide is decidedly a tissue irritant to the body, regardless of the part of the body it invades, it causes local irritation, local destruction of tissue, and the replacement of that tissue by scars.

Thus, given a dust containing silica dioxide in sufficient concentration, in sizes small enough to permit its entrance to the ultimate air spaces in the lungs, we have a situation which offers danger to the worker.

We have no real knowledge as to true figures, but as a simple rule, we can adopt for practical purposes the thought that the human body can withstand successfully a concentration of dust containing 100 per cent silica dioxide in a particulate size less than 10 microns, in a concentration not in excess of 5,000,000 particles per cubic foot. If we decrease the percentage of silica dioxide present in the dust, we can correspondingly increase the concentration with comparative safety. We must, of course, take into account the portion of the worker's time spent in the dusty atmosphere.

To arrive at a rough conception of a safe atmosphere, we multiply the percentage of free silica in a given dust by the total number of particles per cubic foot. If the result is under 5,000,000 the condition may be considered relatively safe. If the result is over 5,000,000 the condition must be regarded as unsafe.

Bear in mind too that silicosis is essentially a disease of great chronicity. Except in a few exceptional instances it will require from seven to thirty years for a worker to develop advanced silicosis. It is evident too that coincident dusts may either retard the development of silicosis or hasten it. Recent research seems to indicate that the admixture of aluminum dust to a silicious dust will greatly inhibit the reaction of the latter; whereas a silicious dust combined with some alkaline coincident dusts may hasten the development of silicosis.

Much research is now under way in problems such as this. We have never learned how to cure silicosis, but we are learning rapidly how to prevent it. Our knowledge in this respect seems to be limited to the removal of dust from the breathing zone of the worker. Later discoveries may show us how to modify existing dusts with contaminant dusts that will render silica dioxide innocuous.

Owing to its very great chronicity, it is only the rare case who actually develops disabling silicosis during his industrial lifetime. It is realized, of course, that exceptional instances take place, but the coincident ravages of age usually keep pace with the effects of dust, so that much of the disability usually attributed to silicosis is often, in fact, actually attributable to other diseases or incapacities which advancing years bring in their wake. To me the great peril of silicosis, the peril not only to the industrial

worker himself, but his family, co-workers and the public generally, is the accompanying susceptibility to tuberculosis.

Complicated by Tuberculosis

Silicosis per se does not kill. Tuberculosis as a complicating factor of silicosis rarely recovers despite treatment, and the individual so afflicted is not only totally disabled himself, but a definite menace to all with whom he comes in contact, particularly the fellow worker who may have silicosis. So perhaps the most important places in which the services of the physician in a dusty trade are necessary are—first, along lines of discovering and barring from exposure to a silicious dust those persons who may already have arrested tuberculosis; and secondly, discovering those persons already exposed to dust, possibly already silicotic, in whom tuberculous infections may have developed.

It is well recognized that no individual should be exposed to dust containing silica dioxide until he has undergone a thorough physical examination, including carefully made and interpreted x-ray films of his chest. It is likewise obvious to anyone familiar with silicosis that no person who is exposed to silicious dust should be denied the privilege of frequent physical examinations and x-rays of the chest, not entirely to discover the existence of possible silicosis, but to discover a coincident tuberculosis if such exists.

A man so diseased should, in protection to himself and to all with whom he comes in contact, be removed from industry. Let me emphasize the uselessness of a physical examination, unless it be accompanied by properly taken x-ray films, except in cases of gross tuberculosis.

It is the function of the physician, therefore, to conduct in a thorough and an intelligent manner the pre-employment examination of all persons who are to be engaged in a dusty trade. The purpose of this examination should be threefold. First, to discover and bar from employment in dust, any person who is suffering from tuberculosis in an active, a quiescent or an arrested state.

A possible exception might be made in individuals suffering from a so called healed primary complex, or a healed childhood infection. It is well known that exposure to

silica dioxide is very likely to excite into activity a tuberculous lesion which may be quiescent or arrested, and once such a lesion is reactivated, the chances of recovery are remote.

The second problem which confronts the physician at the pre-employment physical examination is whether a given individual is, by reason of secondary physical defects, more susceptible to the development of silicosis than a normal. Is he suffering from diseases of the nose or upper respiratory tract, such as chronic sinusitis, disease of the lungs or air passages, or obstructions which produce mouth breathing?

We must remember that silica dioxide is not dangerous until it reaches the lungs, and that the normal individual retains in the nose and the upper air passages a large quantity of the dust inhaled from the atmosphere. In instances where this nasal retention is disturbed, exposure to silica dioxide dust may be dangerous to that individual, where it would not be to another.

It is believed that certain diseases of the heart and circulation, of the kidneys, possibly syphilis, chronic coincident diseases of the lungs, all may render a man more susceptible to silicosis than normal. The physician at his pre-employment examination must follow certain established criteria in this respect, and bar from exposure to dangerous dusts those persons who through existing disease may be more ready prey to silicosis or tuberculosis.

Re-Examination Needed

After the applicant for employment has successfully passed his physical examination and is engaged in a dusty trade, the duty of the physician is not yet ended. This workman must be periodically re-examined, first to discover the early appearances of pulmonary fibrosis, but what is even more important, to detect the early evidences of complicating tuberculous infection.

A man should not be dismissed from employment in a dusty trade merely because he has evidences of non-disabling silicosis. Workers in dusty trades, especially stone cutters, moulders, pottery workers, and similar craftsmen, are usually highly skilled, and it seems unfortunate from a social and economic point of view to deny them employment so long as they are physically able to carry on, especially since the actual disabling qualities of silicosis are in doubt.

They should be denied employment in a dusty trade if that condition is found at pre-employment examination, but they should not be barred from continuing an employment in which they are already engaged. Of course, in such instances you, as engineers, must realize that you have failed, because if you had kept the breathing zone of the worker free from dangerous dusts, silicosis would not be present on physical examination.

In this work of preventing dust diseases in industry, it should be evident that the closest and most intelligent cooperation between the physician and the engineer is necessary. The physician must, through his knowledge and research, tell the engineer what dusts, or, for that matter, what other substances used in industry are harmful. He must tell the engineer how such dusts or other materials enter the body, how they leave the body and what they do in their passages through or their residence in the body.

Must Make Analyses

The engineer must in turn tell the physician of the harmful dusts and other substances surrounding his workers. He must make chemical and petrographic analyses of the dusts, and other indicated analyses of the atmosphere in the workshop. He must make dust counts and check his counts at regular

intervals, conferring with the physician in an effort to discover whether, in the light of their joint knowledge, working conditions are dangerous. He must develop and install carefully designed ventilating equipment. He must arrange for modification of chemical and other industrial processes, where such modification is possible, and must bend his efforts toward removing from the danger zone of the worker the offending substance, whatever it may be.

Too many engineers construe this function loosely. They pass on to the physician as his responsibility certain functions which essentially are theirs; such functions as dust analyses, dust counts, and similar technical duties. All too often it is considered adequate merely to install a fan.

Ventilating devices in dusty work rooms must be constructed only after careful engineering study has given a knowledge of the physical properties of the air and of substances polluting it. It is possible to calculate to a very fine point the volume of air that must be removed from a given spot to remove the dust originating at that place, and the engineer must approach his task from just as scientific an angle as the physician approaches his.

There is no room in industry for haphazard methods on the part of either the physician or the engineer.

ADJOURNMENT

Industrial Fumes, Gases and Vapors

THURSDAY MORNING SESSION

October 14, 1937

The meeting was called to order by Voyta of Wisconsin, Madison, who presided and Wrabetz, Chairman, Industrial Commission introduced the speakers.

Injurious Effects of Metal Fumes and How to Prevent Them

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The inhalation of metal fumes is a common cause of illness among certain occupational groups. Two very different systemic reactions may result from breathing air containing particulate metal or metal compounds: (a) metal fume fever, an acute, transitory, non-fatal disease causing slight or temporary disability; (b) systemic metal poisoning, mild, severe, or even fatal in its effect. The same occupational exposure may produce both reactions, metal fume fever developing following the worker's early exposure, chronic systemic poisoning developing later as a result of prolonged exposure.

We may consider metal fumes as solid particles generated by condensation from metal in a gaseous state. Condensation is usually accompanied by oxidation.

There are two chief physical characteristics of metal fumes which bear a direct relationship to the ease with which they may be absorbed: (a) The solid particles are much finer than atmospheric dust, probably averaging less than .5 micron in diameter; (b) they tend to flocculate and settle out of the air as dust. The finer the solid particles suspended in the air, the longer the time required for them to settle out. Many of the coarser dust particles in the air are trapped in the upper respiratory tract and by the ciliated cells lining the trachea and bronchi, while the finer particles may be carried to the terminal air spaces of the lungs. Here they are taken up by the phago-

cytic cells and are eliminated chiefly by way of the blood and lymph.

Sayers and his associates¹ found that only about 15 per cent of inhaled particulate matter, such as lead dust from automobile exhaust gas, was retained in the lungs, the remainder passing out with the exhaled air. Drinker and his associates² and Brown³ made quantitative measurements of fumes retained in the lungs. They found a direct relationship between the percentage of fumes retained and the size of the particle and the density of the fumes breathed. They also showed that slow deep breathing increased the reaction resulting from inhaling zinc fumes. Such breathing should increase the percentage of particulate matter retained.

Hazardous Processes

For convenience we may place the more common occupational environments which are likely to afford a harmful exposure to metal fumes in three large groups:

1. Smelting of ores and refining of metals.
2. Employment at processes handling molten metal such as molding, cutting, and welding operations.
3. Salvage and cleaning operations, including the burning of metals or metal covered objects, especially by means of acetylene torch or electric arc.

In the first class, the ores or metals processed provide the source for the generation

of fumes. Such operations are usually permanent and exposures tend to be more constant, although as a rule the greatest amount of fumes is generated during tapping operations.

Likewise, in the molding processes the molten metal is the source of metal fumes. In welding, cutting, and salvage operations, the metal fumes may originate from metal products processed, coated surfaces of the metals, fluxes used, or from the coating or core of the electrode used.

These latter operations may provide exposure to a greater variety of toxic metals, but as a rule such exposures are to lesser concentrations. Exposure usually is less regular since the operations vary from time to time both as to extent and raw materials used.

Atmospheric Concentrations

Data relative to the minimum concentrations of metal fumes which will produce metal fume fever are limited. It is believed by some that, except in case of the super-sensitive individual, metal fume fevers can be avoided by keeping atmospheric concentrations below 10 milligrams per cubic meter of air. Drinker and his associates¹ suggest 15 milligrams per cubic meter as a safe limit where workers are exposed to the fumes of zinc oxide, provided the fumes of such impurities as lead, cadmium, and arsenic are not also present in harmful amounts.

Our knowledge of safe limits from the viewpoint of chronic metal poisoning is likewise meager. Prolonged exposure to lead concentrations in the air breathed should be kept below 1.5 milligrams per 10 cubic meters of air.² In the study of chronic mercurialism among fur cutters³ it was found that cases developed after prolonged exposure to atmospheric concentrations varying from .6 to 7.2 milligrams of mercury per 10 cubic meters of air.

Less than 5 per cent of those exposed to concentrations which did not exceed 2 milligrams per 10 cubic meters of air developed symptoms of chronic mercurialism, and all cases that developed under such exposure were mild. Canavan and his associates⁴ reported upon a case of chronic manganese poisoning which developed following exposure to manganese dust, where the concentration in the atmosphere was from 10 to 20 milligrams per cubic meter of air, 9 to 12 per cent of which was manganese.

Metal Fume Fever

A strict interpretation of the term "metal fume fever" does not place it in the class of conditions termed "metal poisoning." The reaction set up in the body is not directly attributable to the toxic metal, or dependent upon the inherent toxicity of the metal particles inhaled. The superficial action of the finely divided metal destroys the tissues, and the absorption of these altered body proteins affects the individual much the same as typhoid inoculation or the injection of other foreign proteins.

Metal fume fever has long been recognized as an industrial disease. Other terms commonly applied to the condition are: "Brass founders' ague," "brass chills," "zinc fever," or "zinc chills," "spelter shakes," etc. Formerly it was thought due to the poisonous effects of zinc and zinc alloys. Various workers in the past quarter century have shown, however, that it may be produced by the fumes of metals other than zinc; notably, copper, magnesium, manganese, and probably lead. Koelsch⁵ in 1923 reported upon the occurrence of metal fume fever among employees in a copper rolling mill.

Investigation showed the men to be working under conditions which caused them to breathe air containing heavy concentrations of copper dust. The symptoms resembled "brass founders' ague." In his report he quotes Kissalt⁶ as showing that mercury, nickel, and probably other heavy metals when inhaled in vaporized form caused symptoms similar to those of "brass founders' ague."

Drinker and his associates⁷ in 1927 reported that men experimentally exposed to fumes of magnesium developed the classical symptoms of metal fume fever.

Clinical Picture of Metal Fume Fever

The clinical manifestations of metal fume fever are as follows: At the end of the day, or 2 to 12 hours following exposure to metal fumes, the individual notices a dryness of the throat in addition to the metallic taste which most workers commonly experience during exposure. A feeling of tightness of the chest, varying with the exposure, usually indicates the severity of chills and fever which are to follow. In mild cases the individual may not be aware of any fever and may complain only of a chilly sensation, followed by sweating and general weakness.

Exposure to extreme cold may hasten the onset of fever and chills, but as a rule the worker awakens from sleep with a high temperature and chills, which are quite similar to the chills and fever experienced in attacks of malaria. After they have developed, nothing in the way of extra covers or hot baths appears to affect these chills. Toward the end of the attack the individual sweats profusely and is left with a feeling of marked weakness. In the majority of cases some weakness is still felt the next day. It is commonly believed that hot baths and hot drinks of tea or lemonade may succeed in partially aborting the attacks, if taken at the first sign of respiratory difficulty such as a dry throat or tight sensation in the chest. Drinker and his co-workers⁸ by their experimental work were unable to show that even excessive "sweating" of an individual 2 to 4 hours after exposure altered the reactions in any manner.

Examination of the blood of workers suffering from metal fume fever shows a gradual increase in the polymorphonuclear leukocytes which begins toward the end of the attack and persists for some time after the fever has disappeared. This increase in white blood cells appears to have a direct bearing upon the degree of temporary immunity established.

This probably accounts for another characteristic clinical observation. The workers are most likely to be affected after a vacation period. More cases develop after a holiday or on the first day of the week, after an absence of one or two days from exposure. The condition is found more frequently affecting new employees or old employees returning to work after a prolonged absence from exposure.

As a rule, gastrointestinal disturbances are seldom complained of except in cases where exposure has been to fumes of substances affecting the digestive system. For instance, it is well known that zinc coated metals contain other toxic metals as impurities. The welding and cutting of these release the toxic substances together with the fumes from the zinc, as well as fumes from certain fluxes which are used.

We have no conclusive evidence regarding chronic effects produced by repeated exposure to zinc fumes. A study of workers in brass foundries⁹ showed that the group experiencing attacks of metal fume fever were in somewhat poorer physical condition than

were those who did not develop fever and chills. Theoretically, those experiencing irregular exposures and complaining of repeated attacks of fever and chills which leave them in a generally weakened condition would, in a measure, develop lessened resistance to acute and chronic infection.

Detailed information regarding the pathology of metal fume fever is not available. A search of the literature at hand fails to show any record of death from metal fume fever, uncomplicated. The illness is of such a transitory nature that most of our knowledge regarding blood changes is the result of experimental work and isolated case reports.

In view of the fact that zinc is relatively nontoxic, and of the conclusions expressed by Drinker and Fairhall¹⁰ regarding the hygienic position of zinc, it is difficult to show why chronic illness should result from exposures producing simple metal fume fever. It would seem, however, that in consideration of the recent work showing the role played by zinc in the treatment of diabetes with insulin, possibly some investigation should be made to determine if exposure to metal fumes capable of producing metal fume fever may not affect the endocrine system, especially in persons with some metabolic disturbances, such as potential diabetes or thyroid dysfunction.

Differential Diagnosis

Metal fume fever may sometimes be overlooked, unless the physician considers occupational environment. The condition may simulate attacks of grippé or bronchitis; or, if in a malarial region it may be mistaken for a fresh attack or a relapse from a former attack of malaria. Careful study of the blood will aid in diagnosis; those suffering with grippé or bronchitis seldom show the increase in white cells usually found present in persons suffering from metal fume fever, while those with malaria usually show the organisms present in their blood. The duration of symptoms is usually less in the case of metal fume fever.

However, it is not uncommon to find persistent rales upon examination of the chest several days after an attack. However, in persons with grippé or bronchitis, these rales are usually associated with a slight elevation in temperature, which is not found persisting in metal fume fever, uncomplicated. Massive exposure producing metal

fume fever may be followed by attacks of bronchial pneumonia, as a result of pulmonary irritation and infective organisms commonly present in the respiratory tract.

Metal particles are not the only injurious substance present in fumes generated by some industrial processes. The use of an acetylene torch in a space with poor ventilation has resulted in incomplete combustion of the gas and the liberation of carbon monoxide gas.

Doig and McLaughlin¹ reported upon an illness affecting welders of galvanized metal, using an electric arc. The men complained of lung irritation so severe that their sputum was often blood-tinged. Investigation showed this to be caused by excessive concentrations of nitrous fumes generated by the processes. X-ray examination of the chests of several in this group, who had been employed for many years, showed changes thought due either to the prolonged irritation caused by nitrous fumes, or possibly to the fumes of silica inhaled. The electrodes used were silica-coated.

Chronic Poisoning by Metal Fumes

It is generally recognized that the most serious exposures to toxic metals in industry occur in occupations where the worker breathes air contaminated with these poisonous substances. It is true systemic poisoning by metals may develop in an acute or sub-acute form, as a result of massive exposure. However, the vast majority of such cases are chronic, caused by frequent and prolonged exposure which leads to an accumulation of the toxic metal in the body. Poisons entering the body by way of the lungs, to be eliminated must be taken up by the blood and lymph. When present in the blood, they are carried to all parts of the body.

Poisons taken in by way of the mouth may not be absorbed but be passed out with the feces. If absorbed, it may be trapped in the liver and returned to the intestinal tract in the bile, and eliminated with the feces. Some, it is true, may be transferred by the blood to distant organs. Most heavy metals and their salts are true protoplasmic poisons. Some, such as iron and zinc, are more common constituents of body tissue. The action of these toxic metals is generally cumulative and no immunity, temporary or permanent, may be established if exposure is to sufficient concentrations.

Because of the fact that metals are usually

toxic, the possibility of poisoning from inhaling fumes generated in the processing of any metal should always be given consideration. While zinc itself may be relatively nontoxic, it is seldom used in industry in a form free from toxic substances such as lead, arsenic, selenium, cadmium, and many others.

Following the initial attack of metal fume fever, because of the temporary immunity which they develop, workers may continue under conditions which caused the attack and not suffer a recurrence. It must be borne in mind that these very conditions may afford exposure to other toxic metals which have cumulative effects and later lead to a chronic poisoning. If atmospheric concentrations of the fumes are kept below those capable of producing metal fume fever in the new worker, the chances of chronic poisoning by the toxic metals present as impurities are definitely reduced.

On the other hand, however, these impurities may be present in amounts sufficient to lead to chronic illnesses later, although the concentration of fumes has never produced metal fume fever.

Clinical Picture of Chronic Poisoning by Metal Fumes

The symptoms produced by poisoning from metal fumes will vary. Some metals affect chiefly the nervous system, others the lining of the blood capillaries, while others exert most characteristic injury upon the blood-forming organs.

Generally speaking, the clinical picture of metal fume fever, regardless of the metal responsible, varies only in severity, while that of metal poisoning per se varies with the particular metal fume inhaled and with the degree of exposure. For example, massive doses of lead fumes inhaled may produce such acute conditions as lead encephalitis and severe gastrointestinal complications; while continued exposure to smaller concentrations will cause such chronic changes as anemia, lead palsy, and chronic nephritis.

Exposure to heavy concentrations of mercury vapor leads to acute nephritis, salivation, and diarrhea, while the more common industrial exposures to but slight concentrations will eventually produce the typical mercury tremor and psychic changes characteristic of chronic mercurialism. Strictly

speaking, there are no signs or symptoms of poisoning from metals which can not be due to other causes. For this reason diagnosis is always a matter of differential diagnosis and metal poisoning can only be established by careful consideration of all factors, including occupational history, medical history, clinical and laboratory findings.

While laboratory findings are a very important factor in diagnosis, they can not be relied upon as the sole evidence necessary.

Prevention of Metal Fume Poisoning

While the responsibility of controlling health hazards associated with exposure to fumes of toxic metals rests primarily upon the employer, effective elimination of such hazards can only be secured by the whole-hearted cooperation of employers, employees, the State, and other regulatory inspection agencies. Three fundamentals contribute most to actual prevention. They are: Good housekeeping, supported by engineering control of hazardous processes, and intelligent medical supervision.

Good Housekeeping

We think of good housekeeping as applying to clean floors and work benches; materials, tools, and processes arranged and maintained in good order; adequate lighting, and no overcrowding of work places by men and materials. All these will do much to lessen the concentration of toxic fumes in the atmosphere, but seldom is the control of processes so effective that some fumes do not escape into the general air of the workroom. From here they may be inhaled, or may contaminate the bodies and clothes of the workers. So general workroom ventilation is a factor in good housekeeping.

The provision of adequate washing facilities is a prerequisite. Under certain conditions lockers and showers for workers are necessary for the safe operation of many processes.

As a rule sweeping and cleaning should be done after regular working hours. Not only can a more thorough job be accomplished, but what is more important, other workers will not be subjected to any increase in atmospheric contaminants occasioned by cleaning methods. If vacuum or wet methods are used, accumulated dust is more effectively and safely removed.

Engineering Control

It has been found practical to exhaust, locally, most processes generating metal fumes so that the toxic fume is trapped at its source and does not gain entrance to the workroom atmosphere. This is done by means of hoods or enclosed processes. Special hazardous processes can usually be isolated in the plant, thereby making potential exposure of all employees unnecessary.

Both local exhaust and enclosed methods are more effective if special attention is given to general workroom ventilation. Disposal of fumes trapped by enclosed processes and local exhaust or isolation methods requires that attention be given that such wastes do not contaminate the air drawn into the work places by general ventilation.

Medical Control

Adequate medical supervision entails special care in the placement of workers, and should not be aimed at the selection of "super-men," since it is practical to make work places safe for the average man. Individuals with serious kidney, respiratory, or other systemic diseases should not be placed where they may be exposed even to minimum concentrations of toxic fumes.

Where processes are known to be potentially hazardous, an important check on the efficiency of engineering control is gained through regular periodic examination of workers. By this practice, in many instances, not only will evidence of absorption be detected before serious injury has resulted, but an opportunity is afforded to correct control measures so effectively that the workers showing early signs of absorption may safely continue at their regular jobs. Routine records of illness should be kept.

Any abnormal rate of absenteeism due to illness among an occupational group, regardless of the diagnosis reported, should call for special investigation to determine if there are any environmental conditions aggravating the primary illness.

Personal Protective Equipment

If proper attention is given to the three fundamentals mentioned—good housekeeping, medical and engineering control—only specific and unusual emergency exposure will call for the provision of personal protective equipment.

The masks or respirators provided work-

ers who must necessarily be exposed to metal fumes should be of special construction and adapted to the processes and materials used. The United State Bureau of Mines¹ has, after testing, approved certain types of masks for workers exposed to specific metal fumes.

No filter type of respirator capable of protection against toxic metal fumes has been submitted for approval. While two or three filter type respirators have been approved for protection against lead dust, the use of which may in a small way reduce the hazard of fumes, they cannot be relied upon for full protection. Filter type respirators approved for protection against nuisance and pneumoconiosis-producing dusts will not protect the user from toxic fumes.

Several of the hose-line or positive pressure type masks have been approved, but there are certain limitations to their application which make them impractical for use in some kinds of work.

Substitution

In a vast majority of cases, resort to substitution is an impractical method of eliminating health hazards due to metal fumes. The raw materials used usually have special application. Furthermore, substitution is often a dangerous practice, even though it is practical. Instances may be cited where the substituted product has proven equally as dangerous as the one it replaced, the only difference being that less was known at the time concerning its toxic properties.

Electroplating Fumes and Vapors and Their Elimination

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The industrial physician is responsible for the health of all employees in his plant, in so far as their health may be affected by their occupations and their environment. Consequently he must be familiar with the various jobs and conditions under which the men work to know definitely the associated health hazards. He must work closely with the safety, maintenance, chemical and purchasing departments to keep himself in-

formed on changes in methods and materials that may influence those hazards.

Thus fortified, the physician occupies a strategic position in the hospital, as the employee invariably comes to him first with complaints which he may associate with his work or which are of a nature that would warrant an investigation which may lead to the discovery of an unhealthy condition.

One of the processes which may be sus-

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pected of involving a health hazard is the electro disposition of metal. In preparing metal for plating as well as during the plating operation, and in the treatment of salvage material after plating, a number of chemicals are used, such as solvents, acids, alkalis, metals and salts, and many toxic and offensive fumes and vapors are liberated. While it is true our prime interest concerns the injurious fumes and vapors, we must also interest ourselves in the non-injurious offensive types, since they may affect the worker's mental attitude, giving rise to dissatisfaction which in turn may result in inefficient work.

Poison is commonly introduced into the body by three routes, ingestion through the mouth, absorption through the skin or inhalation through the lungs. In electroplating our greatest hazard lies in the respiratory route; the ingestion and absorption routes are of lesser importance.

Fumes and vapors, such as heavy acids, may enter the respiratory tract as fine spray and produce local reactions in the nose, throat and lungs, while others such as hydrocyanic acid pass through the lungs without producing any local symptoms and enter the blood stream.

Skin absorption is important in connection with the coal tar derivatives, benzene, toluene and xylene and the petroleum derivatives as carbon tetrachloride and trichlorethylene. Since these are all volatile, poisoning may occur by inhalation as well as by absorption.

Ingestion Is Rare

Ingestion of poison by mouth occurs rarely and is usually the result of a definite accident. However, in the lead electroplating industry, rigid precautions must be taken to prevent the ingestion of lead salts that may have been deposited on the clothing and body of men while working around the plating tanks.

In general in all electrolytic processes irrespective of the constituents of the bath only two gases are liberated, oxygen at the anode and hydrogen at the cathode. Since the anode efficiency is always high and the cathode efficiency relatively lower, and the further fact that the gases are liberated in the relation of two hydrogen to one oxygen, the gas from the anode is negligible compared with that at the cathode.

The amount of oxygen and hydrogen liberated, as such, is of no consequence as a

hazard, but out of their properties as gases arises one of our greatest problems in the control of electroplating fumes and vapors. As the gas is liberated, it forms tiny bubbles in the solution which rise above the surface and break, throwing a fine spray or mist of bath solution into the air above the tanks which may be inhaled by the workers. Consequently to understand and evaluate our hazards we must know the bath constituents in all electrolytic processes.

The materials coming to the plating room usually have a film of oil or grease on them which must be removed and the surface treated before they are placed in the plating solutions. This is accomplished by dipping the parts in a degreasing solution such as xylene or placing them in a vapor bath as trichlorethylene. Usually this operation is carried out in open tanks, and as bath solvents are highly volatile, some of their fumes escape and contaminate the room air.

Xylene though less toxic than benzene and toluene has some narcotic action on the central nervous system. Trichlorethylene is the most commonly used degreaser, and is capable of producing general narcosis. Workers at the tanks complain of giddiness and occasionally lose consciousness, but few deaths have been reported. Trichlorethylene also has an important characteristic that must be borne in mind—workers have been known to become addicted to its use.

Because of the highly volatile nature of these solvents it is impractical to attempt exhausting the tanks. We found we could eliminate the xylene with its hazards by installing closed tank systems of trichlorethylene washing and vaporizing, passing the parts through the spray and vapor chambers on conveyors. This also eliminated our trichlorethylene hazard and the penetrating, sweet smelling, sickening odor in the plating rooms which had been a source of complaint and concern to the workmen.

Carbon tetrachloride is used in some operations, but its use should be discouraged because of its extreme toxicity.

Following the degreasing process the parts are washed in a strong hot caustic solution to remove organic particles of dirt. This washing is more effective if an electric current is passed through the solution, which by the bombardment of hydrogen gas on the part at the cathode produces a scrubbing effect. Since the aim of the electrolysis in

this process is to produce gas, and none of the current is used to deposit metal, a large amount of gas as hydrogen and oxygen is liberated and considerable bath solution is atomized into the air. The solution being composed of strong alkalis is very irritating to the respiratory tract, and the tanks should be exhausted.

In some cases other operations are required before plating, such as pickling and bright dipping. The pickling bath contains weak solutions of hydro-chloric or sulphuric acid and some nascent hydrogen is generated. Since iron, steel, zinc, copper and lead may contain arsenic as an impurity there is always danger of hydrogen arsenide gas being formed from time to time. This is a powerful hemolytic poison and early symptoms of poison appear soon after the gas is inhaled. All pickling tanks should be exhausted.

In the bright dipping of brass a concentrated solution of sulphuric and nitric acid is used, and large amounts of nitrous oxide or nitrogen dioxide fumes are liberated when the parts are placed in the solution. The oxide of nitrogen has a strong local action on the respiratory tract and may produce serious lung damage. It is unfortunate that that gas is not very asphyxiating; the worker may continue to inhale it without experiencing anything more serious than a choking sensation until some hours later.

Poisonous Salts Used

In the actual plating solutions we deal with poisonous salts of sodium, copper, zinc, nickel, cadmium, gold etc. The cyanide compounds are our greatest concern because of their high toxicity. Plating room workers should be instructed as to the dangers involved in the handling of the various compounds and solutions, and the possibilities of the formation of hydrocyanic acid gas in accidentally mixing acid and cyanide solutions or promiscuously slopping these solutions on the floors or spilling them into stagnant drain pipes.

In the electrolytic process the hydrogen gas bubbling out of the solution will atomize these compounds in the air, and the tanks must be adequately exhausted. It is probable that some cyanogen gas is mechanically thrown out of the solution by the hydrogen gas and undoubtedly minute amounts of hydrocyanic acid are formed. However, the tendency of the cyanogen is to return to the solution, so that the hydrocyanic acid formed

is negligible and does not represent a hazard compared with the copper sodium cyanide that is sprayed into the air. Small amounts of hydrocyanic acid are readily assimilated in the body as sulphocyanides and excreted in the urine.

Chrome is usually the finishing plate in automobile hardware, and in its deposition we use a concentrated solution of chromic acid and a very weak solution of sulphuric acid. Since the efficiency of the chrome bath at the cathode is only about 15 per cent, 85 per cent of the current is used in the generation of hydrogen gas, with a resultant active spraying of the solution. Exhaustion of these tanks must be efficient to prevent air pollution. Chromic acid is relatively non-toxic. Its effects on the body are readily recognized, and probably for that reason it has held too important a part in the literature on toxicology. It may produce ulcers on the skin where concentrated solutions have contacted, but outside of their slow healing properties these are of little consequence. If not exhausted properly it produces in workers erosions of the nasal septum which frequently go on to produce permanent perforations which are annoying but do not predispose to any disfigurement or health problem. Like nickel in susceptible individuals, it produces dermatosis which invariably clears up on removal of the person from work in the sensitizing materials.

In the process of stripping salvage parts for re-working, concentrated alkalis are used to remove chrome, and concentrated sulphuric acid to remove nickel, copper and zinc; or an electrolytic bath of sodium nitrate can be used to remove all the deposited metals. The tanks in all these operations must be exhausted.

The elimination of fumes and vapors in the plating rooms is for the most part the concern of the maintenance engineer.

However, the chemist may eliminate them by changes in methods or solutions, designed to stop their production, and the safety engineer may eliminate them from contact with the workmen by the introduction of hoods, masks, gloves, etc. Probably in the future factories will be air conditioned, and our problems of air pollution will be minimized.

When we analyze the problem of ventilating the plating rooms, we are confronted with many difficulties. Exhaust systems of individual tanks designed by rule of thumb to operate with one hundred per cent effi-

ciency, if other things are equal, may fall far below the expected figure because of air movements produced by surrounding exhausts. This is especially true of an induced system operating near a direct system. I have seen an induced system actually functioning as an intake air shaft in an air bound room, and the substance it was supposedly exhausting was being drawn into the room air as a contaminant.

Other conditions tend to unbalance a well constructed system, such as open windows, doors, skylights, all of which produce air currents that may divert fumes and vapors from the tanks as they pass to the various exhaust hoods in the room. While room temperature, humidity, barometric pressure, and outside air velocities, likewise influence the exhaust system efficiency.

Remove Fumes at Source

The cardinal rule, of course, is to design the system to remove the fumes and vapors at their point of origin. In electroplating tanks the American Standards Association has recommended that this point be from six to eight inches above the solution level, so that the spray from the breaking gas bubbles may be collected. It further recommends that the point be not more than three feet in height from the level at which the operator is standing, to draw off the fumes before they reach his breathing zone. Overhead hoods and exhausts may prevent fumes from entering the room air, but they are of little value to the worker standing at the tank. Tanks should be as narrow as possible and should be vented on both of the long sides, to aid in efficient exhaust of the solution area.

Too frequently we satisfy ourselves that our plating rooms are safe for employees to work in, because we have complied with all state rules and regulations relating to the removal of fumes and vapors, and because state inspectors pass favorably on our systems after their casual survey. We walk through the plating room using our noses to detect the presence of fumes and place our hands against the exhaust hood to determine the efficiency of the systems. While it is true our five senses are valuable in the detection of hazards, it is folly to rely on them to the exclusion of the more scientific means at our disposal. Pitot tubes, anemometers, manometers, and swinging vane velocity meters are available to test air velocities and determine the air volume the various ducts are carry-

ing, and regular periodic checks should be made with these several times a year or as often as indicated.

In the final analysis we are not interested merely in exhausting a tank or a room but rather in the air pollution. Our chief concern is what is in the air we are breathing, and if the contaminant is injurious to health, how much of it is present. A quantitative chemical analysis of the air is the only way to determine this.

We have introduced in our plating rooms several machines for collecting air samples, as designed by the Bureau of Mines and the United States Public Health Service. This method essentially consists of drawing air through a solution in a collecting bottle at a fixed rate, the air passing through an impinger tube so designed that its velocity is increased to about 200 miles an hour. As it strikes the bottom of the bottle or baffle, the air is broken up into minute bubbles, which facilitates absorption in the collecting solutions. By using different solutions or a series of solutions, the suspected solid, liquid or gaseous pollutant is extracted from the tested air, and a chemist makes his analysis.

A complete air analysis is not necessary, as this would entail a very lengthy and difficult problem. Knowing what fumes and vapors are formed from the known constituents of the bath, our interest lies in the harmful ones that may be present in the air and not in the small immeasurable amounts of harmless chemical combinations that may be formed.

To obtain as representative a test as possible, the collecting bottle is placed at face level near the operator, and air is drawn through the solution during the entire period he is working. The total air volume that has passed through the collecting solution is roughly equivalent to the amount of air that would pass through the lungs of an average man during the same period.

Long-Time Studies Made

At some key points in the plating room we are installing air analysis equipment which is to be run continuously, and determinations are to be made on 24-hour collections or more frequently if indicated. By this procedure we are able to make more detailed studies of our hazards at fixed points over a long period of time and attempt to find and control conditions in the room that produce fluctuations in our air pollution.

Along the same line of health research we have formed a health hazard committee, composed of representatives of the safety, chemical, medical and maintenance departments, whose duties are to discover, discuss and correct unhealthy working conditions. The safety man observes, the chemist determines, the physician interprets, and the maintenance engineer eliminates the hazard.

This method of approach has worked out well, the general discussion invariably contributing to a better understanding of problems and a more rapid solution. This is especially true in regard to our plating rooms, where we are dealing with highly technical processes, the intricacies of which are thoroughly understood only by the chemist.

There are no reputable industries whose management, even in the absence of state compensation laws, would ask their employees to engage in work that we as physicians find injurious to health; and there are no dusts, fumes, or vapor hazards in industry that cannot be controlled by a competent engineer, if he knows what results he is to obtain.

The use of masks, hoods and respirators in the plating rooms is an admission of defeat by the chemist and engineer. Workers invariably cheat at intervals, if forced to wear a cumbersome hot hood or respirator throughout the day, and during these periods they are subjected to the hazards the apparatus was designed to control. We should consider these only as emergency measures.

Until such a time as the industrial hygienist and toxicologist determines for us definite safe limits of various poisons in the air in which an unprotected man may work, we must follow an uncharted course with caution, ever being on the alert for signs and symptoms that may lead to the discovery of new health hazards and the establishment of safe standards. The scientific study of processes in our plant by the chemical, ventilating and safety engineers co-ordinating with the physician may assist materially in determining standards of safety in handling of toxic substances; for the toxicologist sets his standard on the basis of the symptoms or pathology produced by a known quantity of substance administered.

Any standard we set up as safe will not necessarily mean that no man will exhibit symptoms while working within it. As long as any toxic material is in the air, certain susceptible or sensitized persons will manifest symptoms, just as individuals in other walks of life are sensitized to pollens in the air, foodstuffs, drugs and local irritants to the skin.

We cannot hope to correct this condition, but we can control it by removing the susceptible person to work in other departments. By analyzing our air, establishing reasonable standards and keeping our polluting substances within these standards we can at least be assured that our workers are not being exposed to quantities of toxic substance that may produce serious damage to their health.

ADJOURNMENT

Industrial Safety Lectures

Four industrial safety lectures were presented before Congress delegates on Tuesday, Wednesday, Thursday and Friday mornings. The speaker was Irving J. Lee, M.A., The School of Speech, Northwestern University, Evanston, Ill.

He spoke on the techniques and methods for the preparation and delivery of effective safety speeches. The subject was divided

into four phases: (1) How to Prepare the Speech; (2) How to Give the Speech; (3) The Content of the Speech; (4) Plans and Blueprints for the Organization of the Speech; and (5) Bad Habits and Their Removal.

The speaker was introduced by W. H. Cameron, Managing Director, National Safety Council.

HOW TO MAKE THE SAFETY SPEECH

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CHAPTER I

HOW TO PREPARE THE SPEECH

Why Give Speeches on Safety?

It has long been realized that of the great trilogy in safety work, Engineering, Education, and Enforcement, Education plays a significant role. And it is with a technique by means of which Safety Education can proceed, that we are interested.

In order to "get across" the principles and practices of Safety it is necessary to employ either or all of the following methods; there are no others.

1. Presentation of the message by means of the printed word in editorials, pamphlets, articles, etc.

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2. Presentation by means of visual stimulation using pictures, still and moving, posters, charts, graphs, etc.
3. Presentation by means of the spoken word in speeches and lectures, that is, by auditory stimulation.
4. Combinations of visual and auditory stimulation as in the use of a talking movie.

The following pages of this handbook were prepared because we are convinced of the value of the speech as a device, which gets across ideas and changes attitudes with some effectiveness.

We might begin by telling you of an experiment carried out in a public speaking class at Northwestern University in Evanston, Ill. At one of the early sessions in the course a student gave a speech on the evils of drunken driving. He was followed by another student who displayed a series of striking posters depicting the hazards of driving on icy streets. Finally, an editorial taken from a newspaper discussing the necessity of a state driver's license law was passed out to each member of the class to read.

It should be mentioned that the procedure was undertaken as a phase of the regular consideration of problems of social significance as part of the class work. The students did not know that an experiment was intended.

Seven weeks later the class was given a written test in which they were asked to write as specifically as possible what they remembered from the session on Safety. There is no need here to discuss the method of scoring and the tabulation of results. It is enough to indicate that they recalled least what they had read in the editorial, that they did fairly well on the posters, but that best scores were recorded on the material presented in the speech.

Thus it should be recognized even on the basis of this very inadequate experiment, that the efficiency of the speech as an agency of communication must not be overlooked. We might also cite a recent investigation at Indiana University which concludes thus:

"There is a demonstrated superiority of auditory over visual presentation not only in the present experiments but also in those of others . . . since 1932 the studies of visual vs. auditory mode have quite uniformly demonstrated auditory superiority."

The experimenter suggests, that "it is possible that the enormous increase of auditory stimulation from radio sets for 78 million Americans three to five hours a day, from public-address systems everywhere, and from sound films claiming 88 million attendances weekly is developing auditory habits." (J. R. Elliott, "Eye vs. Ear in Moulding Opinion," *The Public Opinion Quarterly*, July 1937, page 86.)

It should be clear that if we are interested "in moulding opinion," that we must take advantage of the newly developed and long-lived "auditory habits" of people—in short that we must pay some attention to the business of speech-making in the work of safety education.

How to Learn to Speak

Even though the value of speech-making be granted there is still the problem of how we shall go about learning the process. A rapid glance at the history of speech-teaching indicates but four approaches to the problem. Let us review them.

1. One seemingly practical school preaches a doctrine something like this: "If you want to learn how to speak before an audience, get out and

speak. The more experience you have in public speaking the better speaker you will become."

But the adherents of this "practical" school are unable to explain why it is that many people, even after years of experience, still do not do a good job of speech-making. We should explain such a situation this way. *Instead of practice and experience making perfect, they simply make permanent a host of bad habits.* If you play golf, you know how easy it is to develop mannerisms and ways of doing things that cost you strokes. Much of our experience with adults, who are eager to improve their speaking ability, makes clear this one fact—that before we can do anything constructive we must first do something about their bad habits. There is thus some reason to believe that practice alone is not enough.

2. Then there is the "Magic Key" approach. The essence of this method is its search for some secret, some magic formula, which will manufacture eloquence overnight. But no one has as yet found that formula, though there are those who advertise to the contrary. Euclid long ago insisted that there is no royal road to learning. The same thing must be said about the business of speech-making.

3. Widely employed is the "Courage and Personality" approach. It has recently been stated as follows:

"Before you can become an effective public speaker, you must be the absolute master of yourself. You must not yield to any fear. You must feel in your heart that you are a leader, that it is your mission in life to mould public opinion. This cannot be done by a man who is timid, afraid or vacillating. Therefore Nature has provided the gifted public speaker with a courage that is almost divine. You too, can be a powerful public speaker, but you must gird yourself with courage and be an apostle of strength."

You will notice, however, that this "shot-in-the-arm" school fails to tell us *how* "we may feel in our hearts that we are leaders," or even *how* "we may gird ourselves with courage." They are quick with advice and exhortation, but short on specific instruction.

4. The point of view taken in these pages insists that public speaking is an art or technique, just as is walking, swimming, writing or driving an automobile. You have to learn *how* to do all these things. In exactly the same way you have to learn what to do and how to do all of the factors involved in the speech process. In short, we should call this the "Technique" approach, since all the effort is directed to describing and demonstrating the ways by which a speech can be put together and delivered. If we can make clear the specific elements that go into the speech process, and if the individual will diligently endeavor to put them into practice, it is possible to predict increased facility in the art of public speaking.

Stagefright and Ignorance

Everyone who has ever faced an audience knows about that "sinking feeling," that combination of heaviness, tightness, and emptiness that make up what is called "stagefright."

An analogy will help to make the explanation clear. Suppose you were put into an automobile at the top of a hill. All the doors and windows are locked, so you cannot possibly get out. Now there is an interesting thing about this particular car; its levers have all been changed. Where the brake

pedal should be, there is the accelerator; where the steering gear should be, there is the gear shift, and so on. You know nothing about the change in levers. If we give that car a push so that it starts to roll down the hill, what would your reactions be there at the wheel? How would you feel? Quite probably if you are a normal human being, you would be scared, confused, panicky and emotionally disorganized.

But let us suppose that by some miracle you found a way to stop the car, and came out of the situation safely. And then two days later you were placed in the same position. Would your physical and mental reactions be the same as they were on the first day? Probably not, because you have learned what to do.

If you are not a seasoned performer, is not the picture of the driver in the first instance, a fair picture of what happens to you as you stand in front of an audience? In short, we are insisting that you experience an intense emotional disorganization for the same reason that the driver did—you do not know what to do.

Our experience has demonstrated quite clearly that stagefright tends to disappear as soon as the individual learns what speaking is all about. When you know what to do and what you are to say, in brief, when you have acquired some of the fundamental techniques of putting a speech together and delivering it—then and then only will ease and confidence replace the terror and disintegration that is the bane of the amateur speaker's existence. Stagefright is banished, when ignorance is turned to knowledge.

Preparation of the Speech

The first attack on stagefright is the knowledge of how to put your speech together. We must insist here that though seemingly unimportant, the business of preparation really is something that must be learned thoroughly and immediately. Our experience with business and professional men makes quite clear that bad preparation is the reason why between 75 and 85 per cent of their speeches lack effectiveness.

Bad Ways of Preparing the Speech

1. *Writing it out word for word and reading it.* This is a necessary method for the technical paper, or where matters of policy must be dealt with, or where the speech is likely to be quoted. Such a speech may be polished and dressed up until it says exactly what is intended, carefully and diplomatically.

But note the disadvantages. When it is written out word for word it is likely to become stiff and formal. It will read like an essay, unnatural and learned—characteristics a speech should never have. Further, very few people are good readers. It is too easy to attend only to the manuscript, thus losing contact with the audience. And above all, a speech that is read loses the sparkle and enthusiasm that should accompany real speaking. This method the safety speaker should avoid.

2. *Writing it out and memorizing it.* Obviously here we have all the advantages of the carefully prepared speech. But we have also the faults of stiffness and formal structure. If the words are painstakingly memorized there is always the danger that they will be given in rote, mechanical fashion, with an air of routine and hurried effort to get the task over as soon as possible.

Furthermore, note that the memorizing process is sheer drudgery, that it takes hours and hours, and even when you think you know the speech, you can not be certain that at some point you will not forget it. Memory is one of the most unpredictable things we know. We never know when we will forget names, dates, and many other things with which we are quite familiar. Thus, because the memorized method is both difficult and uncertain, we advise safety speakers to avoid it.

3. *The Impromptu method,* involves speaking from one's background without specific preparation. Suppose you have to give a speech on some aspect of safety observance. You read and think about the subject. You do not take notes, you write nothing out, you attempt simply to absorb as much information as possible. Then when the time for the speech arrives, you face your audience and in general hope that words will come. This is the lazy man's method. If words do come, the ideas they express will tend to lack coherence and power. In general such a speech is bound to fumble around saying very little. Too much reliance is placed with the gods, and those of you who have on occasion tried this method know that sometimes the gods do not come through.

Far better to depend on the perspiration that goes with good preparation, than on the moment of inspiration.

The Natural Method

The method of putting a speech together that will be presented here has been tried and tested by some hundreds of people with uniform success. It works better than any method we know.

Have you ever watched a good cook at work on a cake? The speaker can learn much from observing his technique. First, he sets out his pots, pans and mixing spoons. Then he places in easy reach all the ingredients. Finally he mixes them carefully in the proper proportions. Then the oven gets in its good work and the people around the table do the rest.

The natural method of speech-preparation follows an analogous procedure.

First, the speaker must assemble his material, gather his ideas, examples, facts, figures. Well in advance of the occasion of the speech, it is a good idea to carry a card or sheet of paper in your pocket on which you can list one after another ideas that come to you, or that you pick up from your reading. Pay no attention now to ordering the ideas, simply set them down in a list. There will probably be too many. Even though some may have to be discarded, the assembly process is the first step.

The second step is to get these collected ideas into some plan which will show the direction your speech will take. Every type of activity has its plans and guideposts. The sailor has his map, the architect his blueprint, the football coach his diagrams—and the speaker, an outline. The outline is the plan of the speech. In it are words, phrases and sentences, which contain the ideas which will grow into the final speech. The outline is the guidepost that directs the course of your ideas. Use it badly and you are certain to get lost. Use it, follow it, and you are sure to know where you are going.

But it may be asked: Why have an outline? Because this method of preparation involves merely the memorization of the ideas that you are to talk about, not the words. Here, the speaker knows exactly the order of his ideas, while the words he is to use are those that come at the moment of

utterance. Does this sound difficult? Actually, it isn't, because the great problem in normal communication is not inability to find words, but the failure to find the idea that comes next. Given the idea and information about the idea, the words will come. But first, the ideas must be known. The outline is the means by which the order of your ideas is determined.

There are two kinds of outlines, the Skeleton and the Full.

The Skeleton Outline contains only the bare bones of the speech. There is very little in it. It contains only direction signs. It is very short, easy to memorize, and clear only to the man who made it. It gives merely a *clue* to what is to be said. In it are put words and phrases which, when seen, hint at more. It is useful for the man who has done a fair amount of speaking.

Example of Skeleton Outline Industry's Part in Saving Traffic Lives

1. Cost to Industry
 - a. 3,300 killed in work
 - b. 17,000 killed outside
 - c. Expense of replacing them
2. What should industrial management do?
 - a. Help cut 35% of traffic fatalities by 1940.
3. How to do it.
 - a. Organize Safe Driver's Club
 - b. Send letters to employees
 - c. Inspection of employee's automobiles
 - d. Vision tests and physical examinations for workers

The Full Outline is made up of complete thoughts instead of clues. It is really a summary of the main and minor points written out in sentences. It takes a bit longer to make this kind of outline, but it is very useful because it contains more of what you are to say. A full outline can be given to a stranger and he will know what you are to talk about. It can be put away, reread years later still making sense to the one who prepared it. Indeed, it could very likely be given again almost as it was the first time with but a little preparation.

Example of Full Outline (Same Subject)

1. The cost of motor car accidents and fatalities which industrial management must bear is a striking amount.
 - a. 3,300 in 1936 lost their lives in course of their work
 - b. 17,000, however, in addition were killed by automobiles in no way connected with their work
 - c. Notice the cost of replacing their experience and skill, and the hiring and training of new workers.
2. These losses should challenge the fighting spirit of Industrial Management.
 - a. Latter should cooperate with the National Safety Council to reduce by 35% the traffic fatalities by 1940
 - b. The employer has an influence over his men "after the whistle blows" so that he can imbue them with a safety consciousness.
3. Some plans that may be used to stimulate an awareness of Safety
 - a. Organization of a Safe Driver's Club whose objects are:
 1. to cooperate with the local authorities

2. to keep up a continuous educational campaign
3. to teach personal responsibility
- b. Letters from Management to employees
 1. These should be sent at frequent intervals, and signed by a ranking company official
- c. Inspection of employee's autos in company garages
 1. Check tires, brakes, steering mechanism, etc.
- d. Vision tests and physical examinations of workers
 1. These supply evidence of the employer's sincerity in combating all the factors.

The final speech outline will, then, be represented by a group of words, phrases, and sentences set down in order, numbered, and so arranged that they represent the speech in miniature. With the plan before you, it is only necessary to tell in your own words the complete story summarized in each item of the plan.

The third step in preparation is to *memorize the outline*. It should be known forward and backward. All the various words and phrases should stand out in one's memory with perfect clearness. In short, you must know the outline. Knowing it, words will come easily.

The last step involves rehearsal of the speech as it is to be given. In this connection two methods of practice have been most productive.

1. Sit in an easy chair in a quiet room, removed from listeners. Get as comfortable as possible, then say the speech out loud quietly as though talking to yourself. Don't look in a mirror or bother to gesture. Just attend to the development of the ideas. Merely hear yourself talk.

2. Give the speech on your feet, preferably while walking. Students have found that walking up a quiet street after dark a useful procedure.

During each method of rehearsal it is possible to check the time of the speech, to give you an exact idea of the length of each of the parts.

In summary then, the Natural Method of putting the speech together has four main steps:

1. Getting and listing the ideas
2. Making an outline
3. Learning the outline perfectly
4. Rehearsing of the speech out loud

The Six-Day Plan

Experience has shown that men do their best job of speaking when they have at least a week in which to prepare the speech. Indeed, it is almost possible to say that no one ought to give a speech if he has not had that much time.

In experimenting on time-plans the following has given the best and most consistent results. It is based on a six day schedule with the speech due on the seventh.

First and Second Days:

Begin to collect and list the topics and ideas to be used. Do whatever reading is necessary. No time limit can here be specified.

Third and Fourth Days:

Keep adding to the list of topics. Begin thinking about their order. Mull the ideas over. Make the outline.

Fifth Day:

Read the outline over half a dozen times. Begin to memorize it. Rehearse it out loud—the "sitting-down" method. Twenty minutes to half hour is enough to put in on this day.

Sixth Day:

Read the outline over half a dozen times. You should know it by now. Then say it out loud on your feet, the second rehearsal method. This practice session very often goes roughly. Do not be alarmed if you do not seem to be doing so well. It simply means that the speech has not taken final form in your mind. But it will if the suggested procedure has been followed faithfully. 20 minutes is enough time on this day.

Speech Day:

Read the outline over a couple of times silently. Above all, do not give the speech out loud on this day until you face the audience. It is too easy to put too much into a practice delivery, leaving little energy remaining for the real event. Then when you face the audience, with full confidence that you know what you are to say, give it to them with all you have.

If there is more than a week's time, two weeks perhaps, the program should be followed proportionally. Take twice as many days for each step. The above program is a schedule that works, but it may be modified as occasion demands. Regardless of the time available, however, the four steps in the process must be followed.

If we were to give the best possible advice, it would be something like this: Never give a speech without sufficient preparation. You will only come to grief, if you do. Hurried outlining and memorization of the ideas is certain to make for worry and uncertainty. Give yourself plenty of time for each step. Get the outline firmly in mind. Rehearse conscientiously.

Any safety speaker who will do these things will begin to speak with confidence because he will know what to say.

Mary Heaton Vorse once said that "the art of writing was the art of keeping the seat of the pants to the seat of the chair." The art of speech preparation involves the same effort.

With some practice this method of speech-making provides an opportunity for growth. After a time you will find that while speaking you will be adding things that had not been prepared. In the enthusiasm of the moment new ideas will shape themselves for utterance. In short, you will begin to "think on your feet." This follows logically, because you have a clearly defined plan to begin with. There can be no original thinking unless a line of thinking is already under way.

CHAPTER II**HOW TO GIVE THE SPEECH**

If you have prepared your speech so that you *know* it, you are ready to devote all your energies to its delivery.

Before you get up to speak, if you are human, you will very likely feel a keen inner excitement that you may not understand. It should not worry you, because it is a *purely normal response*. Why does it occur?

That Inner Excitement

When you are sleeping or sitting quietly, you are using little energy. But as you awaken and move about the various activities of the day, the energy used increases. Now it is a significant fact that speech-making is a high-level activity. It is hard work and consumes one's strength. Ask any politician who has given a series of campaign talks on any day!

Your body is wonderfully made. Because speaking requires additional energy, automatically as the time approaches for the delivery of the speech certain glands, particularly the adrenals, release fluids into the bloodstream which stimulate and tune you up for the task at hand. The result is that stirred-up feeling. Without it you would be emotionally dead. With it you are alive and ready to go. Thus, this heightened feeling should be welcomed. It is one guarantee against dullness.

But as the stir-up continues it means that more and more energy is being generated. And just as a steam boiler needs a safety valve, so too does the speaker need some way of releasing the tension and pent-up steam inside him. The best way we know of draining that inner-tautness is to *move a bit*. Have you ever wondered why the substitute before going into the football game runs up and down the sideline, swinging his arms, lifting his legs high? Sitting on the bench he becomes tense, eager. The movement loosens him up, uses some of the excess energy.

However, the speaker has no running space. Is there anything he can do to work off the tension? Here are some suggestions:

1. Take long, slow, deep breaths. You will be surprised at the calm that results from the movement of the chest and stomach muscles.
2. When you get up to speak, get up slowly or walk up slowly. The more time you take the more movements you can make.
3. Find something to do either before you begin speaking, or in the first few minutes. For example, if it is an after-dinner talk, move your chair out of the way; or if you have notes, lay them out carefully in front of you; or if you have pictures or charts to be used arrange them in good order.

One man who heard of this principle devised a method of forcing activity in this way. He would carry his notes and some papers, then just as he prepared to face the audience, he always managed to let some of them fall to the floor. Then slowly, he would pick up the papers and methodically arrange them before beginning to speak. Though this particular procedure should probably not be recommended, that man has stoutly insisted that it always made him feel better.

We can summarize the argument in this way: Movement of the arms, hands, body makes for a discharge of energy which results in ease. Try to move a bit early in the speech.

Facing the Audience

You are standing in front of the audience and the speech is under way. Should you stand in one place or move around? Our experience indicates that you should not stand rooted to one spot.

First, because it is difficult for people to look at a stationary object for any period of time. Try right now to focus your attention on anything in your room. It is almost impossible to concentrate on it steadily without other ideas coming into the mind. The hypnotist puts his subject to sleep by making him look straight ahead, while listening only to the hypnotist's words. Unless you are interested in putting your listeners to sleep you will move about on the platform.

Second, because movement to various positions in front of the audience enables you to gain contact, to talk directly to different areas and groups of people. Standing in one place prevents you from pointing your talk to all your listeners.

Third, because movement helps to give you ease and composure. It is an aid in becoming natural and in giving you a "feel of the floor." We have seen movies of a student who had difficulty in attaining ease while speaking. His knees would wobble, and his feet seemed to be rooted in place. In the particular speech filmed it was necessary for him to walk across to a window, lift a flower-pot and bring it back to the center of the platform, while talking about the flower in it. The movies clearly reveal the difference in his feeling of naturalness after the movement had loosened him up.

An important point must be made here. People often ask whether a speaker must stand up straight during his speech. The answer is, No. If he has the urge to lean against a table or rostrum, he should lean. The only caution is this: Anything one does to achieve a *sense of freedom* and the elimination of discomfort is good. But in so doing care must be taken not to do anything that will offend the good taste of the audience or make them notice the act to the exclusion of the material of the speech. Later we shall have something to say about bad habits which tend to do this very thing.

Very often a speaker will find it difficult to move about. He just finds it uncomfortable to take several consecutive steps in any direction while talking. If this is your trouble, here is a simple exercise which has had good results, and which can be practiced in a private room. Simply take two steps to your right or left. Then stop and plant yourself. After some moments take two more steps and stop again. Taking but two steps at a time is not only easy, but it is surprising how much ground can be covered. Besides, these steps make an excellent way of punctuating a change in the thought-development of your speech. After one idea has been discussed, move, stop and go on with the next idea.

The Use of the Hands

What should the speaker do with his hands while speaking?

Observe a group of people in earnest conversation. Where are their hands, in their pockets, behind their backs, at their sides? Not if the conversation is in earnest. Rather they are likely to be waving, pointing, lifting and falling, circling about, measuring off imaginary spaces in the air—constantly being used.

Have you ever tried to clamp a baby's arms at its sides? Then you know how he squirms to get free of the abnormal position.

Why is being put in a strait-jacket such torture? Because it means that the body and arms are being kept from functioning naturally, moving freely.

In brief, we are trying to say that to use one's hands and arms, that is to gesture, is a perfectly normal function whether in a group or before a group.

Then too, gesturing makes the meaning of what you say clearer to the audience. Whenever you have to talk about dimensions, boundaries, directions, or the size and shape of anything, you will find it easier to make the description with the use of your hands. To see this point clearly, stop and try to describe in words only a spiral staircase. It is a difficult task. But how easy it is with a wave of the hand!

Furthermore gesturing is almost a necessary factor in our daily communication. Suppose we eliminated the following situations in which gestures are used, how difficult would be our methods of communication: a boy "thumbing" a ride, waving to a passer-by, shaking hands, shrug of the shoulders, taking and giving objects, the length of that fish, giving directions, etc.

The Safety speaker has usually abundant opportunity to use his hands for purposes of description. Note just a few situations: highway obstructions, passing on the wrong side, the right and wrong way of doing something, a collision or any accident, a skidding or careening car, etc. Indeed, no Safety speaker can afford *not* to use his hands if he is to get across graphically vast numbers of factors in safety observance.

From what has been said about movement as an aid to the speaker, it should be obvious that gesturing is but another means of helping him to assume easily and smoothly his natural tone and manner in talking to an audience. We have seen this happen: a man may have been talking dully, woodenly, failing to interest his listeners, when suddenly he has an opportunity to describe an incident graphically. Almost immediately apparent is the effect of the gestures in turning the slow tide of the speech into something lively and interesting.

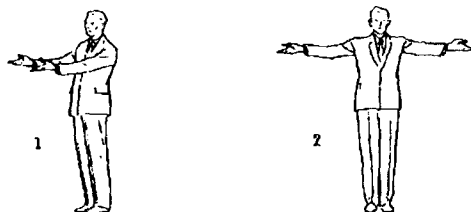
At this point we should put an end to some misconceptions.

1. There is no such thing as a correct gesture. What is right for you may be all wrong for someone else, and vice versa.
2. There is no such thing as a bad gesture. The only bad gesture is the one you didn't make when there was an opportunity to make your meaning clearer.
3. The average speaker cannot gesture too much. It is only the rare individual who must be restrained.
4. Gesturing is not a means of decoration, a device to make the speaker look pretty. It is rather a most useful technique of achieving ease and emphasis, which is also helpful to the audience.

Learning to Use Your Hands Freely

There is a rather simple system by which almost anyone can learn to gesture without self-consciousness. But like any other art, to achieve this ease takes practice. However, if you will follow the suggested method for

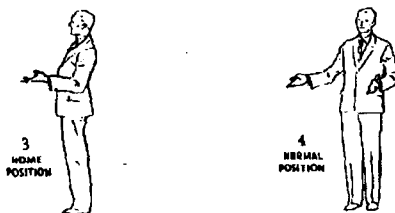
a few minutes a day, you should begin to use your hands with some freedom after a week or two. The method has been tried with some success with a wide variety of people. You can follow the procedure alone or in a group.



1. Raise both arms outstretched in front of you with palms up to the height of your shoulders. Then drop them swinging back and forth freely until they come to rest at your sides. Repeat half a dozen times.

2. Raise both arms outstretched sidewise until they reach the height of your shoulders. Drop them until they fall against your thighs at each side. Repeat half a dozen times.

3. With palms upward, and with the upper arms held fairly close to the body, raise your forearms so that they extend in front of you parallel to the floor. Keep the fingers relaxed and loosely extended, not closed up and tense. We call this the HOME POSITION. Then drop the forearms to the side, and repeat the whole movement about a dozen times.



4. From HOME POSITION move both arms forward about four inches away from the body in the same plane, so that the bend in the elbow is about 150 degrees instead of about 90 degrees. This may be called the NORMAL POSITION. Repeat a dozen times.

5. Practice bringing both arms up to each of these two positions. Then practice bringing alternately the right and then the left arm singly to each position. You will see that each arm makes a normal gesture in either of the two positions.

From the two basic positions, Normal and Home, can be made every possible gesture. No matter whether a speaker is emphasizing a point, or swinging his arms, or pointing or waving his fist, his arm and hand must

go through either or both of the basic positions. So that if you learn to bring your arms up to Home and Normal positions easily, you should be able to make any arm movement without restraint.

Delivery and the Audience

Up to this point we have been concerned with those purely mechanical aspects of delivery, having to do with one's hands and feet. But the delivery of the speech involves other matters. More especially it is concerned with the problem of a right relationship with the audience. We are thinking here of the speaker's attitude and manner in connection with the speech as it goes out to the audience.

Let us begin by noting that phenomenon called "Audience Blindness." In its simplest form we see it as a shifting of one's gaze away from those to whom one is speaking. On the platform you face an audience. Being blind to it makes it deaf to you. If you will not look at them, they are not likely to listen to you. By your failure to get "contact" you seem to say that you are not interested whether they get what you have to say or not. You seem to display aloofness. If you want them to follow you, to understand what you are saying a full-fledged stare is an asset.

Look at them all the time, even when you move around. Get contact early and keep it throughout.

Reality in the Speech

There was a time in the history of public speaking when artificial techniques were taught and used. The good speaker was supposed to use high-flown language, big words, rousing climaxes, and studied gestures. He was taught "oratory" instead of straight-forward talking.

But that time is gone. In the business of Safety there is no place for "oratory." There is place for honest, clear-cut, real speaking which gets ideas across to listeners. *We now know that the speech is best which is most real.* The effective speaker today must be himself. His manner must be simple and direct. He must seem to talk to the audience just as though he were talking to them around the supper table. He works hard to be simple and forthright. He avoids trimmings and the things that are unnatural. He is himself.

It is no difficult task to tell you to be natural. Nor, contrary to what some think, is it easy to be natural. But it is possible. Here is a suggestion: Use many "you's" and "I's." Refer directly to the audience. Talk about "us" and "we." Make clear that Safety education "affects us," that "we are involved in everything that we do."

Booker T. Washington once said, "I take my audience into my confidence much as I do a person." You can approach that intimacy by sprinkling the little words, *I, you, we, us*, throughout your speech.

Does the Speaker Need a Big Vocabulary?

Abraham Lincoln once said this: "Among my earliest recollections I remember how, when a mere child, I used to get irritated when anybody talked to me in a way that I could not understand. I can remember going to my little bedroom, after hearing the neighbors talk of an evening with my father, and spending no small part of the night trying to make out what was the exact meaning of some of their, to me, dark sayings."

"I could not sleep, although I tried to, when I got on such a hunt for an idea, until I had caught it; and when I thought I had got it, I was not satisfied until I had put it in language plain enough, as I thought, for any boy to understand."

William Jennings Bryan believed the same thing. These are his words: "The purpose of speaking is to convince. To convince, you must make the people understand. . . . A certain man is said to have sawed two holes in a door, one for the big cat and one for the kitten. It was unnecessary, for a hole big enough to let the big cat in would let in the kitten also. It is the same in speaking. If you speak in simple language both the learned and the unlearned will understand."

Lincoln and Bryan knew that big words and high-flown language never made an idea clear. If young boys and girls, and adult men and women are to get the point of your Safety Talk, then you too must "speak in simple language . . . plain enough for any boy to understand."

Sameness vs. Variety

There is a legend of an old method of torture used in the Orient whereby a man was staked to the ground on his back. About three feet above his forehead was suspended a container from which about every thirty seconds fell a drop of water. The legend insists that few men remained sane after two days of the steady dripping. The eternal sameness drove them mad.

Sameness in a speaker's voice, in the loudness or softness, in the slowness or rapidity with which he speaks—this will not drive an audience mad but it will put them to sleep. If a speaker is not aware of what is happening he soon falls into a rut. He speaks at an unchanging rate of speed. Or he goes along in the same key without letting his voice rise and fall naturally as in conversation.

Suppose a baseball pitcher were to pitch nothing but fast ones. Or nothing but slow ones. How long would he last? Any time a speaker maintains a steady pace for long or a steady loudness you may be sure he won't last long either. The audience ceases to bother, they let their minds go off in other directions. A good pitcher however, won't pitch only fast ones. He mixes them up. He changes his pace.

That is exactly what the speaker must do. He too must change his pace. He must speak rapidly for a time, then slow up. Or he speaks a while at a moderate loudness and then quiets down or gets louder. What he does makes no difference. The important thing is that he get *variety*.

Variety exists in ordinary conversation. It is only when the man stands before an audience that he mistakenly thinks that he mustn't be natural. These two go together. Get variety and you have naturalness. Get naturalness and you have variety.

Make sure you have them both.

The Attitude of the Speaker

We have pointed out the necessity for Reality in delivery. But the effective speaker must go one step farther. He must be enthusiastic as well. He must be sold on what he says. He must "break down" the stiffness and speak as he would when telling about "that fish he caught after a bitter battle." He must "come alive" because it is alertness not deadness that

keeps listeners awake. Someone has rightly said, "Dead men tell no tales," but dead speakers communicate no ideas.

The effective speaker is always friendly. No one has a right to appear before an audience with a frown. He must be cordial and genial. If the speaker is cold and unfriendly the audience will be just as cold in following what he says, and in carrying it away with them.

No speaker in the history of public speaking got across an idea who wasn't utterly and completely sincere about it. There have been some shallow men who "put on" earnestness whenever they felt it was needed. But they probably did not do it for long. Both earnestness and its absence can be felt by listeners.

You have heard salesmen who were smooth and suave. But if you think back you probably didn't buy what they had to sell. The same holds true in speech-making. If you have something to sell, your one hope in getting it sold is to be utterly honest about it. The man who will break down and talk with absolute honesty can make mistakes galore. He can mispronounce words, mix his tenses, split infinitives and they will go unnoticed. But not so dishonesty. Honesty in a speaker is more important than all the elocutionary tricks known.

And the knowledge that reality, enthusiasm, friendliness and honesty are important should do much to add confidence to the speaker. He should realize that if he has something to say, if he can make a contribution to his audience, a contribution that he believes in, then nothing else counts. And once the speaker recognizes the power inherent in these fundamental qualities, it will take more than an audience to frighten him.

CHAPTER III

THE CONTENT OF THE SPEECH

Up to this point consideration has been given to the techniques of preparation and delivery. It was assumed that safety speakers either know or should know the subjects about which they have to talk, or at least, know where that subject matter may be found. However, it is quite possible that a man will have at his command facts and figures, arguments and examples, and still not know what to do with them in a speech.

This chapter will attempt to answer the question: What should go into a speech? And our concern is to point out the techniques of handling the stuff of safety effectively.

Suppose a speaker gathers a wealth of material and presents it all to an audience. And suppose further that at the end of the speech they have only a hazy memory of what it was all about. What would be the point of giving such a speech? Just as long as the audience retain little or nothing definite, the effort is a mere dumb show, interesting while it lasts but of no importance. By any test of success that kind of speech is a failure for the man interested in preaching Safety.

For the Safety Speaker there can be but one test—NOT HOW MUCH

HE GETS OUT, BUT HOW MUCH THEY GET AND REMEMBER. Always he must think in terms of the residue he will leave, and not in terms of how much he can pack into his speaking time.

The Principle of Limitation

As soon as you realize that "audience retention" alone is important in the speech process, you will understand a corollary fact: That if an audience is to *get* what you say, THEN YOU MUST LIMIT THE NUMBER AND SCOPE OF THE THINGS YOU TALK ABOUT. You must concentrate on a few ideas, or even better on but one idea and develop it adequately.

The necessity for this should be clear if you recognize how difficult it is to break through the average listener's body of interests. Just think of the elements clamoring for his attention already, his home, family, job, friends, sports, politics and a host of others. The result is to make him insensitive to new stimulation. If you would break through that protective armor you must concentrate your fire on one idea, not scatter it over a dozen. More and more we come to the conclusion that if a speech gets across one idea, one big point, that is all that can be expected.

Have you noticed the show-window of some great store? Just a few items displayed, so that if you stop to look, you really will see something. Then notice the windows of a shop on some side street, crowded, every available inch of space filled, so that if you do stop to look, you are likely to be obsessed with confusion, and actually see nothing. Too many safety speeches are like those crowded windows.

Remember the rule: *One point gotten across is far better than a dozen gotten out.*

Getting Direction

A friend drops in on another. "Let's go for a ride," he says.

"To where?" asks the second.

"Oh, I don't know," is the answer, "let's just ride."

Then what happens? They ride aimlessly. They cover a lot of ground, use a lot of gas, and return having gotten nowhere. Some speeches are like that too. They start, use a lot of words and usually end nowhere.

How much better if those two friends had decided on a specific direction and set out for it. The man who prepares a speech must be economical. There must be no waste motion. Before starting he should know his direction. He should have a *purpose*. He should ask himself this question: What do I want to happen as a result of my having given this speech?

For the Safety Speaker there can be three possible purposes.

1. To give information to his listeners. To tell them about the new stop-signs, that driving on icy pavements is dangerous, how to avoid holiday traffic, etc.

2. To make his listeners think. Quite often if a man does nothing but recognize the things he does badly, that is enough to make him change his habit. Awareness is the first step in the development of new behavior.

3. To get his listeners to do something. The speaker may want boys and girls to cross streets at intersections, to pedal their bicycles carefully, or he may want workmen to quit their horseplay, etc.

It makes no difference the purpose decided upon, but that there is

direction is important. It is difficult enough to hit a target when aiming at it, but how much more difficult is it to score a hit without even pointing in the direction.

Achieving Visibility

Every man who has ever faced an audience knows that their attention shifts. Sometimes they sit and listen quietly, straining to get every word. And sometimes they sit phlegmatically, or restlessly and inattentively.

Why does this waning of attention occur? Can anything be done to maintain an audience's steady interest?

Before these questions can be answered, we must understand a fundamental fact. People listen when they understand. They understand when they see. Their attention declines and wavers whenever the subject matter ceases to be *visible*. They become interested when the material of the speech is *concrete*. The key words then, are *visibility* and *concreteness*. When these qualities are achieved people will listen.

The important question for the speaker is this: What kind of material are visible, easily understandable?

In an effort to find an answer, a series of experiments were conducted in which listeners were presented with a dozen different kinds of speech material. The audience in each case reported as to the visibility of each of the kinds, placing them in rank order, from that which was immediately understandable to that which was not. From the results which were fairly uniform, it was possible to construct a "visibility scale" in which each type of material was rated.

The Visibility Scale

1. In every situation where explanation was necessary it was found that highest visibility was achieved when the listeners were shown a working model, or an actual demonstration of the idea. They were able actually to see what was meant. Thus, if one were to point out that a workman was using a tool badly, far better than telling him how he should use it would be an actual demonstration of the correct method by the speaker.

2. Moving and still pictures were uniformly reported in second place. However, the pictures must show clearly the point to be made, and they must be handled so that those in the back of the room can see them. We found that the speakers had a tendency to hold posters off to one side, rather than in front of them and high in the air.

3. Charts, graphs and diagrams when they were good ones got across the ideas intended. Sometimes, however, they needed so much clarification themselves that the point was lost in the process. Further, it was found that there should be no more than one idea on each. More tended towards confusion.

4. Up to this point in the scale objects played an important role. But it often happens that they are not available. The next best for purposes of visibility is the use of the hands and body for description. Go back to the section on gestures for a discussion of how they help to communicate meanings. In one of the experiments, the graphic description using the hands alone to describe an automobile collision was given first place.

5. But opportunities for manual depiction do not occur too frequently

so we are forced to achieve visibility through the use of words. Our findings indicate that a humorous story which makes the point you are after, has high visibility rating. Note that we are not saying that humorous stories should be dragged in to divert the audience, but rather that a well-chosen one can get them to see your argument.

6. Examples, incidents and illustrations were rated high in almost every instance. Besides making for quick understanding, they tend to be interesting because of their narrative form. One of the most famous of American lectures, "Acres of Diamonds," by Russell Conwell was given over 6,000 times. Some audiences were said to have heard it a half dozen times. Read it through sometime and you will see why. Every point in the whole speech is made visible by means of an example or illustration.

7. The use of comparisons is just below the use of examples in the scale. These involve the attempt to explain how the thing you are talking about is like or similar to something else. Often if your idea is a new one, or one with which they are not too familiar, we have found that connecting it with an idea with which they are familiar helps considerably in achieving visibility. In making comparisons this formula may be useful: "The thing I am talking about is just like. . ."

8. We are getting down the scale. The further we go the less clearly understood is the material. At this point comes the slogan or battle-cry which packs much meaning in a few words. Writers on safety have evolved a number of good ones. "Stop, Look and Listen," "Save a Life," "Do a day's work, but don't burst a blood vessel doing it," "There's no armistice on Old Man Accident—Let's keep him out of our plant."

9. The use of quotations either from the Bible, poetry, well-known sayings, the great writers or from popular literature.

In this connection we must mention the use of the testimony of authorities. In the field of safety there are individuals whose names and achievements are respected. Their writings usually represent the best thought on the subject. You should have access to their writings. And even though testimony was ranked rather far down the scale, yet we found that it had high persuasive value. People believed what trained thinkers had said. It was used effectively often as a final bit of ammunition to clinch rather than make clear your point. We conclude that it should be used whenever there may be doubt as to the soundness of your argument.

10. Almost at the bottom of the scale in terms of their visibility value are figures and statistics. Only on rare occasions did listeners get and remember them. More about them in the next section.

11. The bottom rank in the scale might be called "wind." We are thinking here of straight talking, of long-winded abstractions, of direct explanations, of the listing of details, of a general outpouring of words. "Wind" is something which goes out to an audience, but affects it very little. They do not see "wind," they just hear it.

In a general way the scale includes almost every type of subject matter known. How it should be used is now the problem.

Experience demonstrates that a speech with fifty per cent of its time in between items 1 and 7 will be a speech with little waning of attention. And if the visibility score can be raised to seventy-five per cent, that is, if 3 out of every 4 minutes of speaking time is taken with the use of concrete objects, examples, comparisons, etc., the audience is certain to give close attention. But if the content tends to be localized around 9, 10 and 11, with

little besides some figures and a goodly quantity of assertions and simple statements, inattentiveness and restlessness will not be an unusual result. Indeed, we should expect it.

How to Use Statistics

Very few Safety speeches are given which do not at some point involve either directly or indirectly the use of facts and figures. And unless speakers are careful, listeners are apt to leave without getting or remembering them.

Numbers are peculiar things. Words have meanings and definitions. Numbers have neither. If someone says a word you do not understand, you can go to a dictionary to find out. But suppose someone says "36,000 people were killed by automobiles in 1935," can you describe how many that is? Try it. How many is 36,000?

A number as such is an abstraction, merely standing for something else. All of which should explain why statistics have such a low rating in the visibility scale. As an abstraction, it is almost impossible to see what one means.

Nevertheless, it is possible to use figures effectively. We have found a useful formula. Whenever it is necessary to use figures, the significance of which you want an audience to get, make them equal to something else. Describe the number in terms of other things. Notice that the moment you describe something in terms of something else, you move up the scale to item 7, which in terms of visibility is a long distance from item 10.

For example, 36,000 is equal to the number that often see a World Series or a Football game. Or it may equal the population of a city or half a dozen towns. Or to show it in terms of other numbers; if you were to start counting 1, 2, 3, 4, . . . one count each second, twelve hours from now you would be still counting. Or if the bodies of the dead were stretched out, they should cover some 40 miles. With the aid of the "equal to" formula, we begin to see how many the number represents.

With some ingenuity the presentation of figures can become an interesting phase of the speech. But always you will find that the effort expended on translating them from the abstract to the concrete pays in terms of increased audience attention.

Secondly, we have observed that it is easier to listen to a round number than to one which gives every digit. For example, \$1,000,000 is more understandable than "\$1,006,235."

In the third place, it is wise to state the figures in percentages. Instead of saying that the accident rate was up by 99 as over against 62 last year, simply indicate that the rate was up by 50 per cent. There is immediately an economy in the total use of numbers.

This last observation leads to the final caution in the use of statistics—USE THEM SPARINGLY. From what has been said it should be clear that statistics are an instrument, a means of making a point. They should not be used as ends in themselves. How often have Safety speakers fatigued their listeners with long accounts and intricate figuring little of which was remembered for an instant!

Mention should be made here of a significant contribution to the business of statistical presentation in the use of pictures and symbols. Rudolph Modley is the author of a book called *How to Use Pictorial Statistics*,

published by Harper and Brothers, which shows how figures can be presented by means of symbolic representations of men, ships, automobiles, etc. He describes the rules that must be followed in the use of "picture statistics" and in addition shows the kinds of facts that cannot be made clear by this method.

For the individual whose work forces him to speak frequently, this book or the publications of Pictorial Statistics, Inc. (of which Modley is executive director) should suggest an invaluable technique of stating facts which will be intelligible to the "man on the street."

How to Get the Humorous Story Over

Do you remember the time you heard a man tell what you thought was a good story? And you went home and repeated the story, and nobody thought it was funny? And you could not figure it out.

What was the trouble?

You told the same story, but you didn't tell it the same way.

Humor is the result not of *what* you say, half as much as *how* you say it. Your story didn't get over because something was wrong with your delivery.

The psychologists have a dozen theories as to why we laugh at certain things rather than at others. But the public speaker has to know only one set of facts.

If a story is to be funny then the manner of the speaker must be in fun. He must tell the story in a spirit of fun. There can be no humor unless the speaker feels and acts in that spirit.

See the funny situation in the back of your mind. Think about the thing that made you laugh when you first heard the story. Chuckle at it inwardly. And in this mood tell the story.

All fun involves playfulness. The moment the speaker forgets to be playful he becomes serious. And when he becomes serious humor disappears and his stories fall flat.

Thus when you tell a story, tell it as though you really were in fun, and not as though the fate of the nation depended on your getting it over.

For most people the business of living is a serious matter. There isn't much time to practice lightness and playfulness during working hours. But if you want to make people laugh, you have to practice playfulness. To be funny you have to learn to be in fun.

Beginning the Speech

The introduction of a speech is very much like powder and lipstick to a woman—not absolutely necessary, but helpful.

The first words set the tone of the speech. Begin well and you can coast along. Begin weakly and you must overcome an obstacle built of bad impressions.

In general we should agree with Aristotle that "an introduction is a beginning that paves the way for what follows." Actually, the introduction is not an integral part of the speech. Rather it is a kind of appendage by means of which one can move smoothly into his main ideas. However, if an introduction makes possible this movement it will be found to do something else, namely, capture the attention of the audience.

Even though the introduction be recognized as something "tacked on" to the body of the speech, the speaker is advised to think about it carefully.

We all know that once we are started things are all right. The problem is how to avoid those empty, harrowing moments when so little is really said, and to get started with force and purpose.

The following methods of beginning a speech should be found helpful.

1. *The story opening.* Here the speaker makes use of an example or narrative which illustrates the point to be developed in the speech. This opening story should not be too long, and above all it must be relevant, must lead to the argument.

2. *The personal experience.* An excellent way of getting started because it often breaks down restraints. Simply describe a situation in which you were involved or which you witnessed, which of course has something to do with the ideas to be discussed. Start off unhesitatingly by saying, "I want to tell you of an incident that happened to me. . . ."

3. *Bringing it home immediately.* Begin the speech by showing your audience how the subject you are to talk about affects them. In short, tell them *why* you are giving the speech to them. Be as specific as you can in demonstrating how each man is involved personally. Thus, if you are to talk of certain kinds of accidents in the plant, bring the audience into the picture right off, by explaining how they may be affected.

4. *Use of a quotation.* Plan to read or quote from memory something said by someone in the field that you are to talk about. Often a piece of poetry, or well-known saying allows you to move easily into the speech by pointing out the meaning of the quotation and its application to the present situation. If you read the quote, hold the paper or book up almost to the level of your chin, so that when you read from it you can look out at the audience, thus achieving contact at the same time.

5. *The question opening.* Let your first words frame a question or a series of questions, which will be answered by you in the course of the speech. This is one of the easiest methods because it permits of simple development from question to answer. Ask your questions directly as though expecting an answer from the audience. A brief pause should follow each. After experimenting with this type of beginning you will see that it tends to get the audience thinking along with you.

6. *Believe-it-or-not-technique.* This method involves the statement of a fact or series of facts which at the moment sound unbelievable. Notice how well this opening is designed to catch the attention. It will take a bit of research to find the material for this type, but the effect is well worth the effort. It is relatively simple to deliver, because you have merely to state your facts in declarative fashion. It is well to pause for a moment after their statement to let the force of their uniqueness sink in.

7. *A brief arresting sentence.* Here we have an opening that is short but effective. An interesting essay on "The Safe Worker" begins thus: "John Henry was a showoff and it killed him." And another on the same topic, "A woodpecker uses his head when he works, but you can't say as much for some of the rest of us."

8. *Graphic physical description.* Essentially this amounts to a narrative which is given with gestures. Accidents, collisions, etc. can almost always be described thus. Or you may begin by an actual demonstration of something you are to talk about. A talk about Safety in the Home might well begin by a concrete actual description of the right and wrong ways to reach for objects on the top shelf.

9. *Physical activity on the part of the audience.* Recently a speaker

before a high school audience began thus: "How many of you here ride bicycles? Will you please raise your hands?" The moment they put their hands up he had both their attention and interest in the development of the speech. Very often, especially if the group is not too large, it is possible to open by asking for information, or by asking certain individuals questions. Obviously here you achieve cooperation while paving the way for your own discussion.

The speaker should be aware that this method requires *response* from the audience. The situation may be faintly embarrassing if you ask them to do something without their doing it. However, if you are direct and positive in your request, without making it too difficult there need be no fears.

10. *Statement of purpose.* This method while not as spectacular as some of the above will be found useful where time is limited. It allows you to "plunge right in" to the speech. Thus, you begin by saying, "My purpose in talking to you today is to tell you why our accident curve is rising, and what we can do about it." The method will also be found useful, where the purpose of the speech is primarily informative. Avoid plunging in when you are interested in getting them to think about or do something about a specific problem.

We close this section by repeating that thought should be given to the choice of openings. After some practice in devising them you will recognize the possibility of using two or three in combination. For example, the "believe-it-or-not" opening merges well with the "personal experience" and "bringing it home" types. A little experimenting will prove both the possibilities and the productiveness of the above list.

Caution:

1. Do not high-light the introduction at the expense of the body of the speech. Remember it is only an appendage.
2. Never begin speaking by apologizing either for your lack of preparation or for your inadequacy. Too often such apologies smack of insincerity, or else they are downright lies. Besides if it is absolutely necessary for you to apologize, you should not be up there speaking; your place is in the audience. And even if you do know your speech, so that you do a good job, the initial impression is likely to linger.*

Ending the Speech

Our experience with Safety Speaking makes clear certain defects with respect to the conclusion of the speech.

1. Often speakers just run down, leaving things dangling in the air.
2. Too often they close on a note of weakness, without punch.
3. Worst of all, many do not stop when they should. Having come to what is a logical stopping-place, they go on to repeat their final ideas in slightly different language.

The good speech ends by rounding out the idea and in one last effort attempting to make the point of the argument. In other words the conclusion has a significant function. It provides a last opportunity to drive your idea home. This opportunity should never be lost, because there is some reason to believe that what an audience hears last it remembers longest. Safety speakers must learn to take advantage of this fact.

*For the best treatment in the whole of speech literature of techniques and methods of beginning and ending the speech, the reader is urged to study chapters 16 and 19 of *Basic Principles of Speech*, by Lew Savitt and W. T. Foster, (Houghton Mifflin, 1938).

Our major concern then, is to describe ways and means by which this may be accomplished. The methods follow.

1. *Summary.* Merely restate, if possible, in different language the main points covered in the speech. Enumerate them in roughly the order that they were given in the development of the speech. Do not do this mechanically as a kind of necessary chore. But realize that an enumeration of the points will briefly refresh for them what they had already heard, thus making for emphasis.

2. *Suggestion of specific action.* Frequently the safety speech suggests new kinds of behavior, new ways of doing things. Take advantage of this fact by leaving for the end of the speech your concrete proposals. Your last words should urge them to do what you have said they should.

3. *Quotation.* Just as in the beginning, it is possible to use the statement of an authority to give weight to your own argument. The quote provides an effective closing especially because it rounds out the development of the idea. When you read a quote, emphasize it, otherwise its force will be lost.

4. *An offer of service.* Certain speeches are liberal with advice and instruction, which often suggests that they may be followed up by further demonstration or discussion. Do not hesitate to mention that you are available for this additional help. Welcome their visits.

5. *The slogan.* This was described as item 8 in the visibility scale. It is frequently used as an effective closing device, because it usually has in it the heart of your discussion. The great difficulty, of course, is to find slogans which haven't been worn thin by overuse. But even if you can't find them, a sharply worded sentence will do as well.

6. *The story that "echoes" the speech.* This is one of the best ways of closing known, because it performs all of the functions in one. It consists of a story or example which in and of itself suggests the gist of the whole speech. A good "echo" story retells in the closing moments all that has gone before. Suppose you had to give a speech to a group of workmen on "The Showoff" which you had to end with this method. Here is a rather good example.

"John Henry was a showoff and it killed him. Workers all over the country tell tales about him that make your eyes bug out.

John could pick up a length of rail, turn around, and put it back in place—alone. He'd swing a 10-pound sledge in each hand and play a tattoo on a steel drill that would sink it faster than any machine. He swore no machine would ever take his place.

Once they arranged a drilling contest between John and a steam drilling machine. At the end of thirty-five minutes John had sunk two holes, each seven feet deep while the steam drill had put down only one hole, nine feet deep.

John proudly took the \$100 prize and went home. But after supper he complained of a pain in the head. The next morning they found him dead. The exertion had caused a blood vessel in his brain to burst.

Had John been sensible as well as strong, he'd still be drawing pay. A mere man can do no more than a man's work, and when you try to do more, you are just asking for strained muscles, sore backs, ruptures, torn ligaments."

7. *Bringing the point home.* Just as it is possible to begin by showing

1. National Safety Council, "The Safe Worker," Vol. 10, No. 11, pp. 7-8.

how your ideas affect them as individuals, so can one close by making explicit how each of them is involved in what you have said. Show specifically how the health, income and morale of the audience is either endangered or disturbed. This, as no other kind of ending, can drive the point home. But beware of overshooting the mark. Keep this one brief.

8. *Visualization.* At the close of many talks it is possible to paint a picture of what things would be like if only they would do or think as you want them to. The only difficulty of this conclusion is that it lends itself to fantasy and exaggeration. But that is not to say that when done simply and honestly it is not effective. Good visualization sets up a goal toward which an audience can strive.

9. *Ending on a question.* "Isn't it about time we did something about this problem?" "How much longer must this state of affairs continue?" "Isn't it possible to do something right now?"

10. *The Challenge.* Here the speaker dares them to take the new line of action, by setting up a goal which they seem hesitant about reaching. He distinctly challenges them as individuals to leave the situation as it is. He raises the question of their adequacy in meeting the problem.

There is dynamite in this ending. And it can't be done by weaklings. The speaker himself must demonstrate the courage which he is indirectly asking for.

Testing Your Speech

This chapter suggests several tests which should be applied to every finished speech to test its effectiveness. If you can answer each of the following questions in the affirmative your speech should be a good one, that is, on paper.

Is the speech limited to one big point?

Does it have a definite purpose?

Is at least fifty per cent of the material within items one and seven on the Visibility Scale?

Are statistics used sparingly and translated into something concrete as frequently as possible?

Does the speech have an introduction which leads into the body of the argument?

Have you rounded off the speech with at least one of the methods of concluding?

CHAPTER IV

PLANS AND BLUEPRINTS FOR THE ORGANIZATION OF THE SPEECH

About 400 B.C. a teacher named Corax recognized that in the courts some speeches were better than others because they were more skillfully organized. So that in his book, the first on public speaking known to have

been written, he devotes considerable attention to the problem of developing a plan by means of which the speech might be clearly ordered. That is our concern in this chapter.

There is a fundamental rule in organizing the material of the speech which might be stated in this way: Instead of thinking about the material of the speech as a whole, block out the material in units. The pattern of these units will then make up the speech. To explain the rule we shall present a number of plans in which we indicate the content of each of the units. Each plan suggests in miniature the organization of the speech. Think of the plans as the framework into which your content goes.

1. *The One-Point Plan.* Note that this pattern makes possible the demonstration of the Principle of Limitation. Though the simplest plan we know, it is by no means the least effective.

Unit 1. State the point you want to get over to the audience. Analyze it as simply and clearly as possible.

Unit 2. Explain or prove the point by means of facts, figures, examples or testimony. This is the meat of the speech. Keep the visibility high.

Unit 3. Restate the original point that you were to make.

2. *The Constructive Criticism Plan.* It has been suggested that this formula grew out of the method used by the old Medicine Show Man. His plan of attack was to describe a host of aches and pains, after which he drew out the magic bottle whose praises he sang long and loudly. His next step was to urge you not to crowd but to move up and buy one of the few bottles left.

Unit 1. Open the argument by pointing out an evil, or set of abuses, or some badly working situation which you are interested in correcting. Be sure that your listeners understand the thing you are arguing against.

Unit 2. Suggest a remedy or solution which will correct or cure the evil. Be as detailed at this stage as you choose.

Unit 3. End the speech by appealing to them to join you in action on your proposal.

This pattern of development provides an excellent opportunity for the demonstration of variety in delivery. The first unit being explanatory and descriptive can be given in a direct, conversational manner. The second unit should permit you to step-up the energy level of your talking. The end suggests in its appeal the possibility of power and drive with abundant bodily action.

3. *The Simple Motivation Plan.* In this pattern we are interested in getting action on some proposal. The effort is to get more than assent to what we say by means of a direct argumentative plan.

Unit 1. Explain clearly to your listeners what you want them to do. There should be no doubt at all in their minds when this unit is complete.

Unit 2. This is the motivational step. Tell them why you want them to pursue some line of action. If possible indicate where and how they are involved, and how they will be affected by the proposal. In short, here is the opportunity to bring the subject home, by tying it up with their interests.

Unit 3. Tell them how to do what you suggest. Incidentally, this is where many teachers and foremen fail to do a good job of instruct-

ing. They are not sufficiently definite in their instructions. If shopmen, or students are at all confused or uncertain of the directions given them, the results will show in the job they do. The speaker must realize that there is an important difference between this and the first unit. Knowing *what* to do does not at all imply that an individual will know *how* to do it. Therefore this unit should receive careful attention.

Unit 4. Urge them to go out and do what you have told them. This is clearly an appeal for action on your original suggestion.

4. *The Logical Plan.* The name of this plan is most apt because the order is that which most closely parallels the argumentative form. This plan will be found to be especially helpful if the speech is to be given to a critical audience.

Unit 1. Start out by showing that there is a *need* for some specific line of action, or that some proposal must be acted upon because of the necessities of the situation.

Unit 2. Show how *desirable and valuable* the action or proposal will be for them. Or the desirability may be reckoned in terms of social usefulness.

Unit 3. Make clear that the idea is *practical*, that it has worked elsewhere. Give examples of that workability. Indicate that the idea can be put into effect, conditions being what they are. This is the step which should appeal to their common-sense.

Unit 4. Appeal to them to take action, or give consideration to the merits of the idea.

5. *The Plan that grows out of an Example.* Safety speakers should find this formula one of the most useful because of its high persuasive value. In addition it contains almost all of the necessary factors to induce limitation and visibility.

Unit 1. Open the speech by telling a story or citing an example which has in it the basic idea or situation you are to talk about. Care should be taken to see that the example does contain the nub-idea of the speech.

Unit 2. Explain that the situation represented in the example is a typical one, which occurs frequently. Thus, if the talk dealt with drunken driving, after telling of the accident caused by John Jones because he did not see a car coming around the corner, it is an easy task to indicate that drunkenness in general leads to results just such as you have described.

Unit 3. State the problem that must be faced, and show *very briefly* how the audience is affected by the situation.

Unit 4. Suggest a solution or corrective of the situation.

Unit 5. End the talk with a reference back to the example of the opening. Then appeal to them to take note of the situation, or to take steps to adopt your suggested solution to the problem.

6. *The Short Speech.* Quite frequently a speaker is asked to say "a few words" about Safety. Or he may be called upon unexpectedly with little time for preparation. In such a situation there is little opportunity for either thinking or research. What is needed is a serviceable formula which can be quickly put together. After some searching and testing the following has been found of help in this particular speech situation.

First, decide on a single idea that you will talk about. It makes no difference for practical purposes what the idea is, but it must be specifically stated in your mind and limited in scope.

Secondly, develop the speech by opening with a *single example* of the point you are to make.

Third, talk about the idea which has grown out of the example. Here you make the point of the speech.

Fourth, end the speech with a single sentence forcefully stated, or with a slogan in which the main idea stands out clearly.

Such a speech can be given in most effective fashion in from three to five minutes.

A fair example of this plan of attack can be seen in the following, taken from the National Safety Council publication called "The Safe Worker."

"A man in South Dakota owns a horse, or at least he was pretty sure he did.

The mare disappeared when she was about a year old. The other day the owner thought he saw it in another fellow's pasture. There was a little disagreement between the two about ownership and the original owner took the matter to court.

"Your honor," he told the judge, "that mare belongs to me and I can prove it . . . there's a dime a little south and to one side of her tail."

So a veterinarian performed an operation on the right hind thigh of the horse and extracted a 1920 dime, placed there by the plaintiff, who led his mare back home.

(One point discussion)

There's no need to argue why the owner put the dime in his mare's hind leg, but the story proves the value of identifying things properly.

For instance, all exits should be marked. All power switches and electrical equipment should bear warning signs. Wherever a sign or some distinctive marking will help to point to danger spots around machinery or call attention to other hazards, one should be erected.

(One sentence ending)

Help your foreman and safety supervisors by calling attention to any hazardous conditions you believe should be labeled."

Only general advice can be given on the use to which these plans may be put. In a rough way we have found the following suggestive.

Plan 1 should be used when your purpose is to have your listeners understand why a particular rule exists, or why certain things should be done in certain ways. Essentially you are interested in having them agree with you.

Plan 2 finds its best use whenever you are concerned with the correction of some situation which has not been functioning properly. When something has gone wrong, this is the best formula.

Plan 3 lends itself to those occasions when action is needed. Whenever a foreman finds it necessary to get something done, this is the appropriate formula. Careful attention must be paid to Units 2 and 3 for best results.

Plan 4 as suggested in the description of its organization lends itself especially well in the conference room or around a conference table where matters of policy are being treated. Whenever the problem is one whose influence may be widespread, intensive consideration to the problem can be given by means of the first three units.

Plan 5 can be used in general educational work more effectively than any of the above plans. The device of the example followed by a generalization makes for visibility almost from the start. Such a speech can be given to practically any kind of audience from high school to luncheon club, on practically any phase of safety education.

A Word About Material

It is one thing to devise plans and blueprints for the organization of the speech, it is quite another thing, however, to have material to go into the plans readily at hand when needed.

As we have suggested every speech should be the development of at least one idea. So far as we know ideas can only be developed through the use of facts, figures, stories, examples, testimony of authorities and arguments in the form of statements.

Where are these materials coming from? There can only be two sources, your personal experiences and your reading. You can draw on your experiences for only limited information and only for a short time. The fund of personal observations soon gives out. But on the writings of others you can draw forever.

It is easy to read articles on your subject. But that isn't enough, there must be a way to keep those facts and illustrations so that when needed they can be obtained immediately. If you have a "photographic memory" the material will stay with you. If you haven't you need a method of taking down and filing or keeping in order the items you may want to use.

The "Scrapbook Method" is one of the very best. Visit the dime-store and buy a scrapbook. Then, whenever you see material that seems useful in a magazine, newspaper, or a book, clip it out (if you're the owner) or copy it. Paste either the clipping or the copy in the scrapbook. It is advisable to divide the book into sections which may be marked Accidents, Figures, Stories, New Methods, Enforcement, etc.

The scrapbook kept trim and up-to-date can be one of the best sources of ready information the speaker can have.

Too many men rehash the same old stuff time and again. They put together one speech and call it quits. Every time they are heard out come the same figures and the same arguments. These men fail to keep up with what is happening. They cease growing.

No man who would keep audiences listening can afford to stop growing. Read and keep on reading if your speeches are to be full of interesting and valuable material. Don't let your background get thin and empty. Keep filling it.

There is another habit the speaker can well afford to acquire. You have probably noticed that ideas and hints for speeches come at odd moments during the day, while walking about, while talking with others. You are likely to hear stories, incidents which at the time seem useful. Then later when the material might be fitted into your speech, you find that it has slipped from memory.

There is one way to be sure that you can have the story ready at command. Get the notebook habit.

Buy yourself a small notebook, one that can be easily carried in a vest pocket. It should be no more than three inches long and two inches wide, otherwise it becomes cumbersome. Then, whenever you come across

likely-looking material, jot it down. Every now and then glance through the book. You will be surprised at the amount of data that can be gathered in this casual way.

CHAPTER V

BAD HABITS AND THEIR REMOVAL

You have undoubtedly listened to a speaker whose speech was spoiled because you were more interested in certain mannerisms and reactions of his that distracted your attention away from the speech. Sometimes the speaker knows of his habits, but more often he is entirely unaware of what he is doing. Absorbed in his speech-making he becomes utterly oblivious that he may be disturbing his audience by something that in itself is trivial.

However, any study of listeners' reactions will reveal quite clearly that they notice the extraneous behavior of the speaker. Of course, the evil is worthy of our attention, because if listeners notice other things, they tend not to get what is being said.

Perhaps seventy-five per cent of the amateur speakers have two general classes of bad habits. They are,

First, what we may call "sounds without words," a peculiar meaningless noise which can become most irritating. They include "er, ah, ch, aw, and uh, mmm, etc."

Second, certain random physical movements which are clearly purposeless and which detract rather than add to the effectiveness of the speaking. Some of the commonest include, twisting or playing with the fingers, smoothing the hair, pulling the ear, rubbing the nose or forehead, buttoning and unbuttoning the coat, drumming on the table, jingling coins in the pockets, playing with a watchchain, rising and falling on the toes, shifting the weight from side to side, or forward and back, nervous prowling back and forth.

It should be clear that if you have either of these kinds of bad habits, steps should be taken to eliminate them. A rather simple program has been found for the removal of the "sounds without words." It is equally applicable to the random movements.

First, note yourself that you make the "sounds" during normal conversation.

Second, make the decision to stop them. Simply determine that you will be rid of the things.

Third, whenever you feel one of them coming on—stop. Say nothing. Allow no sound to escape from your lips. Omit the sound entirely.

Fourth, enlist the cooperation of those around you in the effort to notice when you commit the fault. For example, have someone you know raise a hand whenever he hears a "sound." Persistent notice of the error can bring about its elimination in a week or two.

Some Final Advice

1. Avoid stimulants before you get up to speak. Speakers are usually sufficiently excited anyway. Besides the secondary effect of most stimulants is to induce a depressant condition.
2. Do not drink too much ice-water. Perspiration tends to be increased as a result.
3. Wear comfortable clothing. If you can speak without a vest, so much the better. You must be free and relaxed.
4. Fatigue is one of the speaker's worst enemies. If you are tired, you will be unable to pack the punch necessary. You should be physically fresh for each speech occasion.
5. Eat sparingly before the speech. However, do not get up without having had anything. After all one does need nourishment.
6. Remember to take that deep breath before you start speaking. Also get up slowly, they'll wait.
7. Never make the mistake of talking "down" to an audience, whether it is composed of high school students or workmen. Talk simply and honestly on all occasions. Indeed, it is better to talk "up," assuming that they are informed and capable of understanding.
8. Avoid by all means the "god complex," that insufferable tone of superiority, as though only you counted in the world. Dignity has its place, but it is not on the platform. "Be yourself."
9. Remember that audiences are composed of normal human beings. And normal people are pretty much kind and sympathetic. Watch sometimes how people react in times of difficulty. Audiences know that speaking is not an easy task, that it requires work and energy, and instead of being out "to get" the speaker, they are more likely to be pulling for him, congratulatory when the job was a good one, sympathetic when it has been flubbed.
10. If you are to talk about Safety, you have to feel that giving speeches that may save lives is important. And above all, no matter how important the subject, you have to know it. You will have had to do some work in putting the outline together and learning it. Speeches are always the product of perspiration, not of inspiration.

A LIST OF BOOKS ON PUBLIC SPEAKING

Sarett, Lew, and Foster, W. T., *Basic Principles of Speech*. Boston: Houghton Mifflin Co., 1936.

By all odds the best book in the field. The Safety man is advised to read this book carefully. Chapter 3 gives the best advice for the control of stagefright in the literature.

Monroe, Alan H., *Principles and Types of Speech*. New York: Scott, Foresman and Co., 1935.

Very readable. Chapters 3 and 4 are concerned with the analysis of the occasion and the audience. Good material on the various types of speeches. See especially ch. 14.

Brigance, W. N., *Speech Composition*. New York: F. S. Crofts and Co., 1937.

Good treatment of the problem of style and the content of the speech. The chapter on "The Psychology of Gaining Acceptance" will be useful for the Safety man.

Sandford, W. P., and Yaeger, W. H., *Principles of Effective Speaking*. Third Edition. New York: Thomas Nelson and Sons, 1934.

Interesting material on "The Elements of Interestingness." The discussion of the "vital" and the "familiar" is good.

Gislason, H. B., *The Art of Effective Speaking*. Boston: D. C. Heath and Company, 1934.

A good book. The treatment of the Content of the speech and of the various purposes as they may be developed will be found productive.

Dolman, John, Jr., *A Handbook of Public Speaking*, Revised Edition. New York: Harcourt Brace and Co., 1934.

A small, readable book which covers a lot of ground. There is a chapter on Persuasion and another on Humor.

Borden, R. C., *Public Speaking, As Listeners Like It*. New York: Harper and Brothers, 1935.

Written in a breezy style, this small book has a good deal of very practical advice, including an interesting "plan" for the short speech.

Winans, James A., *Public Speaking*. Revised Edition. New York: D Appleton-Century Co., 1917.

This is one of the "classics" in the field. The Safety man should go to this book for further information on the techniques of persuasion and audience analysis.

Phillips, Arthur Edward, *Effective Speaking*. Chicago: The Newton Co., 1908.

Another "classic" whose emphasis is on the content of the speech.

Woolbert, Charles Henry, *Fundamentals of Speech*. Third Edition, Revised by Smith, Joseph, F. New York: Harper and Brothers, 1934.

The best statement of bodily action and its value in chapters 3 and 4, in the "classic" tradition.

This list is organized in the order in which they will be most useful for the man interested in Safety. The books at the top of the list are in general "all-round" books good on a number of the elements of speech. The books at the bottom of the list tend to have only restricted usefulness, though this is not to say that they should not be read by men who are interested in learning the best that is thought and written on the business of public speaking.

Maintaining Interest in Safety

WEDNESDAY MORNING SESSION

October 13, 1937

Methods of propagating and sustaining interest in a safety program were discussed in a session on "Maintaining Interest in Safety," held Wednesday morning.

C. B. Boulet, Personal Director, Wisconsin Public Service Corporation, Milwaukee, Wis., presided.

Panel participants included Ernest W. Beck, Superintendent of Safety, U. S. Rubber Products, Inc., New York City; Gordon C. Huth, Assistant Manager Industrial Relations, Universal Atlas Cement Company, Chicago; K. C. Loomis, Manager, Running Board Division, Ohio Rubber Co., Willoughby, Ohio; F. R. McLean, Safety and Insurance Department, White Star Division, Socony-Vacuum Oil Co., Detroit, Mich.; C. N. Rakestraw, Secretary, General Safety Committee, Cleveland Electric Illuminating Company, Cleveland, Ohio; and William Weir, Director of Safety, Carnegie-Illinois Steel Co., Gary, Ind.

CHAIRMAN BOULET: If you have been in safety work very long, you know that the frequency curve is dependent about ninety per cent on the interest curve. That is why I think this Maintaining Interest in Safety session is important.

If we can find the answers to the questions of why interest is likely to drop and what to do about it when it does drop, we are going to really get something out of this meeting.

We are going to tackle this problem very much as a doctor handles a patient. First he diagnoses the case, takes the patient's temperature, takes his pulse, looks at his tongue, and does all of the other things that a good doctor should do.

After that he tries to find the cure for whatever the patient has; but before he can find the cure he has to know what is wrong, and after he has done that and the patient gets over the disease, he tries to give him a tonic to build him up, to put him back where he formerly was.

That is exactly what we are going to try to do here. First we are going to try to find why this safety work slumps every so often.

We ask: What are the symptoms—not the causes. How do you know that safety or interest in safety is falling away, that it isn't up 100 per cent? What are the symptoms of lack of interest on the part of management,

on the part of the safety department, on the part of supervisors, on the part of men? How can you tell, if you are the safety man, whether management is losing interest? How can you tell, if you are the manager, whether the safety man isn't just drifting along? How do you know, if you are the accident supervisor, whether the operating or production supervisors are or are not interested in safety?

How can you tell? That is important, because if you can tell early enough you are going to keep that frequency curve down. If you wait until the frequency curve goes up, then you have let the disease get a start, and your problem is a lot worse.

How do you know whether the president of the company or the vice president of the company is still as interested as he was when he said, "Yes, we will spend \$25,000 for safety"? Is there any sign by which you know?

MEMBER: I believe when they put off a meeting for a month.

CHAIRMAN BOULET: All right, when they postpone meetings. It may be the fault of the president or the fault of the supervisor, but that is one answer, when they start to postpone meetings. Is there any other?

MEMBER: The first time they turn you down on an appropriation for doing the work.

CHAIRMAN BOULET: When they say, "We can't spend any more." Another one is when they start to pinch the old money-bag and say, "No, we are not going to spend it." That in itself is lack of interest or falling off of interest.

MEMBER: When the officials fail to attend the meeting.

CHAIRMAN BOULET: I am glad to get that one. When the officials fail to attend the meetings; when they say, "Let somebody else do it."

MEMBER: When they don't follow through on safety suggestions.

MEMBER: When you mention something to the higher officials and they say, "We will see about that a little while later."

CHAIRMAN BOULET: A passive attitude toward safety. We have had five or six good indications of how you can tell whether there is a dropping off of interest in accident prevention. Do all of those causes apply equally to the safety man, the supervisor, the men and the management? Let's think a minute. What about the safety man? How do you know, when you analyze yourself, that you are still interested in safety? What are some of the indications?

MEMBER: Working at the job.

CHAIRMAN BOULET: You mean the fellow just doesn't work any more? That is a good answer, when he starts playing too much golf or starts to give his interest to other things. Any other indication on the part of the safety men?

MEMBER: When he becomes complacent in his job, thinks his record is o. k., and stands on that record.

CHAIRMAN BOULET: When he thinks he has made a record, he has won a National Safety trophy, and says, "Boy, we are good!" And he sits back and thinks he is the best safety man in the country.

MEMBER: Just the reverse of that, when he says, "What's the use?"

CHAIRMAN BOULET: I like that because I have had that experience, frankly. When a fatal accident report comes in, you say, "Oh, hell, what's the use?"

MEMBER: When the work becomes a drudgery.

MEMBER: When he fails to develop new ideas.

CHAIRMAN BOULET: When he coasts along

on the old ones, in other words. That is a good one.

MEMBER: When he starts to be an errand boy for the superintendent.

CHAIRMAN BOULET: What about the men? How can you tell when the men are losing interest?

MEMBER: When your accident record goes up.

CHAIRMAN BOULET: I am not so sure that is right, because I want to find out an unsafe attitude or a lack of interest before the record goes up.

MEMBER: The number of items on your safety list.

CHAIRMAN BOULET: The number of items on the safety minutes; in other words, the cooperation the men are giving. If they sit back and say nothing, you can say, "I am slipping somewhere."

MEMBER: When he fails to report injuries at the time they occur, after being instructed to do so.

MEMBER: By your attendance record, by the men not attending safety meetings.

CHAIRMAN BOULET: I will take that, but I wouldn't make it voluntary on the part of the men.

How many people here make attendance at safety meetings compulsory? Let's see the hands. (Majority.) I am going to ask another one. How many do not make it compulsory? Quite a number. How many who make it compulsory pay the men for the time they spend in the meeting? Let's see the hands. (Majority.) I am glad to see that. I think that is part of the answer. You can't make it compulsory unless you pay for the time. If you don't want to pay for the time, there is a lack of interest on the part of the management. I will take that one, the lack of attendance is a sign, but my guess is attendance ought to be made compulsory and you ought to pay for it.

MEMBER: What kind of meetings—mass meetings or safety committee meetings?

CHAIRMAN BOULET: Let someone else answer that.

MEMBER: Safety committee meetings.

MEMBER: Mass meetings.

MEMBER: Any meeting with safety aspects.

CHAIRMAN BOULET: I will take all of

those. I think meetings on safety ought to be paid for. There is some argument on that. In our own company we pay every man's time for every meeting he attends, and we have every man in at least one meeting every month.

MEMBER: That is within the plant?

CHAIRMAN BOULET: That is within the entire company. The meeting is held in the plant. I happen to work for a public utility. We have men on the line, digging mains, gas plants, and what-not. No matter where the meeting is held or when, we pay for the time. I am not saying you have to.

MEMBER: Are they held during working hours or at night.

CHAIRMAN BOULET: Generally during working hours, although on some of the shift crews it is necessary to hold the meeting after the shift because to hold it during the shift would shut the plant down.

In some places where one or two men can supervise the plant during the safety meeting, we excuse those men one month but not two months. I keep a record on my desk. If a man misses two meetings in succession, regardless of the excuse, I want to know why.

I write a letter to the superintendent of that plant and I give a copy to his big boss, and I ask why the man has been away. Unless it is sickness, there is another letter coming along that says, "If this man is not going to attend safety meetings, he had better get a job somewhere else. If you can't operate your plant to give these men a chance to attend safety meetings, you had better get some more men." There is only one answer. If you aren't willing to spend the money, there is no use trying to carry on your safety program. I don't mean to squander the money.

I am just going to tell you something that was said in this room yesterday, from this platform, by an old-timer in safety—Mr. C. B. Scott, former President of the National Safety Council.

He said this: "If I can bring any one thing to you, if I can give you any advice at all as to the one thing that is most helpful in a safety program, it is this: 'Personal contact.' That is the answer of your safety meeting."

We have covered this thing "hit and miss." But I think we have part of the diagnosis.

I am going to ask one of the experts on the platform here to clinch the matter.

F. R. McLEAN: I would just like to make one comment on the question of management's interest. We had five very excellent suggestions, such as postponing meetings, failing personally to show interest by attending those meetings, refusing appropriations, and so forth. I think there is one that even goes deeper than that to which we might give consideration.

Does your management let it go entirely in your own hands as safety men, or do they give you the benefit of their opinions and ideas? In other words, when you ask for an appropriation or for a meeting or for their participation in a meeting, do they say, "O. K." and give you just exactly what you want and no more, or can you count on that management to go over that program with you, look at that appropriation in detail and really give you the benefit of what they realize is their deep personal interest in it?

I think perhaps you can detect something from that; in other words, cooperation that is passive or cooperation that is deeply and personally interested.

CHAIRMAN BOULET: Now I am going to ask one of the experts to tackle one of the other phases—either the men or the supervisory force?

GORDON C. HIRTH: Management, in my opinion, is the whole thing. If the management doesn't come through properly, the scheme of accident prevention will very quickly collapse. Let's jump to the safety department. That is one of the other items on the list. It seems to me when the safety department becomes satisfied with the records and starts alibiing for the accidents that have occurred, and is discouraged by the management's attitude, if it is not correct, that is probably one of the bad symptoms of the disease in that department.

MEMBER: May I make one suggestion which I think a lot of us are interested in. I believe a lot of the delegates here look at safety from the standpoint of the small plant. We have heard the experts who are directors of a series of plants, and so on. But since the fundamentals of safety come right down to the man and the foreman, it would be well if we could have speakers talk from the smaller plant angle as well as that of the large corporation. Understand, I think it is

very nice to be able to have a large safety meeting and have a foreman spending so much time investigating a certain accident and certain minor injuries. But we know in our plants that the foreman has a certain duty to perform and cannot spend all of his time on that one duty to the detriment of others.

Would it be possible, in our discussion, to consider the man who has a small organization and who has to do the best he can with the facilities at his disposal?

CHAIRMAN BOULET: I think it is. First of all, if we are going to tackle the small plant, what do you mean by a small plant?

MEMBER: Anything from 500 down.

MEMBER: I work in a power plant where we have from 75 to 200 men, a large generating plant. I would like to know what the attitude of this group is toward general safety meetings, what they do at them.

We hold general safety meetings of the whole group, including operating and maintenance men—or we are supposed to hold them—six times a year.

At our last meeting, which has been put off for about three months on account of construction of a new unit of 150,000 kw., we tried something new to us, questions and answers. The superintendent, who was chairman of the meeting, had a number of questions. Here are two or three of them. "What would you do in case of fire? What does the siren in the cold mill room mean?" We have a number of new men who are breaking in and we want to get these ideas of safety across to them. "What would you do in case of severe burn? Severe injury?" These are some samples. We had some twelve or fifteen.

We would point out men in different parts of the room and say, "John" or "Pete" or "Bill, what would you do in case of this?" We held over from fifteen minutes to half an hour beyond the meeting because they were interested. That happened to be one of our most interesting meetings. I would like to know what some of you other fellows are doing to maintain interest. We pay our men, but it is voluntary on their part. We pay them overtime or time off.

CHAIRMAN BOULET: I am going to hold up that query of yours, because, after all, you are curing the patient before you have found out what was the matter with him.

You are getting to the next part of the program. It is all right to come in there, but I am going to hold up discussion of that a little bit longer.

MEMBER: I come from a different angle on this, as a representative of the state industrial department of the State of Minnesota. We have an educational program. We have taken it up with the larger plants. We have had very good success in arranging safety meetings from the broad standpoint—even more broadly than you. We take in the industrial end and the traffic end and the home accidents.

We do not get very much support from the smaller plants. I believe that our experience and our record should give us a chance to go in there and show how accidents happen. I would like your expression of opinion as to cooperation from that angle.

CHAIRMAN BOULET: I wonder if we are getting to the bottom of this thing on small plants. I want some fellow from a small plant to tell how he carries on in accident prevention work.

MEMBER: I have one plant of approximately 350 men, two blast furnaces. Those men are working twenty-four hours a day, three hundred and sixty-five days of the year, so we never have many men in the plant at one time. Some are operators, some are maintenance men. We hold every week a group meeting of all the foremen in that plant, with the superintendent as chairman, and a talk is made by a man who has been notified one week before that he will be the speaker. He chooses his own subject and prepares his talk, which must be written, so that that talk goes out to every foreman in that plant. During the coming week, from Wednesday to Wednesday, a meeting is held on every shift in every department by the assistant foreman or the man in charge at that time. That safety meeting is held. We check up on the entire roster of men to see that some time during the two weeks that man attends a safety meeting. In that way we reach every man in the plant some time during the week at a safety meeting.

A report is made on any questions or any suggestions presented at the meeting, and they are followed through by the superintendent.

MEMBER: Does a safety man attend those group meetings?

MEMBER: Not the group meetings out in

the plant, except upon request. Many of those meetings occur at night, as you can readily see. The night shift, the second shift, has to be taken care of also. The safety man attends, those meetings without request if that division happens to have an excessive number of non-lost-time accidents.

CHAIRMAN BOULET: Do you have a full-time safety man?

MEMBER: Yes, for the two plants.

CHAIRMAN BOULET: Does he have any other job besides safety?

MEMBER: He does all the employing and looks after the welfare.

MEMBER: I think we are drawing the line. Having had experience in the small plant and the large plant, I challenge any of these people to pick out a program and treat it as if their production were stepped up. It will work. It has been tried.

CHAIRMAN BOULET: Are you a small plant operator?

MEMBER: I have been both.

CHAIRMAN BOULET: That brings up this question: Are the problems in the small plant fundamentally different from the problems in the large plant, or isn't it just a matter of adapting the same methods to a smaller group?

WILLIAM WEIR: I don't care whether you are from a large plant or a small plant, there is only one acid test you can apply to any accident prevention program, and that is does your accident prevention program prevent accidents? If it does, it is adequate. If it does not, then you had better tear yourself and your program to pieces and see what is wrong.

CHAIRMAN BOULET: Somebody here said, "Did you forget the supervisor?" Frankly, I did. I am going to ask the fellow who said that to take the supervisor.

C. N. RAKESTRAW: The part of our industrial body that is more necessary to diagnose is the supervisor, and by that I mean the director, supervisor or the foreman.

You talk about the diagnosis or the symptoms of the men. They are almost directly reflected in a good many ways from your foreman. I heard of an incident in a meeting yesterday that I thought was one of the best I have ever heard. The speaker told about the analysis of an accident, in which a man had been painting a lamp bracket, working

from a ladder. The ladder collapsed, and he fell. The foreman said he had told that man time and time again he shouldn't use a ladder that way by putting the stepladder up against the wall instead of opening it up. He said, "I told him that time and again."

"Well," said this superintendent, "what color did you tell him to paint the lamp bracket?"

"Black."

"Suppose he had painted that lamp bracket green after you had told him to paint it black, and the next lamp bracket, after you told him to paint it black, he painted red, and the next one yellow. What would you do?"

"Oh, hell, I would fire him."

There is your answer. There is your diagnosis. There is the man to watch. You should watch your foreman, it seems to me. Is your foreman having the proper interest toward safety and, if not, can you tell from such instances as that where he is telling the man and then not following it up?

CHAIRMAN BOULET: We can probably emphasize that a little more from this angle: Is the foreman putting accident prevention work on the same basis as production? That is important. I think he emphasized that with his illustration.

Let's go on to the next question: How can the causes of lack of interest be found? You will say that is a funny question? We have just been discussing the things that are evident in this lack of interest. Now you say how can they be found? How are you going to tell from your own personal observation, or from reports or some other way, whether the supervisory force is letting down a little?

We had one illustration here. I want some more. How are you going to tell whether the men lack interest? What is your approach going to be, your method of examination or investigation, to discover these causes before they become glaringly apparent on the surface?

MEMBER: When your reports on unsafe acts start to reduce.

CHAIRMAN BOULET: He is going to be on the alert watching the reports on unsafe acts or unsafe conditions, I presume both. If there is a reduction so there aren't very many, he is going to say there is one symptom. There is something definite he is going

to watch for. He isn't going to wait until it becomes apparent. He is going to check and watch for it. Is there any other?

MEMBER: Reports on your minor accidents.

CHAIRMAN BOULET: I think probably we get twenty-five or fifty or maybe a hundred minor accident reports to every major. I know every once in a while someone says, "My gosh, look at this guy here, he has had five minor accidents." I say if we don't get these reports, I am getting worried. So long as we get them, everything is fine, because it shows an interest. It is usually the safest man who has all these scratches and barked knuckles.

MEMBER: What do you do with them when you get them?

CHAIRMAN BOULET: Not a darn thing. I will tell you why. If you start to pick on a man for minor injuries, you are going to get in trouble. I say "not a darn thing." Occasionally the description of the minor accident will very definitely indicate a potential condition for a major accident. We go after those. We don't jump all over the man, but we do make an investigation and check up to find out why that condition existed. We never risk a man for a minor accident.

MEMBER: You are overlooking a good bet.

CHAIRMAN BOULET: I will argue that with you.

MEMBER: In this respect: We have found that we are getting splendid results by the superintendent of the particular works conducting the departmental safety meeting, the foreman's safety meeting. At the meetings he discusses all these trivial injuries reported during the month, with his men, and they have to come prepared—that is the foreman have to—as to how these occurred and what they are doing to prevent them.

CHAIRMAN BOULET: Is that a good plan? Will it work in your plant?

MEMBER: Some of us overlook one of the things relating to minor accidents. Most everything we do as human beings is done because we have formed the habit, and it is done in a habitual manner. Therefore, if our employees get to the point where they are in the habit of disregarding minor accidents, it isn't very long until some serious accident comes along, and they fail to make a report on that.

CHAIRMAN BOULET: When I heard you I

thought you were an attorney for the defense, and you aren't. Can't I get somebody to defend me?

MEMBER: Will someone tell me what you mean by a trivial and a major accident?

MEMBER: One gives you a bad lost-time record, and the other doesn't.

CHAIRMAN BOULET: Elaborate on it. What are we talking about? Are you talking about serious injuries or serious accidents?

MEMBER: I am trying to help you on the argument you had with this gentleman down here as to whether his plan would work or not. We have had a plan which has been very successful, of reviewing all minor and major injuries within our organization at our departmental meetings each month. We have found it very successful.

CHAIRMAN BOULET: We haven't gotten to the bottom of this other question. What is the difference between minor and major accidents? We are talking about accidents, I presume, and not injuries.

MEMBER: Perhaps I can answer that question. In coming here to Kansas City the engine ran off the track. There was one man who had had a number of drinks, and he had a long nose. When the train stopped, he fell forward. He said when he got up, "I don't see how I failed to hit my nose." That was a trivial accident. If he had hit his nose, it would have been a major accident.

MEMBER: What is the difference between a near-accident and an accident?

MEMBER: What are we talking about, accidents or personal injuries?

CHAIRMAN BOULET: Accidents.

MEMBER: An accident involving serious property damage probably can be considered a major accident, but an accident is an accident to a safety supervisor, and almost all accidents carry in their analysis certain factors that he is interested in, whether there is property damage or injury involved, or anything else. An accident may be a major accident to a safety supervisor, and a minor accident to, we will say, a plant superintendent or foreman, because their viewpoints are different, and each is studying the accident probably from a different standpoint. So I think all accidents can be classified as major accidents if they involve accident prevention problems.

CHAIRMAN BOULET: I think you are right.

MEMBER: Mr. Chairman, this roundabout conversation started from the reporting, as I understood it, of minor injuries. In the reporting of minor injuries, as I see it, the Chairman was asked what he did about the man who had too many of them.

To get men to report minor injuries and tell you the truth about what happened, they would have to be like the little child that you asked, "Why did you do this?" If the child tells you the truth and you whip him for it, he won't tell you the truth any more. The same thing applies to the reporting of minor injuries. If we penalize men who report minor injuries, then they will neglect to report them. I think the answer to the success of that, where there is no penalty attached, is that very few of those concerns suffer lost time due to infection resulting from minor injuries.

CHAIRMAN BOULET: We are talking, apparently, now about minor injury reports. I think I can go back to my original statement and say if the minor injury report shows a potential major hazard, something is done; that is a major accident.

E. W. BECK: Gentlemen, what pleased me most this morning was the little handshake you gave that question of what do you do about your minor accidents, and C. B. said "nothing." That seems to be a strange attitude for experts to take, but I have for eighteen years been accumulating figures in a large corporation. Last week was the first time I ever said anything about minor injuries in the aggregate, compared with others.

I have a report here on the subject. It is the first time I have ever drawn up the figures. I only drew it up because one of our plant managers had made a statement over and over again that all accidents were unnecessary; there was absolutely no need of having accidents in the plant, and he rode the plant so hard, they were working with him on the question of the number of accidents reported.

The result was that the personnel manager or the safety supervisor was selling himself on the idea that they were actually reducing the number of minor injuries, so they must have been doing a good safety job.

When he said that to me, I knew it was not a correct and a true statement, because,

you know, I was interested in the cost factor. I took a very complete set of figures, showing all of our plants, all of our minor accidents, the average per million man-hours for minor injuries. I got my answer. The average in the company is 659 injuries, all accidents, including lost-time and minor. Of course, you know the large percentages are the minor. There were 659 per million man-hours and the factory I was just talking about had two-thirds of that number.

But, mind you, when we went over to the next column and checked their frequency rate of lost-time accidents, they were about sixty per cent higher than the average for the same group. Isn't that your answer? So, I agree with C. B. Put the soft pedal on this question of what are you going to do about these minor accidents. Get them reported. Your nurse wants them, you want them, and it is going to help sell management.

I presented those figures at a meeting of personnel managers in New York last week, and it is going back home to the management. When he looks at it and compares his own experience with the average for the company, he is going to answer his own question.

CHAIRMAN BOULET: This started with looking for causes or how to find these indications of lack of interest. Somebody got us off on a tangent.

MR. WEIR: I think most of us have missed the point. If we are to take the attitude that accidents just happen, and one man has ten and the other man has one, and do nothing about it, I think the safety director has failed miserably; because every minor accident or injury has a cause. There is either something wrong with the man, the method in which he is doing his work, or the material he is working with. There has been an unsafe act or an unsafe practice.

I think it is the duty of the safety man to analyze those reports as we do in our plant, call a man in, not reprimand him but show him the error of his ways. If necessary, correct the unsafe practice that has caused that minor injury. If we do that, then we have accomplished something. If we throw them in the wastebasket and say we can do nothing about it, it just had to happen, I think we have failed.

DR. DOUBINS: I gather that these experts go into action after the accident occurs. They get a pile of statistics, set them up on the

table, and they see they have quite a frequency in a certain department. Now, if they are on the job and will go out and get acquainted with the foreman or superintendent and his problems and work with him, they will eliminate accidents that they will never do otherwise.

You can pick the best personnel men and the best engineers and the best doctors, and go into a plant and work, or you can sit in a mahogany office and pile up a beautiful bunch of statistics that will never keep your workmen from getting hurt.

If you are on the job and out there with the superintendent and will go to the management and back to the foreman, you are going to get some place. Over in my place we have spent over three million dollars on safety in the last eighteen months, and it has been effective.

CHAIRMAN BOULET: We have to go on to the next question. Are there any other ways in which the safety man can be on the alert, things he should be watching for, to discover a lack of interest before it becomes apparent on the surface?

MEMBER: A good director of safety, in making his talks and holding his meetings, is going to ask from his men constructive criticisms and good suggestions for carrying on a safety program, and he is going to tell the men that, while he may not be able to use all of their suggestions and criticisms, he is going to appreciate them. If he ceases to get them at the meeting, the men are losing interest.

CHAIRMAN BOULET: Has somebody else a suggestion?

MEMBER: When new work is started, the safety man discusses it with the foreman. The foreman will tell him about the safety feature in discussing the new work. If he does not, watch out.

CHAIRMAN BOULET: Or, if the drafting room fails to incorporate safe features of engineering in their plans, the safety man ought to be on the alert.

MEMBER: One thing that is important is the lack of good housekeeping.

CHAIRMAN BOULET: I will take that one.

MEMBER: Lack of interest when the man is first hired by the foreman not properly instructing him.

CHAIRMAN BOULET: We are going to

accuse the foreman of falling down on interest.

MEMBER: Lack of personal contact with the men on the safety program.

MEMBER: Condition of safety equipment.

CHAIRMAN BOULET: That means guards and protective equipment. If it is not kept in shape and nobody gives a damn about it, you know there is a lack of interest. You have to be on the alert for it.

CHAIRMAN BOULET: Mr. Loomis, I wonder if you would take a shot at this.

K. C. LOOMIS: Laxity on the part of the safety department to carry out rules that they lay down for the supervisors and men to follow. If they put out a ruling and there is an attitude of, "Well, that is just another rule that the safety committee has put down; we have too many of them already," the foreman has a tough job of putting it across to the men. I don't believe a safety ruling should be put out to the men that cannot be carried out and followed by anyone in the division, or any ruling that the safety engineer would fail to carry out himself.

CHAIRMAN BOULET: I would like to add one or two items, and then we are going to the main part of this program—what to do about it. Let's add this: Planned conferences with supervisory groups, to ask their opinions, to find out from them if there is a decrease in interest and, again, personal contact with employees. I think that was mentioned, but it is very, very important.

Section 2 of this question is this: "The Cure—What is it?"

Let's try to attack that problem in a logical sequence by talking first about management. Suppose we have found that the interest of management is slipping. Now the question is, what to do about it?

MEMBER: I wonder if you aren't starting from a fallacious premise there, to begin with. Any fellow in this room, whose management isn't interested in safety, wouldn't be here. What do we know about "management that isn't interested in safety"? I certainly don't know a thing about that kind of management. If I have some idea that my management is losing interest in safety, I think I am wrong. Maybe I am falling down on my job, and I haven't sold him on some idea that I think is all right, and I interpret that as losing interest in safety, failing to keep in mind, myself, that if management

forgets this item of costs that we safety men do a lot of crabbing about, pretty soon there will be no management, no industry and no safety supervisor. I think we are wrong when we assume that any modern management that remains management is losing interest in safety.

CHAIRMAN BOULET: Do you believe as a group that the high plane of interest that management reached, when it established the safety program, is going to continue at that level forever? (No) Neither do I. That is exactly the question we are posing now. It would be foolish to say that management has lost its interest altogether. I say there has been a decrease of interest. What are we going to do to maintain the interest of management? I am going to tell you an experience in our own company.

After six or seven years of an excellent accident record, in which our particular company had won three national trophies, we found that accidents were increasing, and I began to wonder why. I happen to be with a public utility. We have a number of divisions. When I speak of management, I speak of the president of the company and the managers of these divisions, not supervisors. Some of them are directors of the company, vice presidents of the company. Management had become so concerned with other operating problems, such as new construction, other types of operation, retirement of property, financing, that they had lost interest, unintentionally, in the safety program.

I will tell you what we did. We developed a campaign that would not reach the man. We didn't give a damn about the man down on the job, because we knew if the managers got on their toes, the man would respond. Our publicity man developed a plan called the White Elephant Campaign. We passed the white elephant around to every man who had an accident in his division, with a letter from the president of the company. Not only that. The elephant had a bale of hay with it and a pitchfork and a lot of other things. We had a white elephant cut out of pressed wood about three feet high.

Following the institution of that campaign, after one of the worst accident records we had, we went 1,800,000 hours without an accident. Doesn't that prove—it did to me—that management had lost interest and as soon as you restored the interest, the problem was licked? The men were just as en-

thusiastic, I mean they were following the lead of management just as much as they ever did. That is the thing I am getting at. These managers had lost all of their interest. They wanted a safety program, but they hadn't put on the pressure to keep that safety pitch up.

What can we do about these natural slumps in interest? I have given you our answer. Now give me yours.

MEMBER: Keeping management informed about what the safety program is doing; keeping them stirred up and giving them new ideas.

MEMBER: The managers of our different organizations are naturally concerned with costs. They are more interested in costs and profits than anything else because they are responsible. Therefore, the safety man of any organization has a potent means of keeping the manager's interest up in safety if, when his interest lags and costs rise, he shows him the cause.

CHAIRMAN BOULET: Are there any others?

MEMBER: I am working with a number of different organizations. I give the management a copy of a letter that goes to every foreman every week, concerning the working conditions, either in the plant or on a construction job. The result is, they know the specific hazards on that job. If there are any unsafe ladders or tools, not only does every foreman in the organization know it but also the management.

By giving them specific information and getting out bulletins that fit their conditions, their interest can be maintained and accidents can be prevented.

MEMBER: I think the most potent way of getting the manager's interest and keeping him interested is to let the owner of the company know that the manager, through his disinterest, is causing men to be injured and causing the company to lose money.

CHAIRMAN BOULET: What about getting the management into your safety meetings? Ever try it? That is another way.

MEMBER: How do you do it?

CHAIRMAN BOULET: If he isn't coming, you may as well fold up.

MEMBER: Remember, accidents, whether they cause injury or not, cost money. Go to your president, when you have problems, and ask him to come in and give his opinion.

CHAIRMAN BOULET: I think they will come in. In our own property, next week, the president of our company, not the manager, will travel about 750 miles in two days to attend two safety meetings.

MEMBER: I am a little confused on management. We seem to be confining our management to a manager of a branch factory or office or plant. What about the president, the general manager, the executives and board of directors?

CHAIRMAN BOULET: I am talking about presidents and board of directors. I don't know whether the rest of you are; I am. Those are the boys you have to get on the job. Has anyone else an idea as to how to stop this dropping off of interest?

MEMBER: Show how much money they are losing.

CHAIRMAN BOULET: Show how much money has been saved each year. Hit the pocketbook.

MEMBER: Get him to take an active part and get him elected president of the Safety Council.

F. R. McLEAN: One man said it was evident that management was interested because they hired us to do a job. That is wrong. I think fifty per cent of the men in this room may have initially made a job for themselves by doing the very thing we are talking about, originally getting management interested. I know that that has happened in concern after concern, where somebody, because of human interest in safety, has developed the question and made a job for himself. We have to keep on doing that continually.

I think the question of submitting details of all the unsafe practices and so on, that exist throughout the plant, to management cannot be followed. You are going to get your management rather tired of your safety department. They have a job to do, and I think they are interested in results. Our keeping management interested depends upon the results we can show them.

There are two kinds of results, unfortunately. Where you have had a bad accident experience, you can present it to them, sometimes, with a lot of human pathos, to arouse their interest. The other appeal is the financial. They are responsible for the earning capacity of the company. If you can bring home to them that it is a factor of cost, you

are doing it mighty effectively. I think there are two excellent ways of getting that over.

Management is interested in costs in the aggregate. You can make some interesting reports which management should be able to get very quickly, by putting them in graphic form that will show them the costs in the aggregate over a period of years. Some of the most effective ones are showing them what it was before they had safety and what it is now.

The other one is to bring it down to unit costs.

I happen to work for an oil company. I don't think we ever did anything more effective in arousing management's interest in safety than reducing accident costs, combining not only personal injuries but vehicular and all the other phases of accident prevention into a single figure, and reducing it to a cost of so much of a fraction of a cent per gallon of gasoline for each separate plant, distributing plant and manufactured gasoline at refineries.

When we did that, they sat up and took notice, because those were the things that they were interested in: What was the freight cost, the production cost, the sales cost, on that gallon of gasoline?

When it was brought out in those terms, they were very keenly interested. So I say, get it in a graphic form that is talking their language in the way that all their other reports are made, so that it fits into their method of thinking.

CHAIRMAN BOULET: Now let's go to the safety engineer. What will we do with him when there is an indication that the interest level is sagging, or what should the safety engineer do for himself?

MEMBER: One of the best things that can be done is to send him to the Safety Congress. I have attended several in the last ten or twelve years, and I always go home full of new pep and enthusiasm. It is unfortunate that they don't have them oftener than once a year.

MEMBER: I will take a crack at the safety director. He should go to the doctor and have a good physical examination. That may be the trouble with him.

MEMBER: Why wasn't that tried on the management?

CHAIRMAN BOULET: I haven't any objec-

tion. Will someone else offer something for the safety director?

MEMBER: Go around to other industries and get ideas from them.

MEMBER: Suggest that he go out and contact the shop people.

CHAIRMAN BOULET: Get right out on the job and see the problem.

MEMBER: If you have a safety committee set up in the plant with several hundred safety committeemen around through the plant digging out the hazards, reporting them to their supervisors, I think the safety man won't have any trouble keeping wide awake, if he satisfies the requests of all the safety committee members.

CHAIRMAN BOULET: Probably we could set up a catechism for safety men: "First, am I well? Second, am I abreast of the times? Do I know what other plants are doing? Third, am I in close contact with my men?" Will someone name a fourth one?

MEMBER: Am I in contact with others?

MEMBER: Pay attention to your state factory reports.

CHAIRMAN BOULET: "Am I examining state factory reports?" "Am I analyzing all accident reports carefully?" Any others?

MEMBER: I found one thing in my short experience. May I tell you I was a police official for a number of years, interested in safety, and now I am a director of safety. I have found that we have been prone to discipline our people when they have done something wrong, but have failed to commend good work on their part. When they have a good safety record, we are not giving them the recognition they should have.

CHAIRMAN BOULET: That is all right. Any others?

MEMBER: "Am I doing all I can to help the foreman carry the safety load?"

MEMBER: "Am I checking my program to make sure I am not trying to operate in 1937 with a 1916 program?"

CHAIRMAN BOULET: "Am I keeping my program abreast of the times?"

MEMBER: "Do I practice what I preach?"

CHAIRMAN BOULET: That is a good question. I think, you safety men, if you take that list of questions and when you get back home analyze yourselves, you may find something. You may discover that part of your

increasing frequency is due to your own self. We are inclined to pass the buck to the foreman or the superintendent, but we should analyze our own condition.

Let's go on to the next one. What is the cure for the supervisory force?

MEMBER: Some supervisors should be fired and new ones employed.

CHAIRMAN BOULET: We are going to argue in a minute this matter of discipline by firing. Before we start that, I am going to ask somebody up here to take that question and discuss it.

MR. HUTH: It seems to me that the foreman is the most important fellow in this whole business, as far as the practical application in the mill is concerned. For a long time we have been asking these fellows to do something and telling them what we wanted done, but we haven't been telling them how to do it.

We have reached the point in accident prevention where the curve is not up and down as far as it used to be. I wonder sometimes whether we can get it down any farther and hold it there with reasonable certainty without working more with our foremen, telling them what we expect them to do.

One of the methods that seems to be developing recently is the conference method of going into all the aspects of accident prevention, the technical side of it, the human side of it, and working it in with the actual production; not separating accident prevention from production and making it something entirely different from the man's regular work.

CHAIRMAN BOULET: We have a start. Will somebody pick up the flag and carry it on from there?

MEMBER: I would suggest that foremen be given the prerogative to select their men and refer that choice to the personnel department for approval. If the foreman is to be responsible for the man, he should be given the opportunity to select him.

CHAIRMAN BOULET: You think that will help him become more interested. I think that is probably true.

MEMBER: During the past three years there has been a radical change in this thing coming about, due to labor. It has changed the safety inspector's viewpoint.

Recently a publication by the industrial accident commission came through, and their

statement says: "With labor unions assuming added authority, are they considering the added responsibility?"

There is a thing I would like to hear discussed. Is the foreman getting the support of management and the rest of the officials in the disciplinary measures he wants to use? His authority has been taken away from him, to a certain extent. A man, a dreamer of power, in the plant has taken over a good deal of this. I have found that by getting hold of this fellow—he is human like the rest of us—he can be talked to. He has a lot of radical ideas, and other times he has a lot of good ones. The good ones should be accepted. If some are not accepted, he should be told why; otherwise he will have a grievance. The other ones, that aren't good—pass them off and say, "We will forget those. Let's do something about this."

That is where I, as foreman, come in. I feel that is one of the biggest problems we have at the present time. It is gradually increasing. Something will have to be done about it.

CHAIRMAN BOULET: I think you are right. I wouldn't want this group discussion of union labor matters to cause any repercussions.

My experience is that if the union officials are properly approached, they will support your safety programs one hundred per cent. You may not find that in your individual plants. That is a problem that I think each of you as individuals must solve in your own plants, dependent on the relationship between management and men. I don't believe we can solve that problem here.

MEMBER: I am neither a foreman nor a supervisor. I edit two papers in my plant. Somewhere in the plants you will find the contact men with the labor union. I have done it. It may be surprising, but I have fifty reporters, all union men, reporting to me the unsafe conditions, the unfit equipment. I put that into the paper. I gather it along with the other topics. We get along fine. You have to contact the man who really knows. I do that.

CHAIRMAN BOULET: I am certain that that problem can be solved, but I still don't think we can thrash it out here. It is an individual problem and depends primarily on the relationship between the management and the men.

There is a man who has helped to solve it in his own way. We will take that as an arrow pointing the way, if you will; that is, that the new relationship of organized labor and management must be taken into the picture as it affects the foreman, and any adverse condition that has arisen must be corrected, and the safety man can be of help in correcting it. Let's leave it that way.

MEMBER: I think one of the best ways to arouse the interest of a foreman is to make that foreman understand, or the supervisor, if you call him that, that he is responsible for the accidents that happen under his supervision.

CHAIRMAN BOULET: All right, putting the responsibility directly on the foreman for the accident; when the accident occurs, holding him to it.

MEMBER: May I say just a word from the point of view of those who issue orders. I want to make a confession. I am not quite sure it is going to be shared by any representative of management who may be here or not.

I think one of the ways in which we lose the interest of the foreman and supervisory force is because we write orders or issue instructions or put out standard practice without first an adequate discussion of what is to go into it; that is, preceding the order by an adequate discussion, by having everybody contribute something toward it.

Second, after it has been written, there ought to be a period of training and discussion so everybody understands it. It is very simple and easy to put something down on the bulletin board and say, "That is it." It is easy to write a letter. It is easy to put out standard practices and instructions.

I think, from the point of view of management, that is one of the worst curses to destroy enthusiasm and initiative. We have ourselves to blame if the instructions aren't carried out the way we expect, because they aren't understood.

CHAIRMAN BOULET: Your thought is to make the foreman part of management by giving him some say in the development of these safety rules and orders. That is sound. Has anyone else some way to help the foreman get out of this lethargy he gets into?

MEMBER: Referring to the conference method, we have and do still use the conference method with foremen in the safety

meetings. I have with me a copy of one of these conference sheets. If you are interested, I will read a few of the questions that we ask for discussion.

CHAIRMAN BOULET: Go ahead, if it doesn't take too long.

MEMBER: This deals with foreman responsibility. That was the subject of the meeting. The first question is this, "Is there anyone in this group who believes a foreman should be held responsible for all accidents in his department?"

CHAIRMAN BOULET: Someone asked, "How was that decided?"

MEMBER: They did not believe the foreman could be held responsible for every accident, but it is a question you can discuss with your own foremen.

Here is another: "Can the foreman condone infection in his department?" Another is, "Can we condone hernia or rupture accidents?" This is the final question: "Some men are accident risks, some are rigid and tense by habit, others' energies are easily exhausted, confused intelligence, weary and always under pressure and so on. They usually do impulsive things that may be the cause of an accident. To what degree could the foreman be held responsible for such an accident?"

That gives you some idea of what you can do by the conference method.

CHAIRMAN BOULET: The conference method has a definite place in training foremen and directing their thinking. Your questions may be different from those of this gentleman, but still the method is there to be used, and it is another way to inspire the foreman to renewed interest. I am going to close the supervisory end by letting Mr. Rakestraw take a shot at it.

C. N. RAKESTRAW: The question of the relationship of the foreman to accident prevention has been so widely covered that it is hardly worth while for anybody here to go into it very deeply. I don't think anybody will disagree with the fact that you cannot separate accident prevention from production. They are an integral part of the same thing. Once you try to separate them, you are lost. I think all of us try to bring that home to our foremen and make him understand it is just as much a part of his job to have a good accident record as it is

to turn out the right kind of steel or whatever you happen to be making.

MEMBER: May I suggest that, while we all agree that the foreman is responsible for the accident, one of the best ways is to charge every accident to the reserve charges of the department involved instead of charging it directly to the general compensation.

CHAIRMAN BOULET: That is an idea. Some companies probably can do that. Public utilities can't, because we are controlled by the Public Service Commission. We have to put it where they tell us.

Let's go to the subject of "For the men?" How can you stir up the interest of men, little tricks or schemes or ideas?

MEMBER: Charts.

CHAIRMAN BOULET: Accident curves, I suppose you mean.

MEMBER: Contests.

CHAIRMAN BOULET: How many think contests are all right? How many think contests have no place in the safety program? It is about fifty-fifty. I would like to have somebody defend the contest idea.

MEMBER: About ten years ago we started real, intensive safety work. We had been having one, two, three and four major accidents a year. We started to pick out a number of safety committees, of several departments, five men to a committee. We told each one that if their department would go through the year without an accident they would each receive a gold watch. The result was, with forty men on the committee, we bought forty gold watches. I think that will bear it out.

CHAIRMAN BOULET: I wonder if that was really a contest or if it wasn't in the nature of an award.

MEMBER: That was a contest. We kept that going for three years. The consequences were, every man wanted to be a safety committeeman so he could get a chance to go out and do his stuff and get a gold watch.

MEMBER: I want to ask this gentleman a question. Do you pay a man to report on time in the morning? Do you pay him to do his daily work? If you don't pay a man a premium for reporting on time in the morning or doing his regular daily duty, why pay him for doing something that is part of his job?

MEMBER: Well, we pay that man when he reports to work at eight o'clock. If he doesn't report, we don't pay him.

MEMBER: You say you gave them gold watches because they are safety men. In my estimation, safety is just as much a part of their job as anything they do.

MEMBER: It is.

MEMBER: Why pay them?

MEMBER: I think a lot will agree with me that, when you have some little incentive, you are going to get a lot more.

CHAIRMAN BOULET: It is my understanding that just the committeemen got the watches, not all the employees.

MEMBER: Just the committeemen.

MEMBER: I want to answer this gentleman over here as to why pay a workman for doing something he is expected to do in the course of his work? I am going to ask him the question: Why in the Army, for instance, do they give us a medal of some kind for something that we are expected to do anyway? Why do they put us in the brig if we do something wrong? It works that way just the same.

Take the police departments. They have some sort of recognition they give to the man who did his work, did not shirk it.

We will not get very far in accident prevention unless, in connection with our disciplining of men, we also have some sort of award, something that recognizes the individual's merit, the individual's ability to perform his work properly. We have that in the Calco Chemical Company.

We divide our men into three classes, A, B and C. By the way, C is the lowest class. Men who have been in the employ of the company six months or more belong to the Calco Safety Organization. They get a distinctive lapel badge. Men who have been with us more than six months, not exceeding eighteen months, by the way, without a lost-time accident, get a Class B lapel button, and those who have been in the employ of the company three years or more without a lost-time case get a Class A badge.

We go through a considerable ceremony about it. The works manager and one of the vice presidents are always in attendance and award these lapel buttons as a distinction, as an incentive to work for. There is no monetary award with it, but the men think a great deal of it. The buttons are considered as a

promotion, if everything else is equal, and they are Class A members of the Calco Safety Organization.

Let's get back to the contests. The State of New Jersey Department of Labor, in cooperation with all the industries in the state, conducts a safety contest during the last three months of each year. This year is our tenth contest year. The Department of Labor has figures available on these contests. They show that since the contests were started, the number of plants participating and, naturally, the number of employees involved, has grown, whereas the number of lost-time accidents has been decreasing all the time.

There is a definite stimulus to safety. There is a definite method here for making everybody in the plant, executives and men, more safety conscious. We in New Jersey support that because we see the good effect of it. I am not here to advertise the duPont Company. But the duPont Company has just finished a six-months' contest, and they will tell you what value they got out of it. It was immeasurable. Contests, without doubt, are good if properly conducted.

MEMBER: Talking about lost-time accidents—I know one plant where a man broke an arm. He had four days coming to him, took those off, and that was not a lost-time accident.

MEMBER: That is not run fairly and squarely.

MEMBER: It is done.

MEMBER: It is my experience that this contest plan has a tendency to cause fraud in reporting lost-time accidents. I can see from my own experience, and I have checked with some of my competitors who have won safety plaques in this Council, that they have got them by fraud. I have checked certain cases and found men who have sustained injuries that would keep them from doing their regular jobs, and they have been given a broom and stood in the corner with it. They were also transported to and from their homes in taxicabs in order to say they were in the plant. That is what contests have done.

MEMBER: I would like to hear that out. I have had the same experience right in my own town. A man at a committee meeting said he had forty-five trucks on the street every day of the year, that he had completed eighteen months of service with those trucks, without one accident. I asked him this ques-

tion, "Wasn't any one of your trucks struck in the rear?" He said, "No." When a man tells you that, it bears out this man's statement.

CHAIRMAN BOULET: Now you are all picking on the contest. I am going to call on one of my henchmen to defend it.

MR. BECK: I welcome this opportunity because last year my good friend Kuechenmeister was on the same program with me on the same subject; the two experts differed, and I have been thinking about it ever since. I feel this way, that you have to measure it in the final analysis by what you accomplish. To be sure, there is cheating. We have been conducting contests in my company for the last fifteen years, and we have changed the rules only twice. The first change was on account of the deaths. We were charging 6,000 days to a death, but we found it gave a credit to the plant for the next two or three years, so we dropped the 6,000 days charged to a death and did not charge it on severity but added it to frequency, as only one accident.

Next—and this will probably answer some of your questions—we changed the question of lost-time accidents to compensable accidents. You can cheat with lost-time accidents. The surprising thing about it is that the change took place a year ago, and we have had a decided increase in my company during the last year in accidents where only two and three days were lost.

In the final analysis, as somebody said here, the corporation wants to know, "Is it worth while?" So I have here a chart that shows the frequency rate over a period of 15 years, and the rate has been decreased 60 per cent. I am conservative in saying I believe that probably a large percentage of our safety effort to bring about that reduction has been through the contest. We have been saying that the man to reach is the management. How are you going to reach management? C. B. has said the majority of you safety men are here because you created a job for yourselves; you sold somebody the idea. I think he is right. Your success depends upon how good a salesman you are.

These trophies downstairs can be used to sell management, whether they are won honestly or not.

I remember one company that won five trophies last year, and that particular company had the bright idea, "Well, let's cash in on

the publicity." So they put them in a show window on Broadway, and vice presidents and general managers and even the president of that corporation came by those windows and saw them, and they had their eyes opened. They were being sold. They started asking questions. They started approving safety recommendations, and that is what you want them to do. This is one medium.

It is a better medium in large corporations than in the smaller ones. But I have found this: We have five corporations with less than 500 employees, and the fact that one of those fellows won a trophy one year, and didn't know it, aroused his interest. The next year, when he had an accident, he said, "Oh, hell, I lost the trophy this year. I am going to get busy." He started in to do a lot of work.

We use many different ways to bring up children. We all don't bring them up the same way, but we all have the same objective. I think we can think of safety contests in that same manner.

MEMBER: I think the gentleman has proved, by his own statement and figures, that his position is wrong. He says his own figures prove the contest was right, and when he changed one little rule he got different figures and more accidents. I work in a large corporation, and we have found that this matter of contests is a matter of viewpoint.

If you are new in the industry or new in accident prevention program, your contest may be very, very useful. But if you are coming down to a substantial program in safety, embracing a comprehensive safety training program for your foremen and your men, you will soon find that the contest has lost a great deal of its value, and the men are really responding to safety training on the job.

CHAIRMAN BOULET: Has anyone something else?

MR. LOOMIS: We have a poster system that we use in the main plant the day before a holiday. It makes the men feel that we are interested in their safety after they have left the plant. This poster is six feet high and four feet wide. We have a portable bulletin board which can be made very cheaply. On Memorial Day we had a poster seething with motor vehicles: "Injuries equal pain; disability equals misery; death equals sorrow; suffering equals regret. Drive carefully."

For the Fourth of July we had a similar one

placed in the main exit. We had "Fourth of July" across the top. "Automobile accidents" with a question mark; "Persons injured" with a question mark; "Persons killed" with a question mark; and then in brackets on the

outer edge, "Do your part to keep these at zero." Then just a little phrase at the bottom here: "Remember this, safety is like a ball game. It is the number of times you arrive safely at home that counts."

ADJOURNMENT

Pressure Vessels

WEDNESDAY MORNING SESSION

October 13, 1937

The session was called to order by Chairman Dan L. Royer, Chief Engineer, Ocean Accident and Guarantee Corp., New York City, and General Chairman, ASSE-Engi-

neering Section, National Safety Council. Mr. Royer introduced the speakers. The address prepared by Mr. Gibbs was read by Ralph M. Moon, of the same firm.

What the Safety Man Should Know About Steam Boilers and Steam Lines

By E. R. FISH

Chief Engineer, Boiler Division, The Hartford Steam Boiler Inspection and Insurance Co.

With respect to steam boilers and steam lines, the safety man should be familiar with those factors that produce weaknesses resulting in failures—factors that are prejudicial to the safety of personnel and property. The safety man is not necessarily concerned with efficiency of operation, but he is concerned with how the equipment should be operated in the interest of safety.

The term steam boilers and steam piping covers a great variety of equipment ranging from the inconspicuous steel or cast iron heating boiler, the pressure of which rarely exceeds 10 or 15 lbs. per square inch, up to the mammoth steam generating units capable of evaporating over a million pounds of water per hour at a pressure of 1,400 lbs. per square inch and delivering steam at a temperature of 900 to 950 degrees F.

Obviously, such a wide range makes it impossible to discuss the various factors that affect each of them. However, there are certain fundamentals applicable to boilers of both high and low degree.

Internal Deposits

Deposits or accumulations on the internal surfaces of parts of boilers exposed to high temperature gases interfere with the rapid absorption of heat. When directly in contact

with the metal, water absorbs heat at a sufficiently rapid rate to prevent the metal from becoming overheated. However, interference with this orderly process and the metal very rapidly overheats to the point where it loses practically all its strength. Internal pressure then pushes the metal out and causes the so-called "bulge."

In water tube boilers bulges on tubes not infrequently break through, and while they do not often cause any serious consequences to the attendants, sometimes steam or flame are driven out through openings in the settings and some one is injured. In horizontal return tubular boilers the result is likely to be much more serious both from a personal injury and expense point of view.

Bulges in boilers of this type very frequently break through and, being directly over the fire, flame and live coals are very likely to be driven out of the furnace. Many state laws now require fire doors to be equipped with automatic latches that prevent them from being blown open when they are closed. Bulges in H.R.T. boilers have frequently opened to such an extent that a true boiler explosion has happened and great property loss as well as personal injuries and death have resulted.

A serious explosion of this kind happened

at a cotton seed oil mill in North Carolina due to the accumulation of loose scale and mud on the bottom of the boiler over the fire. Six men were killed and several injured, and the property loss amounted to about \$75,000. This accident could have been prevented by proper attention to internal cleaning.

Interior surfaces of boilers of all kinds should be kept clean. Cleaning may be effected by mechanical means, which calls for more or less frequent intermittent attention, and which in the case of fire tube boilers, is very unsatisfactory. Another, and preferable method, is to treat the water used in the boiler so that the scale making constituents are changed to soluble compounds or non-scale-making deposits that are easily blown out.

Oil frequently finds its way into boilers in some plants. This is highly objectionable, since only a very thin film of oil imposes a heat transfer barrier that almost invariably results in overheated metal.

Riveted Joints

One of the ills that affect boilers of riveted construction is the development of cracks between rivet holes in the riveted seams. Obviously, if the metal is cracked between the rivet holes the strength of the joint is very greatly reduced if, indeed, it does not practically disappear. Cracking may be experienced in either the double strap butt joint type of construction or in the older lap seam construction, which is now practically obsolete, although there are many boilers still in use so constructed.

Lap seam cracks usually do not occur between rivet holes but are located under the plate just back of the caulking edge and are due primarily to the eccentricity of the stresses which is caused by the out-of-roundness of the shell at the joint.

Cracks that extend between rivet holes are usually caused by the so-called "caustic embrittlement" which is the result of certain feedwater characteristics, the discussion of which is not pertinent here.

Methods of inspection to determine the presence and extensiveness of cracks of both these kinds have been worked out. Obviously, not to find cracks of such a serious nature may result in disastrous explosions and such have not infrequently occurred.

In a lumber mill in Arkansas an upper

drum of a vertical bent tube type of water tube boiler ruptured because of hidden cracks in a riveted joint. One man was killed and four injured. The mill was practically destroyed with a loss of \$150,000. An explosion due to this cause is not as inexcusable as those due to some other reasons but the correct diagnosis of certain indications will often stimulate an investigation that will disclose the true conditions.

Overpressure

Overpressure, as such, in boilers that are reasonably sound is not very often the direct cause of a boiler explosion except possibly in the case of low pressure heating boilers. The manipulation of stop valves coupled with an inoperative safety valve is a dangerous combination and is only one of a variety of possible causes of unanticipated overpressure. There are many instances where overpressure has resulted in very serious explosions.

The steel hot water heating boiler of a closed heating system in an apartment building in a Washington city exploded a few years ago. Several of the tenants were injured and the property damage amounted to more than \$30,000. Overpressure resulting from the failure of the control devices and a pressure relief valve that was stopped up by deposits were the cause, but lack of expert attention was undoubtedly primarily responsible.

Corrosion

The relatively soft low carbon steels that are used universally in boiler construction are very susceptible to corrosion, and deterioration of this sort has been the cause of many boiler explosions that have resulted in much loss of life and property damage. Corrosion may be either internal or external. Internal corrosion is rather easily discovered by an internal inspection. External corrosion, however, almost invariably occurs in those parts of boilers that are covered or are not otherwise easily accessible and which, therefore, do not come under the scrutiny of inspectors, if the boilers are inspected at all.

There have been enough disasters of this kind to warrant the statement that the concealed parts of the metal structure of boilers must be examined occasionally to determine whether or not there has been any serious wasting away. In other words, any part of

a boiler that cannot be adequately inspected should be an object of grave suspicion.

Most boiler fuels contain some sulphur which burns to sulphur-dioxide gas. If this gas comes in contact with moisture, the very corrosive sulphuric acid is formed. While this may be very weak, it nevertheless does corrode and over a considerable period of time the results reach serious proportions. Soot and dust accumulations very often contain some of this acid, so that if they come in contact with the metal surfaces corrosion results.

However, sulphur does not necessarily have to be present to cause corrosion. Dust in the shape of fly ash very frequently accumulates in interstices between brickwork and boiler parts. Accumulations of this sort readily absorb atmospheric moisture and moisture in contact with plates causes corrosion that over a period of time does, and has, so weakened the metal parts that disastrous failures have taken place.

A question that is frequently asked is whether boilers should be allowed to remain filled with water when not in service. If this is permitted, boilers are very likely to "sweat" with changes in atmospheric temperature. If the temperature rises so that the boiler surfaces are cool compared to the air, moisture is almost inevitably deposited, and we thus have the moisture needed for starting corrosion.

Many instances can be cited of failures due to the wasting away of plates in both water tube and fire tube boilers and in both low and high pressure boilers.

Unless the surfaces, both internal and external, of all pressure parts can be critically examined, there cannot be any certainty that the boiler is structurally competent for service. It should be noted also that when boilers are out of service they are likely to deteriorate much faster than when being regularly operated. Even the week-end shut-down may be a time when corrosion proceeds apace.

The head of the bottom drum of a vertical bent tube type of boiler recently blew out in a public utility electric plant in Missouri. The plant was destroyed with a loss of more than \$100,000. Four men were killed. The cause was the undiscovered external corrosion of the head that had long been buried in the brickwork, inaccessible for inspection.

At a coal mine in West Virginia the ex-

plosion of a horizontal return tubular boiler destroyed the boiler house and started a fire. The loss totalled more than \$30,000. Four men were killed. The top portions of the shell were covered with the customary layer of brick. A leaky roof provided moisture that eventually corroded the shell plates so extensively that the thicknesses were reduced, over a wide area, to the point that there was not sufficient metal left to carry the stresses.

Appurtenances

All boilers of whatever kind are provided with certain indicating and protective devices necessary for their safe and proper operation. In general these may be enumerated as stop valves on the steam and feed connections, water column, water gage glass and gage cocks, safety valves or water relief valves, blow-off valves and connected piping, feedwater regulators, fusible plugs and low water fuel cutouts. This list will, in general, cover the essential pieces of equipment but not all boilers necessarily have all of them.

All these devices are supplied for a purpose. Some of them are called on to operate only at long intervals if they ever function at all.

However, they are all supplied with a definite purpose in view and unless they are in condition to operate when called on to do so they might just as well be omitted.

This means that all appurtenances must be examined and maintained so that they are always in operating condition. Even those that operate continuously sometimes get out of order. Unfortunately, automatic equipment of any kind is likely to sometime, for some reason or other, become inoperative. It is highly important therefore that all the devices around a boiler, on which its proper operation and safety depend, be regularly inspected and properly maintained. Unless this is done, a preventable accident is likely to happen.

The water connections of water columns frequently become stopped up. When this happens low water and overheating result often with serious consequences. With the proper attention this can be avoided.

It is now recognized standard practice for safety valves to be arranged so that they can be tried at any time and wherever there are boiler laws it is mandatory that safety valves be tested every day.

Steam gages sometimes give wrong readings and need to be tested frequently. Blow-off connections, particularly on horizontal return tubular boilers must be of sturdy construction and properly protected from high temperature gases. Blowoff valves must also be of heavy construction and so arranged that they cannot be quickly opened or closed. There have been a multitude of accidents to persons due to failure of some part of the blowoff connection resulting from improper materials, improper operation and insufficient protection.

Attendance

The proper and safe operation of as important and potentially dangerous a piece of apparatus as a steam boiler, be it either high or low pressure, large or small, is dependent on intelligent attendants and should be entrusted only to the care of those who are thoroughly competent. This is a point that is by no means universally complied with, even, oftentimes, in power plants of moderate size.

The value of the equipment in a very large plant is such that the management cannot do otherwise than provide it with the best possible care and attention. However, there are many boiler plants that are but very inadequately attended and in thousands of small heating plants the attendant is wholly uninformed and ignorant.

Piping

Steam piping is not a source of very many accidents. The failures that do take place are usually in connection with cast iron fittings, such as tees, elbows and the valves, and usually in the pressure line.

Water hammer not infrequently occurs in steam lines, especially when starting up cold. A slug of water traveling at a high rate of speed can deliver a sledge hammer blow as an abrupt change in direction or dead end, and many cast iron fittings are broken in this way. Expansion and contraction stresses that are not properly provided for, not infrequently result in cracked fittings or valves that permit the discharge of steam. Even low pressure steam is at a temperature such that serious injury results from coming in contact with it.

Most piping is covered with insulation so that it is not easily examined, but the bolts and flanges and the provision for proper expansion can be checked.

Construction and Repairs

Safety men probably do not often have any part in the selection of equipment or methods of construction or repair, but it is well for them to know that a great deal of welded boiler work is now being done and many pipe lines are being fabricated by welding instead of the usual threaded and flanged construction. Every possible assurance must be taken to determine that the welding process will give sound welds with the proper physical characteristics. Also that only welding operators are permitted to do the work who have demonstrated their ability to produce sound welds under the prescribed procedure.

There have been so many instances of improperly welded joints, both in pressure vessels and piping, that every precaution should be taken to assure welds of an acceptable and safe nature. There need be no great concern about welded boilers, because that work is invariably done in shops that are properly equipped and supervised. This, however, is not necessarily true with pressure vessels of various kinds.

There is a great temptation to effect repairs of boilers and other pressure vessels by welding. Repairs of this kind should be permitted only after thorough analysis of the conditions and then only by proved, competent welding operators. Rules have been adopted by the National Board of Boiler and Pressure Vessel Inspectors respecting the application of welding to boiler repairs that are highly restrictive.

The American Welding Society has prepared rules for the Qualification of Welding Processes and Testing of Welding Operators.

Both the rules for repairs and the qualification of welders should be familiar to those concerned with equipment to which welding may be applicable.

Less than six months ago the welded-in patch in the bottom of a horizontal return tubular boiler in a saw mill failed. The patch measured 24" x 36" and was sufficiently large to cause a major explosion. One man was killed and the boiler house was demolished. An examination showed that it was a miserable job of welding, evidently done by one entirely ignorant of the danger of that kind of repair as well as being an inept welder.

Personal Injuries

Many personal injuries caused by exposure to steam or high temperature water, the discharge of which may be due to a relatively minor accident, are constantly happening. Many of these occur because of carelessness or ignorance on the part of the injured person but many of them are through no fault of the injured man.

Meticulous attention to small details is necessary to avoid the minor accidents. Innumerable injuries have been due to men working on, or attempting to make repairs of, parts under pressure. It should be an invariable rule that the tightening up of bolts in an attempt to stop gasket leaks or making other repairs involving hammering or possibly welding should be positively prohibited while the equipment is under pressure.

Furnace Explosions

Furnace explosions are of rather frequent occurrence, particularly where gas, oil or pulverized coal is used as the fuel. Great care and an orderly method of both lighting

off and operating furnaces using these fuels is very necessary.

The lighting means should be introduced only after a furnace has been well ventilated and before the supply of fuel is started. Some very disastrous explosions have happened in large boilers fired with pulverized coal, gas and to some extent with oil. Small automatically oil fired heating boilers very frequently have furnace explosions, but they are not usually of a serious nature. This kind of accident is worthy of careful consideration by those concerned with boiler operation.

Only a very few years ago a furnace explosion of natural gas occurred under a new 600 pound boiler in a city electric light plant in Colorado. One man was killed and four injured. The property loss was approximately \$25,000. The boiler was just being prepared for service by men who were familiar with the use of natural gas fuel. Apparently the mismanipulation of valves and failure to take the necessary preliminary precautions by ventilating the furnace before lighting off was the cause.

What the Safety Man Should Know About Compressed Air Systems

By CHARLES W. GIBBS

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Power, to most people, including engineers, means electricity or steam. To a few it means water power. Less frequently is compressed air thought of as power. It is more likely to be considered a convenience. Compressed air is probably actually handled by more workmen in the average plant than either steam or electricity. Compressed air is a personal utility, but it is also power.

Because of this familiarity with compressed air and because of its generation and use in so many small shops (practically every gasoline station has its compressed air plant), the question of safe installation and operation is important. This paper will not attempt to cover the actual use of compressed air, but will be limited to the installation and maintenance of the stationary compressor plant and system.

All of the equipment should be designed for the maximum pressures which might be encountered. All reputable manufacturers of compressed air equipment can offer units for practically any service which will provide an ample factor of safety.

For the type of plant which the safety man will generally be called upon to consider, the operating pressure will seldom be above 150 pounds, and the compressors will be either single or two stage. By this we mean that the air will be compressed to discharge pressure in one stroke of a piston (single stage), or it may be compressed part way in one cylinder and then transferred to another cylinder and compressed the rest of the way (two stage). In general, machines above 100 horsepower will be two stage, the power requirements for 100 pound units being about

15 per cent less than for single stage. Two stage has its advantages from your standpoint, also, in that the discharge temperatures from the compressor will be less.

Particular attention should be paid to the method of regulating the compressor output to prevent the building up of an excessive pressure in the system. All compressors are or should be provided with some means of varying the volume of air compressed and delivered to the system so that the compressor output is averaged up to that which is being taken from the system.

A steam driven compressor may be regulated by automatically varying the speed in accordance with the demand, thus maintaining an approximately constant discharge pressure. Electric driven compressors operate of necessity at constant speed.

Methods of Regulating

There are several methods of regulating constant speed compressors usually dependent upon the size of the unit. Small units, such as are used in automobile service stations and garages and in certain applications in industrial plants, are most frequently automatic stop-and-start control. The compressors operate at full speed until the pressure in the system reaches a pre-determined point, when a pressure switch opens the electrical circuit and stops the motor and compressor. When the pressure drops to some lower pre-determined figure, the switch closes the motor circuit and the compressor resumes operation.

Where automatic stop-and-start control is not advisable, a so-called constant speed control is provided. The compressor operates at full speed at all times, the output being reduced in one or more steps to zero, maintaining the discharge pressure below a pre-determined maximum.

On what might be called small and intermediate sized units, constant speed control is usually "all on—all off." That is, the compressor either delivers its full output or none at all.

Some compressors use what is known as free air unloading, where the inlet valves are held open, preventing the compression of air during the unloading period. Another system requires a high pressure relief valve to exhaust the air in the high pressure cylinder to atmosphere, while the intake to the low pressure cylinder is closed off entirely,

thus preventing the further compression of air.

On the larger constant speed units, a system of step control is used, the most satisfactory of which is the automatic clearance control. Clearance control operates on the principle that there will be less air delivered by a compressor if the clearance space in the cylinder is increased. By proportioning the amount of clearance which is added through the opening of valves connecting clearance pockets to the cylinder, any desired degree of unloading may be obtained. Free air unloaders of various types are also used on large units, but they are not as satisfactory, mechanically, as the clearance control.

Steam driven compressors in the smaller sizes usually have a throttling (flyball) governor or some form of automatic cut-off governor. These act as maximum speed devices only. Control of output is by one of the constant speed methods previously described.

Larger units may be equipped for varying the speed to maintain a constant pressure with a built-in device limiting the maximum speed. In addition, it is wise to have an automatic safety device which acts to shut off all the steam if the safe speed is exceeded.

The important thing about the compressor and its regulation or control, from the safety man's standpoint, is that the control should be reliable and as fool-proof as is consistent with the requirements.

Filter Is Needed

The compressor plant should include an intake air filter to keep most of the dust and dirt out of the compressor, to reduce the wear and valve leakage, and, in general, to make the machine a better, safer and more economical unit with a longer life.

The wise purchaser will also install an aftercooler to cool the air as it comes from the compressor and before it passes into the air receiver and from the receiver into the system.

The aftercooler *condenses the excess oil* which may be carried over, condenses the water vapor which is always carried to a greater or lesser extent with the intake air and which is squeezed out of the air when it is compressed, much as we squeeze water

out of a sponge. The aftercooler should be designed with ample surface and built to withstand the pressures encountered. It should be protected with a safety valve and should have a pressure gauge to indicate at all times the pressure existing within it.

Every air compressor plant should have one or more air receivers. These are simple tanks designed to assist in the removal of moisture and oil before the air passes into the distribution system, to provide a reservoir against the peaks of usage, and to maintain a more constant pressure on the system.

The compressed air industry has practically standardized on the A.S.M.E. Code for Unfired Pressure Vessels in the manufacture of all receivers and auxiliary equipment. The receiver should be designed for some pressure slightly higher than the normal expected operating pressure and should be stamped and inspected to be sure it meets the Code. This simplifies insurance problems.

The practice of using air receivers and tanks which have not been given a regular inspection and test is still all too prevalent and cannot be too thoroughly condemned. It is a fixed policy in our company not to quote on air receivers of any lower standard than 125 pounds A.S.M.E. We feel that if we were to quote and sell receivers, for say 30 pounds or 50 pounds and even though they were built to the A.S.M.E. Code, they might sometime, somehow be used on higher pressures with disastrous results. One hundred pounds is the practical standard of air pressure in this country and an air receiver designed for 125 pounds gives sufficient leeway.

Valves and fittings should all be carefully selected and installed for the pressures involved. These parts have now been well standardized and can be bought with safety.

Installation

Now that we have the equipment bought, we must install it. First we must select a suitable location. From a safety as well as economical point of view, the place should be well lighted, with crane service if necessary for handling heavy parts during erection, maintenance, and repair; and there should be plenty of aisle space.

Piping should be so arranged as to be out of the way and yet accessible. Intake piping is usually connected to the bottom of the

cylinder. It should come in from the outside if at all possible, since the colder the air coming to the compressor, the less will be the likelihood of excessive discharge temperatures and the greater will be the useful capacity of the unit.

The air filter should be placed where it can be well and conveniently serviced, and should be regularly cleaned. Discharge piping is important. The air from a compressor is hot, and for 100 pound service will vary from 250 degrees to 400 degrees temperature, depending upon whether a machine is two-stage or single-stage and also varying with the size and effectiveness of the cooling water supplied.

Because of this temperature, the discharge pipes should be where men cannot easily come in contact with them. They should be carried up and out of the way, if at all possible or laid in pits beneath the floor. They should lead as directly as possible to the aftercooler and the shorter the distance between the compressor, the aftercooler, and the receiver, the greater will be the over-all operating economy of the installation.

No valves should be placed in the line between the compressor and the receiver. This statement is made in spite of the fact that valves frequently are placed in the line, and in spite of the fact that there are cases where the space is so limited that two or more machines pump into the same receiver and valves must be placed in the discharge lines at the compressors.

Where this cannot be avoided, it is absolutely essential that a safety valve—at least as large as is on the receiver—be installed between the compressor and the shut-off valve. But again it should be emphasized that no valve *should* be put between the compressor and the receiver. Other arrangements *should* be made if possible. It has been suggested that the best paper on compressed air and safety would consist of the words, "Don't put a valve between the compressor and the receiver," repeated 500 times.

Both the aftercooler and the receiver should be so arranged that they will drain, that there will be no danger of freezing of water in the winter-time, and that all moisture will be trapped and removed from the system as fast as it is condensed. The receiver in most plants is placed outdoors. This gives the air a chance to cool further

by atmosphere radiation, and, since the receiver is frequently bulky, it does not occupy valuable floor space. The aftercooler should be indoors in most climates to prevent freezing.

Receivers usually have one opening near the top and one near the bottom. There is discussion, sometimes in great detail, as to whether the inlet should be at the top of the receiver with the outlet at the bottom, or vice versa. The piping usually lays out better, with less interference with passageways, etc., when the inlet is at the top, but the writer's personal opinion is that it doesn't make much difference.

All water piping should be so laid out as to drain thoroughly and to drain the cylinders and aftercoolers as well. This is a point to watch particularly in the winter-time, if there is any possibility of temperatures in the building going to the freezing point. It is easy for a cylinder head to be cracked by freezing which might weaken it enough to make the machine dangerous to operate.

A well planned system for distributing the compressed air to the various points of consumption will take into consideration the slope of the lines and the location of drop legs and drains. There should be no low pockets which are not regularly and frequently drained. Automatic traps are recommended.

Condensation

During certain parts of the year small quantities of moisture and oil may condense in the pipe lines in addition to that removed by the aftercooler and the receiver. This is due to the differences in temperature between the atmosphere and the cooling water as it may exist at certain seasons. This moisture tends to collect toward the ends of the line, causing trouble for the men using the air.

It is necessary, therefore, that the condensate be removed from the system. In many shops this is accomplished by opening a hose line and allowing it to blow for a considerable length of time before putting the line to use. It is neither a safe nor a wise practice to have air lines blowing freely around the shop to remove moisture. A proper system lay-out will prevent this.

After the installation is made, it should be dressed up with paint and the compressor

and equipment should be kept clean. Windows in the compressor room should also be kept clean, and the walls and floor should be painted.

Operation

And now we come to the operation of the plant. Having selected the proper equipment and having installed it in the proper way, we must now see that in its everyday use we do not permit anything to happen which would create hazardous conditions.

The compressor, of course, must be driven by some prime mover. It is assumed that suitable protective devices have been installed on this prime-mover and that it is installed in such a way that there will be no danger of over-speeding. Reference to various safety codes should bring out the necessary safe-guards for each individual case.

On the compressor end, we must be sure that the regulators or controls are in proper operating condition at all times. We should have no valves of any kind in the piping between the pressure regulators themselves and the vessel in which the pressure is being maintained. If there is a valve in this line, it should be a routine part of every daily inspection of the machine—particularly before starting—to see that this valve is open and the line is free. This valve should be so installed that the pressure is *under* the seat so that it cannot be closed by air pressure if the valve stem should break. Here again is a valve which should not be in the system, but is frequently found there.

It is a very simple matter to test most regulators manually, either before the machine is started or immediately thereafter, and this should be a routine part of the operator's procedure. Most air compressors unload frequently enough to keep the regulators in working condition, but there are cases where machines are used as base load machines and eventually the regulators get stuck and will not function when necessity arises. Regular daily operation by hand of the control system is quickly and easily done, as a general rule, and deserves more attention than it receives.

Steam units should be frequently checked to see that the governor does not permit safe maximum speed to be exceeded. Automatic safety stops should be tripped at least once a week and preferably more often. These precautions are often grossly neg-

lected. Running "on the throttle" should be prohibited.

Cooling water for cylinder jackets and coolers is most important. Not only should a reliable supply be used, but it should be as cool as can readily be obtained. Most compressors requiring water cooling are furnished with a valve on the water inlet to control the water used, and with an open funnel arrangement on the discharge to permit visual indication of the amount of water flowing.

The exact temperature of the water at the outlet is not of great importance, but there are certain limits which should not be exceeded even where water is expensive. A good general rule is to keep the water outlet temperature from any compressor below 120 degrees F. It will generally be found that the use of water quantities recommended by the compressor manufacturer will result in lower outlet temperatures than 120 degrees F.

Cooling water must be clean. The use of scale forming water will eventually result in a reduction in the space for flow of the water, reduced heat removal, and higher discharge air temperatures which are always a potential source of danger and trouble.

Lubrication

Lubrication of the air compressor is the most important operating item for the safety man to watch. An air compressor requires extremely little oil, but the oil should be of the very best grade and manufactured only by a reputable manufacturer and selected specifically by the manufacturer for air compressor service.

When first starting a new unit, it is wise and customary to feed oil generously to a compressor. This helps the cylinder to take on a fine polish and assists in washing out the dirt which is found in any new machine, no matter how carefully it has been cleaned out before starting.

After a few days of running with a generous amount of oil, however, the oil should be cut down until an examination of the intake and discharge valve shows that they are just slightly greasy, not dry, and not oily. There should by no means be oil lying in the valve pockets or in the air discharge passageways in the cylinder. It cannot be stated too emphatically that lubrication has

more to do with the safety of the average air compressor system than any other item.

Compressor valves are subject to extremely hard service. They open and close very rapidly and because of this must be made as light as is consistent with required strength. It is not to be expected that a compressor valve will last indefinitely. It is a part which must be occasionally replaced.

The valves should be given a regular scheduled inspection—the period between inspections being dependent upon the particular service the machine encounters, plus experience. Generally, valves should be removed every three to four months, cleaned and thoroughly inspected for any broken or excessively worn parts.

When a broken valve—and particularly a discharge valve—is allowed to operate for any length of time in a machine, the leakage of compressed air back into the cylinder during the suction stroke increases the compressor discharge temperature severely. A broken and neglected valve is also likely to be found where dirt is permitted to accumulate in the system. This dirt is likely to be oil-soaked if an excessive or poor grade of oil has been used, and will soon become baked into a hard carbonaceous mass.

Eventually the temperature may rise so high that the oil and oil-soaked dirt and carbon start to burn. They are in a dense atmosphere of oxygen and will burn rapidly. This is, of course, a very dangerous situation because if there is enough of the oil the pipe or vessel may become red hot and unable to resist pressure. Then an explosion occurs.

Air Filters

The use of air filters on the compressor intake is not only an economically sound procedure from the standpoint of reduced maintenance and longer life on the compressor and valves, but also from the standpoint of safety because clean valves are less likely to leak and cause excessive temperatures, and if they do leak for a while before they are discovered they are not dirty and there is less opportunity for anything to catch fire.

Air filters should be cleaned as frequently as may be necessary. The frequency will, of course, depend upon the location and the running time of the compressor. They should be inspected not less than once in

every six weeks, and preferably more often, and cleaned if necessary.

The air receiver is a tank and as such requires little attention other than occasional painting on the outside and inspection on the inside to make sure that corrosion is not taking place. Normally, the inside of the pipe lines and receivers will become covered with a very thin coating of oil, which will serve to protect them to a certain extent.

Safety valves should be checked to see that they are functioning and set at the proper pressure to protect the system. On an A.S.M.E. tank, the safety valves should not be set above the pressure stamped on the vessel and for which the vessel is designed.

All safety valves should be sprung by hand at least once a day to insure that they are in good operating condition and to clear them of any dirt that might lodge therein. The safety valves themselves should be designed and stamped to meet the A.S.M.E. Code requirements, and should be connected directly to the receiver with no intervening valve and as little piping as possible.

Once again it will be emphasized that it is most desirable that there be no valve between the receiver and the compressor, but that if there is a valve so placed there should also be a safety valve of adequate size between the compressor and the shut-off valve. This safety valve should be tested the same as all the other valves on the system.

An aftercooler will do more to reduce whatever hazards may exist in the operation of the average air compressor than any other single piece of equipment. It cools the

air before it passes into the receiver and pipe line, thus reducing the strain on the piping caused by daily expansion and contraction, condenses and removes moisture which exists in all air and which is squeezed out during compression and cooling of the air, condenses and removes practically all of the oil used in lubricating compressor so that in case of use of excessive amounts of oil—or a poor quality of oil—the oil can go no further than the aftercooler.

This combined elimination of high temperatures, even though the compressor may be in poor operating shape, and the elimination of the dangerous oil situation, eliminates every possible danger of explosion or fire in the system. Many plants feel that an aftercooler is a worth-while investment from this standpoint only. An additional gain through the use of aftercoolers is found in the elimination of condensed water at the system outlets which renders it unnecessary to blow off the lines before using them, and materially reduces the upkeep on air operated tools.

The question frequently is asked, "How far should air be cooled in an aftercooler to accomplish the desired results?" The answer is, as usual, a compromise between the cost and the results obtained. The compressed air industry has standardized on cooling within 15 degrees F. of the incoming water temperature. This keeps the coolers economical in size, requires a minimum amount of water for cooling, and reduces the temperature of the air to a point where most of the moisture is condensed and may be removed. The explosion hazard is entirely eliminated.

What the Safety Man Should Know About Processing Kettles

By J. D. CRAIG

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The enumeration of the many individual standards which the safety engineer should strive to establish for chemical processing kettles would constitute an imposing list of specifications. But the formulation of proper safety specifications relating to design, maintenance, operation and so on would be exceedingly difficult, if not impossible, without

extensive knowledge and a clear understanding of what is to be done in a given processing kettle under any stated set of conditions. More specifically, what does the chemistry of the operation dictate as logical safety measures? What precautions are imperative to afford

1. The greatest security to the employees;

2. The maximum protection to plant property;

3. The continuity of plant operations with quality of products?

In fact, every safety program should be formulated on these well-recognized concepts.

Too often the average chemical supervisor or operating foreman who is familiar with the most intricate chemical aspects of the operation ignores the safety angle. Instead, his attention and efforts are centered upon such considerations as efficiency, yields, costs, quality of product, rapidity of equipment turnover. The hazards of the operation often do not become apparent until actual experience with an accident.

On the other hand, the safety engineer too frequently lacks any knowledge of the chemistry of what can happen in the processing kettle should there be some deviation from the limits, as defined in the standard practice, due to causes beyond the operator's control. If he were more conversant with it, he would most likely be spared the unhappy assignment of holding the post mortem to determine why it happened. And, more important, he would be in a stronger position to introduce intelligent precautions and promulgate rules of procedure to be followed, should the process get out of control, which would most certainly reduce, if not completely eliminate, the possibility of its ever happening.

Too many safety rules come into existence after, instead of before, an accident occurs.

A more extensive knowledge on the part of the safety engineer of the chemistry of the process being carried on in the reaction vessel could conceivably be the largest single contributing factor in safeguarding the employees, protecting the plant property and insuring non-interruption of the plant operation. Instead of the operator becoming hopelessly confused and thereby taking absurd chances in his panicky state of mind, he would have an orderly course of procedure prescribing what he should and should not do in the emergency.

Design and Installation

Obviously, the type of chemical process and the nature of its operation must suggest the specific precautions and essential safety appliances required on and around the processing kettle. However, certain fundamentals

may be outlined which have a bearing on design:

1. Does the unit operate under positive or negative pressure, or at atmospheric pressure? What is the allowable working pressure?

2. What are the best materials for its construction? How thick should the walls be and how much wear from corrosion and erosion is permissible before its factor of safety is so reduced that the vessel is no longer fit for operation?

3. Is the unit to be equipped with a special lining of corrosion resisting material which, if a leak develops, would cause rapid deterioration of the main shell? Are the chemicals to be employed of the type whose activity increases progressively with higher temperatures or with increased agitation? Are proper tests conducted to determine if metals are capable of withstanding any specific reaction under conditions duplicating as nearly as possible actual operating practices, viz., temperatures, pressures, concentrations, etc?

4. Is mechanical agitation required? Recognizing packing gland problems as being more difficult with most chemical reactions than with steam, has the best possible type been chosen?

Where agitation is necessary and either pressure or vacuum is employed, an unusually deep gland packed with a material capable of withstanding the action of the chemicals involved and lubricated with a lubricant that will not easily melt or be dissolved is of vital importance. A slight leak through a packing gland could be extremely dangerous. Escaping vapors of secondary products formed during various stages of the reaction might have deleterious pathological results. A cloud of poisonous vapor could quickly affect the entire plant, whereas a similar steam release would be purely local and unlikely to have any injurious effects.

5. If a closed reaction vessel, is it equipped with the proper size manhole? To permit unobstructed entrance of an average size man equipped with a safety belt it should be not less than an eighteen inch opening. Too frequently kettles are equipped with only fifteen inch openings, making it utterly impossible for one to enter without first removing the safety belt.

6. Have proper size safety valves and other types of pressure release systems been

provided? Is the corrosive action of the chemicals or their vapors such that it would be preferable to utilize the old style weighted lever type, instead of the newer spring release type of safety valve? It is essential that the valve be constructed of material not readily corroded by any vapors or liquids emitted from the process. Serious explosions have occurred where brass safety valves have been used on autoclaves in which ammonia was liberated from the reaction. Would it be preferable to have the safety valve constructed of the same material as is used on the interior of the reaction kettle? Is the size of the valve adequate to permit instantaneous release of pressure resulting from abnormal conditions? Is it necessary to supplement the safety valve with explosion discs? A reaction carried on under vacuum may necessitate heating coils in which steam pressures range from six to seven hundred pounds. Obviously, the safety valve must release instantaneously and be capable of discharging the greatest volume of vapor likely to form, at a rate insuring a rapid decline in the initial pressure.

7. Finally, has the kettle actually been designed for the process for which it is being employed? The design of processing kettles for an operation carried on under vacuum must, of course, be quite different from those employing pressure. While this principle is so obvious, nevertheless it has been overlooked on occasions with disastrous consequences.

Only recently a large company manufacturing impregnating materials employed for electrical insulation purposes experienced an accident with two fatalities. The reaction necessitated relatively high pressures. One of the processing kettles failed, and here is what the subsequent post mortem conducted by the safety engineer revealed.

The company's business on this new product having expanded beyond the limit of the capacity of the initial installation; another unit was required. In looking over the accumulation of idle equipment in the yard, a large kettle was found which, from a perfunctory examination, appeared to be quite similar to the one already in use for this operation. Being of heavy construction, it appeared fully capable of withstanding high pressures.

When put in operation, its performance seemed identical with that of the original unit until, for some unknown reason, the

temperature got out of control. Before anything could be done, an explosion occurred, killing the operator and a maintenance man repairing an adjacent piece of equipment. It was found out too late that the kettle was not designed to withstand internal pressures, but instead was intended only for external pressure work and as such was safe for only those processes employing vacuum.

It would seem that even a layman would know not to employ a kettle designed for vacuum on a pressure reaction, yet in this instance it was done, and by a responsible company. Incidentally, the safety engineer was not consulted until after the accident.

Inspection Following Installation

The safety engineer's next responsibility should be a follow-up inspection of the installation to be sure that there has been strict compliance with the original safety standards. What are some of the things to look for in this inspection?

1. Are all exposed moving parts, such as gears, belts, pulleys, agitators properly guarded?

2. Have all specified pressure, vacuum, and temperature recording devices been installed?

3. Have temperature recording devices been so placed as to record accurately the highest temperature likely to be reached in the mass of the reaction and not merely surface temperatures, which could conceivably vary over wide ranges in comparison to temperatures in the interior of a large mass of material?

4. Have sufficient automatic controlling and regulating devices, with the proper alarms, been provided? Are the release valves and explosion discs of proper dimensions?

5. Is the ventilation stack, exhaust fan or vent sufficient to eliminate all health hazards from obnoxious, poisonous, or dust-laden vapors emanating from the reaction kettle?

6. Have non-sparking devices, such as non-ferrous drives, explosion-proof motors, and vapor-proof bulbs, been provided in close proximity to the reaction kettle in the event that volatile solvents, distillates, or other flammable materials are employed?

7. Have proper outlets been provided and are they of commensurate size to balance inlets? Sometimes it may be justifiable to

equip a reaction kettle with inlets larger than outlets, but generally it is preferable to reverse this order.

8. Finally, have all the specifications of the manufacturer of the processing kettle been followed by the construction engineer making this installation? Minor deviations from simple instructions have brought disastrous consequences.

Just recently a certain company in my city specializing in the construction of heavy duty pressure vessels was called upon to settle a claim arising from the failure of one of its units which had been provided for a special type of process. The reaction employed a wide range of varying temperatures and necessitated rapid changes. Accordingly, the kettle was equipped both with coils and an external jacket used alternately for steam and cooling water.

For a short while after the kettle was installed the process went along smoothly, but before the end of the first month an explosion occurred. Immediately thereafter a claim was advanced against the builder of the equipment on the basis of defective materials having been used in its construction. The builder's investigation revealed that the instructions which accompanied the equipment had not been fully complied with when the installation was made.

The jacket was provided with bottom inlets and top outlets. There were four such outlets so spaced as to insure the best possible circulation and distribution of the cooling water. Despite explicit details on blue prints furnished with the kettle to show how the connections should be made, the company's engineer found that actually there were three steam connections, but only one water connection.

What undoubtedly happened was that the cooling water coursed in a narrow path from the bottom inlet up one side of the kettle to the one outlet provided, with little or no circulation around the other sides of the kettle. As a result of thermal shock or crystallization, due to uneven cooling, the portion of the jacket which covered the restricted course of the cooling water failed and a narrow strip extending from the inlet at the bottom to the outlet at the top gave way when steam pressure was subsequently applied.

As is generally the case, the operator was standing directly in the path of the traveling

piece of jacket. He was not killed, but did suffer serious injuries. The manufacturer of the kettle, incidentally, did not have to honor the claim.

The all-important observation in this case is the fact that the accident could have been avoided had the simple instructions furnished with the equipment been properly carried out. Shouldn't it properly be the responsibility of the safety engineer to discover such negligences?

Routine Maintenance Inspections

Once a processing kettle has been placed in regular operation, frequent periodic maintenance inspections are essential. Again the type of the process or the nature of the chemical reactions carried on must dictate the frequency, thoroughness, and kind of inspection to be made.

1. Is there an established routine for making both internal and external visual examinations?

2. Is there a competent test engineer and is the safety director authorized to employ him for inspections and hydrostatic tests, thus placing responsibility for the safety of the operating units?

3. Is each special feature of safeguarding, such as pressure release valves, checked during such inspections and suitably sealed or tagged to prevent tampering with after it has been properly set? Is the inspector authorized to condemn units which in his judgment do not test satisfactorily, or which from visual inspections, hammer tests, internal measurements, etc., appear unsafe?

4. Is the inspector authorized to demand units for test when scheduled, or shut them down if reasonable requests are not met by operators? Also, is he authorized to request at any time a shut down of any units observed in operation contrary to prescribed procedure or regulation?

5. Finally, and of utmost importance, should there be an inspection preceding the major examination to determine if the condition of the processing kettle, in the event that it is a closed vessel, offers no hazards to the test engineer? Has the reaction vessel been properly cleaned? Have all explosive or toxic products been removed? Has it been exhausted of all obnoxious vapors or fumes and is an adequate supply of fresh air passing through it during the entire time the workmen are inside?

Gas masks should be available at all times. If of the canister type, the proper canister for the specific vapor involved should be used. But in no instance—and too much emphasis cannot be placed on this observation—should a gas mask ever be used for a deficient supply of oxygen. Too often the gas mask is considered a panacea for all gas problems, but unfortunately oxygen has no substitute for sustaining life. It is impossible to withdraw more oxygen from a canister than is entering it.

Some of you may be familiar with the tragedy that occurred in Buffalo on August 28, 1935 when several men lost their lives while attempting to clean a closed vessel. A preliminary inspection of the tank seemed quite unnecessary since only a harmless material, linseed oil to be specific, had been stored in it. The operator lowered his ladder into the tank and started down, but before he had descended many steps he fell and appeared to be lying unconscious in the sludges and sludge on the tank bottom. His helper, who up to that point had remained outside, rushed into the tank to effect a rescue. He too fell unconscious before getting even half way down the ladder.

Tension was then so great that an emergency rescue squad of the police and fire departments was called. Immediately upon arrival, and without a further inspection of any sort, the captain directed one of his assistants, equipped with the latest type of gas mask, to enter the tank and to everyone's consternation he too suffered the same fate as the workmen who had preceded him without gas masks. With two men lying motionless in the slimy muck on the bottom of the tank and seeing his own officer pitch to the bottom, gas mask and all, when only a few steps down the ladders, the captain decided on drastic action and made ready himself to enter the tank to rescue his co-worker.

Fortunately, he took one further precaution and wore, in addition to his gas mask, a safety belt. He fared no better than the others who had preceded him down the ladder, but by means of the safety belt was hauled out and rushed to Emergency Hospital where he was finally revived. The other victims were removed by means of grappling hooks but all efforts at resuscitation proved futile.

The city chemist, the coroner, and the health commissioner were next to arrive on

the scene. To ascertain, if possible, what the mysterious deadly vapors could be against which gas masks apparently afforded no protection, samples of the atmosphere were taken and exhaustive analyses of the most intricate nature were made in an attempt to isolate the poisonous constituent causing these fatalities. After extensive researches, public investigations, inquests, and much newspaper publicity, someone suggested that possibly there was an insufficient supply of oxygen in the tank. The hunch was readily confirmed by the most simple kind of gas analysis.

The explanation in this instance for the deficiency lies probably in the fact that the linseed oil, being a drying oil which absorbs oxygen from the air, had exhausted the oxygen inside the closed tank. As an ordinary manhole was the only opening, there was no means of circulating fresh air. The simplest kind of preliminary examination would have prevented the sacrifice of several lives by revealing that the air in the tank was so depleted in oxygen that human life could not be sustained therein.

Must Know Chemical Aspects

The foregoing questions are not all-inclusive, but rather merely suggestive of the kind of approach the safety engineer should make in formulating the safety standards to cover any particular set of operating conditions. To make definite recommendations or direct answers to any of them is impossible without first having a thorough and clear understanding of all the chemical aspects of the process to be carried on within a given processing kettle, whether it be the simple open mixing vat or the massive autoclave capable of withstanding pressures of twenty thousand pounds per square inch.

Without such knowledge, how can the safety engineer possibly determine what is needed, especially if during the process certain materials to be introduced in the unit are

1. Corrosive, such as acids or alkalis;
2. Erosive, such as metallic particles, iron filings, etc;
3. Flammable, such as some of the more volatile hydrocarbons;
4. Poisonous or otherwise injurious to one's health.

Frequently trouble arises, not in connection with the regular process, but rather

from some obscure side reaction occurring when the temperature or pressure gets out of bounds. Such contingencies should always be anticipated to the extent that appropriate chemical controls and checks can be instituted. To cite another actual experience would, perhaps, be the best way to illustrate the kind of disaster that can result from neglect of this important angle.

The laboratory of a large chemical manufacturing company perfected a process to manufacture a complex, organic compound, in the course of which a series of intricate reactions took place successively in the pressure vessel. When the process was inaugurated on plant scale everything seemed to be operating smoothly and its behavior appeared to be quite identical with what had been observed in the laboratory. The first step had been completed and the temperature was being increased prior to addition of further chemicals required in the succeeding step. Then, without warning, there was a terrific blast, the equipment was demolished, and the research chemist, who had developed the process in the laboratory, and an operator lost their lives.

The usual post-mortem investigation followed. Ultimately it was found that in the large plant size batch the temperature mounted considerably higher, because of the greater mass of material, than had been the case in laboratory experiments. At this higher temperature certain side reactions occur which are quite normal within such temperature ranges. The result is the formation of an explosive compound, a dinitro derivative, a sort of first cousin to T.N.T. If the temperature in every part of the reacting mass can be confined within the limits as employed in the laboratory there is no possibility of this explosive product forming. But if it is allowed to form and is subsequently subjected to the higher temperatures employed in the later stages of the process, its own instability makes an explosion inevitable.

Following such a catastrophe everyone was eager to work with the safety engineer. The final solution, from the safety angle, consisted of additional laboratory analyses. Immediately preceding the step when the blast occurred, a sample of the intermediate product is now removed from the autoclave and an analysis made to determine to what extent, if any, there has been any formation of this dinitro derivative. If it is present in

quantities in excess of one or two per cent, the entire batch of material is consigned to the sewer. To continue the operation with any appreciable amount of this impurity present would unquestionably bring a repetition of the first unfortunate experience.

After all, it should be the safety engineer's responsibility to see that the process has been carefully described in writing by its author and approved for safety by a competent individual, or individuals, under his direction. At the same time all risks attached to the process should be considered by him and appropriate precautions instituted.

It should be his duty to see that capable, well-trained operators and supervisors are in charge of the process, particularly if it is hazardous. In short, he must possess a comprehensive knowledge of all the chemical reactions in the process, or physical changes which could occur. Otherwise how can he know that appropriate protective measures have been taken?

There is a long list of ascertainable facts which the safety engineer must have available if he is to do constructive work. Where only a limited number of processes and a few reaction kettles are involved, the problem is not so complex as in the case of the large chemical manufacturing plants where there may be literally thousands of processes and hundreds of different pieces of equipment. In plants of the first type, the scope of the knowledge required may be such as to make it easily possible for one man to handle the safety problems of the plant. In the latter instance, it would be an exceedingly heavy assignment for one man to master everything that should be known about the chemical processes carried on in that plant, to the extent that he can intelligently direct a safety program. In such cases, it would appear expedient to expand the safety man into a safety board or conference group.

The membership of such a board might comprise a competent engineer from the construction division; a chemist from the research laboratory; an operating man; a maintenance man; and a representative from the department with which the safety problem is concerned; the entire group to be headed by the safety engineer.

Since the responsibility of such a safety board would be great, it should have proportionate authority to carry out its

regulations. In a way, it might tend to decentralize safety responsibility, which, under certain circumstances, would be desirable—for it would tend to promote a different kind of safety consciousness right down the line, which after all is a most desirable objective.

When the safety problem becomes too extensive and complex, reaching beyond the bounds which one individual can normally be expected to control, there is a tendency not to go far enough below the surface, into the fundamentals.

Points discussed in the session on pressure vessels included the following:

How often should steam lines be inspected?

In general, for ordinary purposes, three times a year should suffice.

What can be done to insure the safety of steam lines which are in constant service? Must these be taken down?

No, regular routine inspection methods

now in use should indicate when a line is becoming unsafe.

Sometimes an experienced welder with high recommendations turns out a job that proves unsatisfactory or even dangerous. How is it possible to guard against this?

A welding job should be supervised constantly to insure consistent work on the part of the welders. Samples should be taken from time to time. Workers should know that this is being done, so that they will be on the alert and trying always to do the best job they know how.

ADJOURNMENT

Safety Fundamentals

TUESDAY MORNING SESSION

October 12, 1937

The panel discussion on Safety Fundamentals was held Tuesday morning, October 12. The session was called to order by D. D. Fennell, Consulting Engineer, Chicago, and Vice President for Public Relations, National Safety Council, who presided and directed the discussion.

Panel participants were: E. K. Alexander, Safety Representative, Texas Empire Pipe Line Co., Tulsa, Okla.; P. J. Brand, Director of Safety, Pullman-Standard Car Manufacturing Co., Chicago; C. H. Dinsmore, Director of Safety, Wisconsin Power and Light Co., Madison, Wis.; E. C. Hild, Safety Department, Iowa Nebraska Light and Power Co., Lincoln, Neb.; D. F. McMurchy, Director of Safety, Tennessee Valley Authority, Knoxville, Tenn.; Ralph W. Pendleton, Secretary, Massachusetts Safety Council, Boston; and J. G. Polm, Safety Director, The Goodyear Tire and Rubber Co., Akron, Ohio.

CHAIRMAN FENNEL: Yesterday I sat in a meeting with a group of mechanical engineers, who believe that a new approach ought to be made to the industrial safety problem by taking it all to pieces and examining the works, trying to find out what has been making it go and what would make it go better.

There is something intriguing in the very suggestion of safety fundamentals. Our first subject today is, "How can unsafe conditions be uncovered?" The subject will be discussed by Mr. C. H. Dinsmore, Director of Safety of the Wisconsin Power and Light Company of Madison, Wisconsin.

C. H. DINSMORE: I will give you some of the experiences in our own company. We have a system set up whereby a committee is responsible for the discovery of unsafe conditions and practices. Our organization covers some 15,000 square miles of territory, a good many thousand miles of transmission lines and distribution. In that area we have our generating plants, our substations; we have our gas plants and water plants, hydro plants—just a typical, operating utility company.

This large area is divided into 14 districts, and the various districts are sort of little companies within themselves; each has its own organization. Now, in each one of those

districts we have an investigating committee that is elected by all of the group.

It is the duty of this committee to investigate every type of accident, employee accident, public accident, automotive accident, or traffic accident. I say automotive and traffic because we separate those; when we speak of automotive accidents we are talking about our own equipment, and when we speak of traffic accidents, those are the accidents that happen to other motor vehicles not owned by the company.

Of course, before you can investigate an accident, you must have accident causes. So this same committee serves as an investigating committee to discover unsafe conditions and practices. One of their means of investigation is to provide every employee, whether it be man or woman, lineman or clerk, with a report form which is addressed to the chairman of this committee, and begins like this: "I wish to report the following unsafe condition or practice." He writes down what it is, signs his name to it, and passes it to his foreman. If it is something that the immediate crew can take care of in their maintenance work, it is done; then the report form is passed on to the general committee. But if not, the report form is passed into the committee by the foreman, and at the Monday morning safety meeting of the

proper group, the condition is there discussed. Before the general safety meeting held in that district within three weeks' time, some disposition has been made of this unsafe condition.

Let us assume that an employee has reported that in a certain substation there are a number of oil switches which are obsolete in type, but it would involve the expenditure of \$30,000 to get new equipment. If some of your companies are like ours, we can't go out and spend \$30,000 every time an employee thinks we need something. But he must be satisfied as to why we are going to continue with that type of equipment, so it is then up to the investigating committee. They may have to go to their manager, or they may have to come to the general office to get the answer to it. What I am trying to say is that the employer who has reported the unsafe condition of practice must have his answer, and everybody in the circle of his group must know how that thing was disposed of.

We try to get the idea across to our employees that if you have once discovered an unsafe condition of practice or hazard and report it, you have set in motion machinery that will eliminate it. The exposure in our company is that we have very few accidents where known hazards exist.

I would say, then, to discover unsafe conditions and practices, you must have a carefully planned program. Our program is a committee. In addition to that committee we have, of course, our regular inspection committees and regular patrol reports that are turned in, patrol of transmission lines, patrol of distribution lines, patrol taking in substations, patrol of plants, patrol of underground work, and so forth. All these reports are available to the committee that must act, and I can assure you that when that committee fails to act, there is considerable razzing from the entire group because they don't get their answer.

Where something cannot be taken care of because of some economy program that might be on, it is kept open until it is taken care of.

CHAIRMAN FENNEL: Mr. Dinsmore's talk will now be discussed by Ervin C. Hild of the Safety Department of the Iowa-Nebraska Light and Power Company of Lincoln.

E. C. HILD: Before our workmen can do their work safely, they must have safe equip-

ment. Many unsafe conditions can be eliminated at the time your engineers make their equipment purchases. At the time of the installation your operators may find some hazards that weren't discovered by your designer. If so, those conditions should be corrected. If they even slip through your operator, then your workman comes next. And only through training that particular man in what unsafe conditions actually are, will you be able to eliminate that condition before you have your accident. We are interested in preventing that accident.

I recall a case where one of our employees had an accident. He dropped a six-pound weight on his toe and fractured it. We asked him why that unsafe condition had been permitted to exist all these years in a brand new plant; and he said that he didn't design the plant, and wasn't paid for the safe design of his equipment. We had lost an opportunity to make that employee co-operate with us in the work for two or three years.

We discussed safety with him, and in the same conversation he uncovered three other hazardous conditions that were, of course, immediately corrected. That employee now feels that he is one of the regular safety employees.

RALPH W. PENDLETON: Periodic inspections are wonderful but I think they could be a great deal better if occasionally they are done by a rank outsider, somebody who is not familiar with the plant itself. Somebody who knows what safety is all about, what accident prevention is, can find things that we are stepping over each day. We ought to collect a great number of suggestions in our inspection work, and then, after we have collected them, we should grade them, according to their merit, A, B, and C. Let us tackle the A's first and then the B's and then the C's.

CHAIRMAN FENNEL: The other night I sat in a meeting with about four hundred men who were celebrating 1,005 days of no lost-time accidents in their plant. The problem of this group was, how could they maintain that very happy condition? I told them they should start in right the next day and resurvey the entire plant, looking meticulously and searchingly for anything that might possibly constitute a hazard. They might find a ramp with a broken plank. They might find a floor that had grown slippery,

or a tread with the surface worn off. But I certainly knew if they went through that plant searchingly they would be bound to find a lot of things that might constitute a hazard, and the beautiful record might be broken because they had failed to detect that thing.

So the program, then, was to make a study of their entire plant. As a matter of fact, before the meeting was over a committee was appointed to start in on that the very next day. Remember, there are no little things in safety.

MEMBER: The gentleman spoke about an outsider making an inspection of a plant. What is wrong with our factory inspectors? Aren't they reporting unsafe conditions that they find in going through a plant?

MR. DINSMORE: After all, there are just certain things that these outside, bona fide inspectors are looking for. That is without taking anything away, of course, from the importance of their jobs. It is more or less of a routine, and they can't look for some little thing that some fellow might stumble over. If there is something the matter with the equipment, if we lack a proper pad in front of a switchboard or something of that kind, proper clearance or something else, they will discover that, surely.

CHAIRMAN FENNEL: Our next discussion will be "What constitutes a good safeguarding program?" It will be discussed by Ralph Pendleton, secretary of the Massachusetts Safety Council.

RALPH W. PENDLETON: I asked Walter J. Brennan, Safety Engineer of the Maine Department of Labor & Industry, about this particular question, and he said to me, in no uncertain terms: "More ill will has been bred by an ill advised, poorly designed safeguarding program than any three other phases of the work."

He said, "In the hundreds of mills that I have been going into the past several years, 80 per cent of the workmen feel that safety is simply guarding the machinery, the moving machinery. They believe that that is all there is to a safety program. The only time you hear about safety is when the company has some point-of-operation accident; somebody loses a finger or a hand. Then that company goes to work on an intensive safeguarding program, and you don't hear about safety again until something else happens."

I believe that in a safeguarding program you must use common sense. We must consider the three essential factors, men, machine, and materials. We must analyze our problems, our specific hazards and our general hazards from those three angles. Having done that, our safeguarding program must be compatible with the plant purse, with the mechanical force available, and with the particular process or hazard that we have to do with.

Today our machines are coming in with accident prevention taken right from the blue print, starting right from there. Of course, that is our engineering approach.

CHAIRMAN FENNEL: Here is a case record. A short time ago I was able to have a very large company put on a safety program, employ a safety director and proceed to put the plant in safe condition. Unfortunately, when a survey was made of the entire plant to detect hazards and to build up corrective means, the company decided that the cost was entirely too high for the time being. They wanted to spread it over three years of time.

In the six months after a purely educational safety program was put on, a 35 per cent better record was made than for the six months of the previous year. But within two months after that one man was killed in an elevator accident because of improper control of doors; and two days later a man was killed in a tempering oven explosion because a relief door to take care of those explosions would have cost about \$200 to put on. There the record of the six months was spoiled. Frequency led into severity and two men were killed within that length of time.

I quite insist that modern safety practice calls first for the correction of all hazardous conditions and the proper guarding of machines.

Now we will hear from Paul Brand, Director of Safety of the Pullman-Standard Car Manufacturing Company of Chicago.

P. J. BRAND: I want to emphasize maintenance, on top of what has been said, and the need for including safeguards on machinery that is purchased. It seems to me that safeguarding today differs very little from that of a good many years ago when the National Safety Council set up standards after thorough study.

I am always glad to go back, review those

standards and fr-shen up. I think that is the point in a good safeguarding program, to establish your standards, make them as uniform as you possibly can, and maintain them in good condition. About 80 per cent of safeguards in certain plants aren't the proper type that go along with good safeguarding. Uniformity is certainly important in this work.

MEMBER: Mr. Pendleton seems to wish to leave the impression that manufacturers of machinery build into their designs practically all the safety that is necessary. I would like to challenge that statement.

CHAIRMAN FENNELL: Let me offer this suggestion: When the management buys machines without the proper safeguarding, they are just immoral; that is all. Any machine that can have safeguarding built into it should be purchased in its entirety, and if it is not there, the machine shouldn't be purchased.

MR. PENDLETON: I agree that when ordering our equipment, we can quite frequently save our company grief and money by considering the safety factor at that time, rather than waiting until later when we will have to build certain guards to protect our people.

Of course, safeguarding standards vary in the states: what is compulsory in Massachusetts may be perfectly all right in Connecticut or Rhode Island.

I still insist that it is Utopia when we can have that thing considered at its source and have the safeguarding done before we get the equipment, as long as we are buying it new.

MEMBER: Unfortunately, price continues to be an important factor in all purchases.

MEMBER: If your purchasing agent is on the job, you will get properly guarded machinery.

J. G. POLM (The Goodyear Tire & Rubber Co., Akron, Ohio): Any of us who don't have something in our standard purchase contract, when we are buying a piece of equipment, to tell a supplier that that piece of equipment must meet the requirements of the state law where it is to be operated, is out of line.

MEMBER: Let us take an actual case. Let's say we are ordering a simple punch press. Should we demand that the manufacturer equip that punch press, say, with any one

of three types of guards, the hand type, cage type or jerk-back type? Should we specify those? Should the manufacturer provide that machine with any of those methods?

CHAIRMAN FENNELL: We certainly ought to find out about it and, if he is not able to do it, get the guard that is available and either put it on ourselves or see that it is put on.

MR. PENDLETON: I know of a particular company that is saying to the manufacturer, "We will buy your punch presses providing you can equip them with the electric-eye guard." When he gets it down to a certain price, this particular company is going to buy twelve of them. The manufacturer is trying to see how he can work out the thing.

CHAIRMAN FENNELL: We will go to the next subject, Donald McMurphy, of the Tennessee Valley Authority, from Knoxville, Tennessee, will discuss "What are the best ways to keep and use accident records?"

D. F. MCMURPHY: I think one of the fundamental considerations is, what objectives do you hope to reach through your safety program? Are you trying to comply with certain laws, or are you trying to install in your plant a practical, workable safety program by which the majority of accidents will be prevented? I might even say, the great majority, because it has been the experience of industry for over thirty years that about 98 out of every 100 accidents are preventable.

I don't believe there ever has been an accident for which there was no explanation. We can take all of the conditions and circumstances under which an accident occurs, duplicate them, and have another accident. That same set-up will produce accidents anywhere in your plant, in ours, everywhere.

An accident prevention program is a program that involves an analysis of those causes, an orderly approach to the elimination of those mistakes in your processes. Whether they are of a mechanical nature or an otherwise physical nature, or whether they are human failure, they are mistakes. Whether or not they result in any injury, they are still mistakes, and they are things that any well organized plant will try to eliminate.

How do they proceed on such a basis? They can't do it effectively from personal observation. They will have to do it from a very complete record of the mistakes that

have been made. All of the conditions that have surrounded accidents in the past, if arranged and studied and analyzed, will disclose to those who have the job of eliminating them, where they are to look for their troubles. It may show this point of operation, that scaffold, that floor condition, that stairway, that elevator, this unsafe practice, or that type of man on that job won't work.

A very simple parallel to this accident prevention program is followed by the public health authorities in the control of communicable diseases. A simple illustration: There is an outbreak of typhoid fever in a little community, a dozen cases or more. The doctors immediately get the history on every one of these cases. "Where have you been swimming? Have you been drinking water from any well or from an unsupervised source?" Questions of that kind, when answered by all twelve of them, usually develop one source of that infection. The prevention then is a means of controlling that source. That is a very simple approach to the control of communicable disease.

Accidents, unfortunately, happen from an infinite number of circumstances and conditions, and combinations of them. The problem is vastly more complex. But by a systematic approach to finding the sources of accidents in your own plant and by directing your control measures towards those sources, you approach your safety program in a very logical manner.

CHAIRMAN FENNELL: J. G. Polm, of the Goodyear Tire and Rubber Co., will discuss Mr. McMurphy's talk.

J. G. POLM: There is one point in connection with record-keeping. It is very easy in a large organization to build up a wealth of information that does not mean anything in the future. The first thing you know, you have duplicated a filing system here and there, and, after it is all done, it is never referred to. You don't have anything except a lot of lost time; you don't build it up to use it.

In our organization we make the original or hospital entry, when someone comes in for treatment, serve several purposes. We use a regular duplicating pad system, making five copies. You probably wonder where all of those five copies go. Only two copies are actually filed. The minute that entry is made in the hospital, one copy goes in the mail basket and out into the shop to the super-

vision in charge of that particular area, so that they can contact that worker within the next hour or two, if he has gone back on the job, and see just what was wrong.

It is strictly up to the supervision to correct that particular hazard if there was one involved, whether it was the human element or whether it was a machinery set-up. There are very few of these individual records that actually come to the attention of the safety department. We depend entirely on the co-operation of the nursing staff in making the entries, and in selecting and accumulating the few that we will be particularly interested in.

The other copy goes to the central filing system in the labor record section so, if you have to handle that individual some time in the future, you can easily have laid out all of his injury records.

As far as any other records are concerned, we just don't keep them in our picture except to establish our cases from a compensation angle. Of course, we do build up statistics to compare our figures with the rest of the field and with the National Safety Council.

From our smaller plant units operating outside of Akron, we don't demand anything in Akron except on the serious cases. Our management has always held that the safety of an individual worker is entirely up to the supervision that he is working under. From a safety department angle and a build-up of records, we have no use for accident details, except to let the individual supervision know that we know something has happened in his organization and it is pretty well up to him to straighten out the situation.

CHAIRMAN FENNELL: I wish some of you would tell us what use you make of your accident records. Statistics are utterly useless unless you do something with them when you get them.

MEMBER: In our company we keep two kinds of accident records: One, the record which is for the claim department, the legal part of the accident. The other is a cause report which we use for analyzing accidents and for accident prevention.

That report helps us to measure our accident prevention work. Through it we can measure just to what extent the company is progressing in accident prevention, to what

extent management is backing up our program, and to what extent we measure up in comparison with other industries. It helps to keep us on our toes. Also, we can measure what departments are doing by studying their records, one against the other. If one department's accidents are beginning to mount, by comparing that department's work with other departments, we can usually find some solution.

Down in the department, they keep the same records, and the department head measures the activities of the different divisions. If the division heads are not performing as the department head thinks they should, if the supervisory force is not following through on accident prevention, the department head has the facts right in his hands.

Then, again, the divisions can measure their supervisors' activities; the supervisors can measure their foremen's activities. The foremen, in turn, can measure the individual workman's activities. Our records are kept on every man in the company. At any time we can tell you the record of any man, from the standpoint of a workman, on any foreman from the standpoint of a foreman, any supervisor from the standpoint of a supervisor, division head, department head or, as far as that goes, the company itself.

MEMBER: I am not going to tell you what our records do, but what I wish they would do in the petroleum industry. I will just cite one instance.

I have a friend here this morning who has a rather severe headache. If we had an accident form on his case it might show that he was up pretty late last night, and it might have something to do with the beautiful lady he was with, and we might stop there. Who would have the temerity to mention in our record that a special entertainment committee had arranged for these beautiful ladies, knowing the frailties of safety men? That is in a light vein.

But here is what I am getting at. Do we have provisions in our records to get at the fundamentals of accidents? Do we go to our manager and say, "Here is a certain type of swing line that has been found in one of our refineries. You put pressure on the dented thing and it knocked a man's blooming head off?" Is that swing line a cause? Is that a fundamental of safety, or is that still only part of a symptom, part of the diagnosis? I would like to get into our rec-

ord some place how we can go beyond those symptoms. The final cause of the thing may go into personalities sometimes.

CHAIRMAN FENNEL: Mr. McMurphy, will you answer the question?

MR. McMURPHY: In my organization we try to eliminate duplication of effort. Is there any particular reason why your compensation record of an injury could not carry the essential cause information? There is no reason why the original report of accident cannot be made a complete one, rather than to have the compensation unit make a report and then have the safety unit come in, investigate it and make a parallel or a duplicate report. Certainly, if a clear, concise description of the manner in which that accident occurred were given to the compensation agency, the question of passing or handling that claim would be greatly simplified. There would be a minimum of supplemental investigation to find the facts.

MEMBER: In large utility companies we usually have two forms of accident reports. One reason is that the accident report must go into the claim department immediately, and it carries facts surrounding the accident and much information with which we in accident prevention work are not particularly concerned, in regard to history, dependence and such. The cause report requires a great deal of study in our company. It sometimes requires a week or two before that cause report is completed, and it may cover many sheets of paper carefully written up. The claim agent isn't particularly interested in all of that information.

MEMBER: You often find in fatal accidents that a man has never been in any other accident. How are you going to reconcile the keeping of records in that particular case?

MR. POLM: This particular point is a difficult one to cope with in an industrial organization. For instance, you have an old employee who has been doing a certain operation for seventeen or eighteen years. He has always been recognized as a safe worker. You have nothing in your files to indicate that there is anything else in the picture except a safe operator. Then all of a sudden he loses a finger. It may be impossible to find out why that particular thing happened. The point is well taken. I too am at a loss to understand this type of case.

M. D. KOSSORIS (U. S. Bureau of Labor Statistics, Washington, D. C.): I would like to tell you about a standard method of analyzing accident causes which is now in preparation and should be out early in the spring. This is an attempt to standardize the analysis of accident causes, in which several agencies participated.

The cause code proceeds on the basis that most accidents result from one of two causes. There is either an unsafe act or an unsafe condition of equipment or machinery. The point is to determine what was basically at fault in the accident.

The cause analysis breaks into six parts, each of which can easily be taken care of on a relatively simple form. The first point asked is, what is the agency or object most closely connected with the accident? If the man slipped on the floor, then the floor is the object. If the accident happened because a man got his fingers caught in a punch press, then, of course, the punch press is the object; and so forth.

The second point, what part of the equipment was involved? That, of course, primarily applies to machinery. Is it transmission apparatus, gears? Is it at a point of operation, or what else may it have been?

The third point is, was an unsafe act committed? Was the man exposing himself unnecessarily to danger? Were boxes and so forth piled unsafely? Was there grease on the floor? Did the man operate equipment without authority? Did he remove safeguards, or whatever else it may have been?

The fifth point concerns the question of material or mechanical defect. Were the tools the man used in any way defective? Was the machinery unguarded?

Sixth, the man's personal make-up, or the personal defect, so-called. Was the man unfamiliar with English, for instance? Did he have poor eyesight? Did he have bad hearing?

In other words, the cause code is getting at three things. Was there anything materially at fault with the way the man did his job? Was there anything the matter with the man himself? Third, was there anything the matter with the equipment or tools with which he was working?

That particular cause analysis will be tested out before very long in one of the states where it will be used on the accident

report form which must be made to the Workmen's Compensation Board.

The reason why the Industrial Commission is going to do it on that basis is precisely that given by Mr. McMurphy, that the question of fault is immaterial on the Workmen's Compensation Act; what we are trying to drive at is causes of accidents, not how the man got hurt, not what the cause of the injury was but what the cause of the accident was that brought about the injury.

Incidentally, the U. S. Department of Labor is putting that same information in a manual, which will be suggested to industrial commissions of states. I think before very long you can get that same sort of information from the Department of Labor.

MEMBER: In my opinion, we have too many records. What is the attitude of the man in the plant with regard to the record? Last week I happened to notice a man walking around the plant, limping. I said, "What happened to you, Joe?"

He said, "Last Friday a plank dropped on my foot."

I brought him into the first aid room, took a picture of it, and he had a broken bone in his foot. I said, "Why didn't you come in, Joe?"

He said, "I didn't want to get my name on the record."

Of course, I went out and tried to find out what was wrong. The man did not want to come in because his name and number were taken. He didn't want us keeping a record of the number of times he went to the first aid station.

It is all right to keep a record if a man has a permanent disability or loses a finger, but where we go to the extent of, every time a man comes in, asking him how he did it and why he did it, he is going to keep away, and he is not going to take care of that thing.

MEMBER: It is a matter of organization and personnel training. We keep records on all accidents, whether they result in injuries or not. We find it is very profitable, and our men are one hundred per cent for it. I just wonder where the foreman was that allowed that man to walk around limping.

MEMBER: Our company also makes a record of every injury, regardless of how slight or how great. We find we get very good cooperation from the men in reporting all

injuries, if they are properly taught the cost of an accident to themselves. You know, it costs a man to have an accident. I found that out by experience on myself. It has cost me in the neighborhood of \$20,000 in salaries in the past ten years for the loss of three fingers on my right hand.

You will find that, if the men realize the cost of an accident to themselves, forgetting the cost to the company, they will be willing to report every injury, regardless of how slight.

MEMBER: I have just one more thought on this man's experience, because it parallels, to some extent, the experience we have had. I have a strong suspicion that, if you were to go back to that department and talk to that foreman and his men, you would find that the foreman is using those reports turned in by the dispensary, to ride the individual. When you do that, you are defeating the whole safety program. You will discourage men from coming in. Sometimes records can be used in that way, to advantage; but if you do it regularly, particularly through your supervisory force, you are going to kill the whole thing.

MEMBER: Mr. McMurey suggested that one character of the record, which we want to use for analysis of the causes of the accidents, might be incorporated in the dispensary record. That is an unwise thing to do. Organized labor has, in a number of instances throughout the United States, made a great point of keeping secret, as the physician does, information regarding the individual medical record with respect to any accident that occurs. We respect those wishes on the part of workmen, and would not under any circumstances broadcast to the mechanical organization possible future developments in the curative processes following an accident. The records might disclose features of man's personal condition which might leave a permanent reflection against him in the organization. Legally it has been maintained that you may not do that.

CHAIRMAN FENNEL: Now we come to the subject. "What is safety education?" and I have tied it to another subject which seems to be quite the same thing: "How can the principles of safety education be applied to the man on the job?" I have asked Mr. Polm to start this discussion; and following him, Earl K. Alexander, Safety

Representative of the Texas Empire Pipe Line Company.

MR. POLM: Safety education is getting across to the individual on the job the way you feel about the situation as a safety director. The thing loses force as it passes through many hands, and you finally find you have trouble on the line. Safety education is much easier to approach where the unit is small. In a large plant it may be a pretty tough proposition. A person can take advantage of the bulletin board service.

We have tried to approach the individual workman on an appeal basis, not with what you call payroll inserts, but pretty much of an educational build-up on a series of six or seven individual weekly cards, where we want to clean up a situation in a particular spot.

We have these cards run off with terse sentences on how much an individual should value his eyes, for instance, if it is an eye problem, or how much he should value his feet, if it is broken toes. One that is outstanding right now relates what our good friend from the Pullman Corporation does in his particular organization, saying that a man wears his goggles in this particular area or he doesn't work in that particular area.

I think most of you will bear me out that it is pretty difficult, with labor as it is today, to use the tactics that were used fifteen or sixteen years ago, and say, "By God, you do this or else." You have other factors in the picture today, and you have to make a build-up.

Our build-up on this eye story is built up pretty well from prepared material such as National Safety Council Safety Instruction Cards. We pick out a series of six or seven, running them along in sequence, so that this individual workman will receive them once a week. If you have a series of six or seven, by the time you are down to the sixth or seventh one, about 90 per cent of your cards are kept, put in the pocket and carried home.

When you finally come to the last card, you can give the individual a short summary and then lay out your safe practice, giving supervision and the individual workmen the time to get set on the program.

We also have our house organ or employees' magazine, and that is a very good approach.

One good spot from an educational angle

is the first aid attendant. If the approach of the attendant is right, and if the patient is courteously handled, that person has a chance to get in some good work for you on an educational basis.

In large organizations particularly, you have to be pretty darned good to get your story across to 16,000 or 17,000 people, when you can't sit down across the table and talk to each one of them individually. If the story goes through six or seven or eight hands, the problem is far more difficult.

E. K. ALEXANDER: I think safety education is trying to get every employee and his family safety conscious. To do that, we started with first aid training. We followed that with bulletins posted regularly on the bulletin boards and in the periodicals which the company furnishes. We have all kinds of safety items, safety information. The accident records are analyzed in such a way that the men will see what are the most hazardous jobs. I think our men are going to report all of the minor accidents as well as any more serious accidents when they become safety conscious.

At all of our locations we have a safety inspection committee. It meets regularly. Each committee member handles all the detail for one day each week. He starts out at eight o'clock in the morning, punches the time clock, and looks on the post for orders or goes to his foreman for orders. In other words, he goes through every detail during that day. For instance, he has to climb a

stole to gauge a tank. The rest of the men in that committee have the privilege of asking him what condition that stole was in, was it loose? If it was, why wasn't it reported?

We feel that will get results on these definite rules that the company have but have become sidetracked. It gives each man a chance to find out what these definite rules are and what they can do about it.

MEMBER: Is there a cooperative program on safety education between the safety men in industry and the labor unions? That might help the workers.

MR. POLM: That is in the picture already. In February, 1936, when our plant was closed for a period of five or six weeks, one of the first committees organized after we opened up was a safety committee of five men. They meet with me once each week.

We have an operating procedure whereby a complaint on the part of an individual must be presented to his supervision, and it is up to the supervisor to act. If the individual workman disagrees with that, then he takes his complaint to his Goodyear local safety committee, and I then come into the picture. As a general rule, I have already passed an opinion on the problem by the time it comes back to me through the labor organization.

You might think that that entails a lot of handling, but it really doesn't. For instance, in two years I think we are up to Complaint No. 36 or 37.

ADJOURNMENT

Safety Inspectors

FRIDAY MORNING SESSION

October 15, 1937

The session was called to order by F. R. Vacuum Oil Co., Inc., Detroit, Michigan
McLean, White Star Division, Socony- who introduced the speakers.

How to Inspect a Factory Elevator for Safety

By K. A. COLAHAN

District Engineering Manager, American Mutual Liability Insurance Co.,
Philadelphia

Some states maintain rigid control over the types of elevators installed as well as over the maintenance of elevators already installed, while other states have displayed no interest and have set up no requirements whatever. Under such circumstances, it is to be anticipated that many so-called elevators, especially those not of recent installation, carry potential operating hazards, requiring frequent and thorough inspection. This is particularly true of the so-called "factory elevator," which normally we look at as being a "freight elevator," not intended for the carrying of passengers, but frequently carrying "factory employees."

Since the purpose of inspecting an elevator is to determine its condition, both from a mechanical operating as well as a safety standpoint, it is logical to consider the safety of the individual making such an inspection.

Loose clothing should never be worn while such inspections are being made, and particularly loose blouses or shirts with flapping sleeves or trousers with outwardly turned-up cuffs should not be permitted.

Numerous accidents have occurred to elevator inspectors because of improper clothing.

It is perhaps unnecessary to suggest that the inspector should be alert at all times, and should watch for and avoid any projections into the hoistway. Extreme care should be used when on top of the car, so that there is no possibility of being caught between the

car top, and the overhead beams or structure. The person operating the car, during the inspection, should be clearly and plainly informed and directed. When inspecting equipment located in the pit, extreme care should be used in avoiding the descending car and in watching the counterweights, as well as those in adjoining hoistways.

In all elevator installations, there are three important divisions:

- The Elevator Machine
- The Elevator Car
- The Elevator Hoistway

The first step should be the operating of the car several trips up and down the hoistway, noting particularly the brake action, and the acceleration and retardation of the car at each stop. Any excessive brake slide should be especially watched for. If the car is operated by a car switch, the condition of the latch locking the operating handle in neutral position should be examined. If the operation is by a hand cable or shipper rope, it should be noted whether broken wires protrude, whether a centering rope is provided and properly adjusted, and whether the locking device and stop halls are in proper position.

In the event of an emergency switch being in the car it should be noted whether it is properly protected and a careful check-up should also be made of the condition and action of all hoistway entrance gates or doors and especially electric contacts or interlocks

where these are part of the equipment. The car covering should be examined to see that it is sufficiently secure and rigid for its purpose.

The car gate or gates should be examined and it should be observed whether there are dangerous projections in the hoistway. The condition of the elevator car floor should be examined.

Sufficient light, either natural or artificial, should be provided. An examination of the car enclosure should terminate the inspection made within the car itself.

Inspection from Top

The next step is the inspection from the car top. There should be an operator who has been thoroughly instructed with regard to his actions during the inspection. From the top of the car, all counterweight through rods and fastenings including cotterpins and locknuts should be examined as well as counterweight oil buffers where these are in use. The counterweight cable fastenings should be closely examined, particularly with reference to broken wires or possible loss of lay. If cable clamps are used, it should be made certain that the bolts are tight.

An examination should also be made of the cable fastenings on the car crosshead, and any variation or lack of tension in cables should be observed. By moving the car two or three feet at a time, the greater portion of the counterweight traction and governor cables can be thoroughly checked.

This examination on the top of the car should include the governor rope releasing carrier, to determine its freedom of operation. It is essential to determine that the releasing carrier is not so rigidly set as to pull the governor rope through the governor jaws. From the top of the car, a careful examination should also be made of the normal slow down, and stop switches, as well as final limit switches. Where a door-operating device is in use, this examination should likewise be made, while all rail surfaces, joints and fastenings as well as rail alignment should be carefully noted.

It occasionally occurs that counterweights run in separate enclosures and cannot be inspected from the car top. The inspection should then be made at the door or opening of such an enclosure nearest to the top of the hoistway, and the cable so marked that the balance of the inspection can be made where these cables pass over the overhead sheaves.

After the inspection from the car top has been completed, the lower portion of the hoistway inspection should be made in the pit. The elevator hoistway pit should be free of water, refuse or combustible material of any type. The lower limit switches should be examined as well as the governor rope idler sheave and compensating sheave if one is in use.

Buffers should be closely examined and in the case of oil buffers the oil level should be noted and the piston examined for excessive sideplay. In the case of spring buffers, it should be noted whether they have become deformed through repeated depression, or have retained their original shape and are properly fitted to the base provided.

In addition, counterweight enclosures should be noted with regard to clearance and security. The under clearance of the counterweights should be examined when the car is at the upper terminal landing, in order to determine possible need for shortening the cables. While in the pit, an examination of the "safety device" should be made, by pulling out the cables on the "safety drum" where a clamp type of safety is used.

The safety should operate sufficiently free to permit of application of the safety jaws on the guide rail. This type of test should be made upon every inspection, and is intended primarily to insure a freedom of action of the safety. It should be noted that there is a sufficient number of turns of the cable left on the "safety drum" after this hand pull-out test, to provide for additional pull-out, required by the governor operation of the safety.

In the case of the "slack cable safety" or so-called "instantaneous types," involving the use of pawls, wedges or rollers, a test can be made by placing a support under the car, and the machine operated until a slackening of the ropes occur. The car support should then be knocked out, permitting the safety to instantly apply. To avoid injury to the cables or overhead equipment, additional blocking should be provided in the pit, to stop the car if the safety does not engage.

Another manner of testing instantaneous type safeties, is by use of a block and fall, attached to the overhead beams by which the car is lifted off the hoisting cables, and then slowly lowered until the safety is applied. The former method of making the test from the pit can be done with a mini-

mum of equipment and generally has been the practice followed out, but where the necessary equipment is available, the test by block and fall is preferable. In making the latter type of test, it may, at times, be necessary to block-up the counterweights.

Machine Room

The elevator machine and those other portions of the equipment located in the machine room should now be inspected. In the case of overhead machines, gratings, screens and flooring should be examined, this to include all overhead fastenings, such as bolts holding overhead sheave bearings to beams.

All overhead drums or sheaves should be thoroughly inspected and tested for possible cracks or weaknesses. This should be done by a light tapping with a hammer. Drum spokes as well as those in the overhead sheaves have frequently cracked, developing the possibility of failure of the drums or sheaves. At the machine, there can also be examined the sections of cables which could not be closely observed from the car top or hoistway.

On overhead drum machines, the inspector should make certain that there is sufficient remaining wrap on the drum, when the cables have been run out to the limit of their respective travels. An important part of the elevator drum machine is the automatic limit stop and too frequently this is found out of adjustment, permitting the car to overtravel in either direction and frequently necessitating full dependence for stopping the car on the stop balls on the shipper rope. It is urgently important that in the maintenance of the elevator machine, the automatic machine limit stop be kept properly adjusted to prevent not only possible personal injury, but also for the prevention of possible property damage.

Another important part of the elevator drum machine which is very frequently neglected in so far as its proper functioning is concerned, is the machine slack cable device; this particularly being true where this device is of the so-called roller or grooved pulley type. In an astonishing number of instances, these have been found to be out of position with regard to their proper place in contact with the hoisting cables, and in any such instance where the car downward travel would be impeded, there would be no control over the continued operation of the elevator machine and the resulting excess of

slack cable. The slack cable device therefore, should always be in proper contact with the hoisting cables.

All gears should be carefully inspected to determine the degree of wear and on machines, where the drive is by a worm-gear, the amount of backlash should be closely noted. An excess of backlash in the worm-gear will denote at least the necessity for adjustment of the thrust bearing or perhaps renewal.

It is also important that the oil level in the gear case be maintained at a proper height and that the oil be frequently changed. Bearings, of course, of all types should be closely examined, with reference to possible lost motion, and with regard to proper lubrication.

In the case of an electric elevator, the motor should be examined with regard to freedom from excess dirt, also the bearings, with reference to proper lubrication.

The condition of the commutator is important and such an examination would include a check of the brushes and brush holders. On A.C. motors, the condition of slip rings should be carefully noted.

The brake is an important part of any elevator machine and still we frequently find it inefficient because of a number of conditions. The brake linings are frequently permitted to remain in place until they have been completely worn through and the surface of the brake drum has been considerably damaged. Linings should be renewed before they reach such a condition, and brakes at all times should be sufficiently effective to perform properly.

Controller Mechanism

We frequently have found a total neglect of the controller mechanism. This neglect extends not only to the mechanism types located on control boards, but also to the self-contained controller mechanism on the machine. It is not at all unusual to find excessively worn contacts where the carbons have been practically burned away.

Under such conditions, the carbon holder can and frequently does "freere" to the opposite copper contact, thus creating a very serious condition in the controller mechanism. On the type of control operated through a solenoid and starting arm, these frequently hang up, and badly burned or pitted contacts result not only in accidents to the elevator

from improper starting, but also frequently severe damage to the electrical equipment.

It is, therefore, essential that particular attention be paid to contacts on the control mechanisms of all types. The examination should also cover resistance grids and fuses. How often have we found fuses that have been renewed with heavy wire, nails or other current carrying objects!

Generally, we find the governor located in the machine room when the machine is at the top of the hoistway. The governor should always be closely checked with regard to freedom of action, lubrication and the ability of the governor jaws to engage the governor cable properly. The number of instances of governor ineffectiveness is surprising. Many times governor inspections have disclosed a lack of clearance sufficient for the fly-balls to properly function, this being due to the governor being located too close to a side wall or some other projection.

Under no circumstances should the governor at any time be ineffective, since such failure, of course, removes the safety factor in preventing the falling of the car by the proper application of the car safety device. The examination of the governor should be thorough, to make certain that under no conditions can it fail.

I recall many years ago, an instance involving an elevator in a very high class apartment building where the governor had been installed, running in a backward direction. Only a careful examination discovered this in time to prevent a possible failure.

In general, the above outlined procedure should be followed, but where the elevator is belt-driven, the condition of the belts, of course, is important, and they should be closely examined, as well as the belt shifters in order to note their condition and arrange for their replacement before failure.

Another type of elevator covered only partly in the procedure outlined, is the hydraulic elevator of several types. Stationary and traveling sheaves should be examined with a mild hammer test and as in the case of the other types of machines and drum or sheave grooves should be noted with regard to extent of wear.

Guide rails and guide shoes of the traveling sheaves should be examined closely, with regard to proper lubrication and excess play. Piston rods should be checked for corrosion, excess of wear and alignment, and where

more than one rod is used the equalization on the crosshead should be noted. Cylinders should be inspected with regard to their being properly supported and secured to these supports.

Leakage under pressure should be noted to determine the packing condition, and operating and shut-off valves should be examined, with regard to leakage and proper fastening. The pump packings should be inspected and it should be noted that a relief valve is provided. The safety valve should be tested preferably by increasing the pressure slowly, or to a pressure of about 10 lbs. above normal working pressure.

Pressure Tanks

Pressure tanks should be inspected for corrosion, leaks, or incipient cracks, and should in all instances be provided with a pressure gauge. Internal inspections of such tanks should be made at least once every three years by a competent boiler inspector. This time requirement also applies to the pistons of hydraulic elevators which should be exposed, thoroughly cleaned and inspected at least every three years.

The above suggested procedure does not, of course, include many details which the competent elevator inspector would observe in his normal inspection of an elevator.

Because of this, there has been but little reference made in this paper to the condition of cables that would justify their renewal. Various factors enter into this question, such as the length of time the cables have been in use, the normal extent of use, the type of maintenance with regard to lubrication, the periods of time between inspections and the condition of the cables with regard to wear and the number of broken wires. All of these phases have to be considered in determining when cables should be replaced, and it has been found extremely difficult to establish a standard of condition which could be followed without exception. I would therefore, recommend that the advice of various Cable Manufacturers be followed in this connection.

Time will not permit of including all of the minor references which might be made. The experienced elevator inspector, however, would undoubtedly pick up such incidental phases, as for instance:—

Checking petcocks on hydraulic pumps or tanks.

Signals or other alarms on elevator cars, the aptitude of the elevator operator, where one is steadily employed for the safe operating of an elevator, car and hoistway clearances, etc.

My outline is intended to be helpful as a suggestion of procedure. It would probably not be contrary to the purpose if I mention that there has recently been published what is known as an "Inspector's Handbook" or "Manual," which is intended to make known the "American" recommended practices for

the inspection of elevators. This handbook or manual has been sponsored by the American Society of Mechanical Engineers, National Bureau of Standards, American Institute of Architects, and has been developed through the co-operation of a large number of affiliated bodies, including the elevator manufacturers, casualty insurance companies and others, under the auspices of the American Standards Association. I would strongly recommend the use of this handbook or manual as a guide in the practice of elevator inspections.

How to Make a Safety Inspection of Electrical Equipment

By P. L. G. HASBKARL

Safety Engineer, Pennsylvania Power & Light Co., Allentown, Pa.

Before inspectors or workmen make inspections of equipment, they should study the arrangement of it, be familiar with its operations and the duties it performs. Without this knowledge an intelligent safety inspection cannot be made.

The person or persons who make safety inspections should try to visualize the movements of the workmen or others who may pass the equipment being inspected. This will enable the inspector to develop safe methods for doing the work and to recommend barriers and other safeguards.

There are three objectives to each safety inspection—first, to prevent injury to persons who walk by or pass in and around the equipment; second, to be sure that it can be operated safely, and third, to be sure that it can be tested or repaired by the maintenance men without risk to man or property. With these thoughts in mind, let us make a tour of inspection of electrical equipment of the producers, distributors and the industrial users of electric current.

Steam Electric and Hydro Stations

Since these plants are the source from which the current originates, we will start here.

Usually during an inspection trip the inspector is accompanied by the superintendent or his representative to act as a guide. Such a person is of much assistance to the inspec-

tor. He should be capable of explaining the methods employed for operating, testing and maintaining the equipment.

Generating Floor

We go first to the turbine or generating room and while on the way observe the entrance into it, whether it is free of foot hazards, obstructions, and that stairways and platforms are equipped with railings and toe boards where required. This part of the inspection should apply to all entrances and exits. Close attention should be given to the operation of the doors to find out if they work freely. They should open outwardly to provide quick means of escape from the room in an emergency.

The floor in the room, especially that part of it around the turbines and generators should be examined closely for obstructions and openings around various pipe lines, control valves extending up through the floor, drive belts, and conduits, to detect all hazards to the users who may at times have to move quickly and accurately without advance warnings, oftentimes under dim lights.

The next inspection is that of the turbines and generators. The guide should be asked to explain the duties of the operators, and others who may work in this vicinity. Then check up carefully to see that sufficient space is provided to operate the throttle valve, to take bearing temperatures and oil pressure,

and that steps and platforms or other suitable means are provided to reach all places to which the operators must go to inspect, adjust, oil or clean these units.

Control Room

Due to the importance and small size of the various units of the equipment in the control room, one usually finds this place quite free of hazards. However, attention should be given to possible foot hazards (curled rubber matting), projections from the board into passageways and instruments that may be suspended too low on brackets from the control board.

Switchboard operators are the key men in the operation of the plant and they should be protected against inadvertently injuring themselves during the performance of their duties.

Switch Room or Gallery

From the control room we go to the switch and bus rooms. These are considered the heart of the plant and most dangerous.

Normally the cables from the generators go to the oil circuit breaker disconnect switches, through these switches to the oil circuit breaker, then through disconnect switches to the station bus. From the bus, cables or leads may go through various switches to overhead lines or underground in cables to the switchyard. Consequently, there are oil circuit breakers, disconnect switches, cables, leads, floor and bus bushings to inspect, test, repair and operate and usually in a limited space.

The inspection of this equipment should be broken down into four parts:—

First—Can the passersby inadvertently make contact with energized equipment? To protect these persons from injury the switch cells should be the enclosed type with removable doors and the cables or leads to the various switches should be of sufficient height from the floor or barricaded with proper type guards or shields. Where this kind of protection is not practical or does not exist, such sections of the rooms are blocked off with substantial guard rails or their equivalent. In safeguarding the passersby, we protect operators, testers and other workmen against accidental contact with the energized or moving equipment.

Second—The operators or switchmen have duties to perform under varying conditions.

They usually work alone—therefore, the inspection of equipment should be made for the elimination of hazards encountered while operating switches, replacing fuses and making inspections.

A check on the length and type of switchsticks will disclose in many cases the distance the operator is removed from the switches during the operating of them. Switch sticks under six feet in length indicate that under certain conditions the operators are working too close to energized equipment and are in danger of arcs and shocks. Find out where and under what conditions these switch sticks are used.

Visualize the position of the operators while they are making switch movements with switch sticks. Will they stand too close to energized equipment in back or alongside of them, are switch cell doors or panels removed—if so, for what purpose?

Normally oil circuit breakers are operated from the control room. In the event switches fail to open or close, how are they manually operated? What is the location of toggles, levers or cranks on the switches? Are there two exits provided as means of escape from any location in the switch room?

What methods are in use for blocking out switches on permits, how are the signs or tags attached to the switches?

Are insulated platforms or rubber matting installed in accordance with accepted practices?

Where are the fuses located, how are they replaced—by hand or with tongs or fuse sticks?

Are the cell doors, switches, etc., properly labeled?

Third—We next deal with the testers. These men have varied duties which bring them close to energized equipment. For example, they test bushings, meggar test insulation, Doble test transformer windings, insulators, inspect lightning arresters, check oil circuit breakers with cycle counter for opening and closing of contacts, etc. In making these tests many guards and barriers are removed, connections and/or taps made to equipment, some of which may be energized, but normally the work is done on de-energized parts with the adjacent equipment energized.

Their methods for doing this work and provisions made to facilitate testing should

be checked into for the purpose of eliminating the hazards they normally encounter.

Fourth—The maintenance men present a different problem. The nature of their work is such that they remain in a given location for a longer period of time than the operators or testers. Inspection of electrical equipment to protect them from injury requires a study of each piece of equipment.

Is the equipment designed so that it can be taken apart readily? Is there sufficient space provided to enable the men to do this work? Are temporary barriers necessary for protection to men and adjacent equipment?

Are adequate lighting facilities provided?

Remember there are occasions when the maintenance or repairmen must work under abnormal conditions.

Check into their methods for repairing or overhauling any part of the equipment—in this way, a thorough inspection will have been made.

The same inspection methods should be followed during the inspection of other electrical equipment in the plant. These units are important and may be hazardous, therefore, be equally as thorough in the inspection of them.

Switchyards

The inspection of switchyards is not difficult, the problems presented in these are obvious. Improper elevation or energized parts without guards or barriers is easily seen. Usually close clearance between various units of the equipment can be barricaded. Where switchhouses are installed, they are generally made of metal and so designed that all of the high voltage equipment is enclosed.

However, many of the outdoor switchhouses contain hidden hazards—this is due to their compactness.

The provisions for testing and making adjustments and repairs should be scrutinized.

Check the location of the test blocks and space available for lowering the tanks of the oil switches, also the location of high voltage leads.

We next examine the lightning arresters and pot transformers. If they are not elevated, are barriers or guards installed around them? Are the air break switch levers or handles conveniently located so as to enable the operator to move them freely? Are insulated platform or ground grids in-

stalled below the levers or handles? Are the air break switch rods insulated or grounded?

Are the fuses replaced by hand or with fuse tongs or a fuse stick? Can they be replaced from the ground? If the fuses are replaced from a raised platform, how is it reached, by ladder or stepped structure leg? Does the operator while climbing up to the platform come in close proximity to energized equipment?

How are the disconnect and air break switches inspected and replaced? Can the blades and clips be de-energized? Are hose connections provided on transformers for filtering the oil while they are in service? Can the top connection be safely made?

Is permanent or temporary grounding equipment provided?

Clearance above ground of overhead, incoming and outgoing lines should be checked.

Are all switches and the equipment properly labeled with signs?

Are the proper number and size of switchsticks kept permanently at both attended and unattended switchyards? Are they protected from the weather?

Conditions of fence or enclosure, also distance of the equipment from the enclosure should be noted.

Can an unauthorized person conveniently enter the switchyard by climbing over or under the enclosure?

Substations

At both attended and unattended substations the inspections recommended for the generating and hydro plants should be followed.

Underground and Overhead Lines

From switchyards and substations the electric current is transmitted to customers via underground systems or overhead lines on wooden or steel poles, or steel towers. These units may be considered electrical equipment—however, no attempt will be made to cover the inspection of them in this paper.

The safety inspection of underground systems and overhead lines should be covered separately. There are available many papers and pamphlets on the inspection of these units of electrical equipment, such as: The Overhead Systems Reference Book; The Underground System Reference Book and

Safety Methods in Power System Construction, published and distributed by the Edison Electric Institute (formerly National Electric Light Association).

Customers' Electrical Equipment

The inspection of commercial and industrial customers' electrical equipment should be approached carefully. The commercial department of the utility company should be told of the proposed inspections several days in advance of the inspector's visit to the customers' establishments.

This will enable a commercial representative of the utility company to contact the customer and explain the purpose of the inspector's visit, also make arrangements for representatives of the customer to accompany the inspectors during the inspections.

All of this makes for good customer relations—likewise, presents an opportunity for the inspectors to teach the customer accident prevention in connection with the operation and maintenance of electrical equipment.

Customers' equipment may consist of an outdoor or indoor substation, one or both; motors, cranes and other various electrical units.

Before inspections are made of the outdoor substations, the inspector should have full knowledge of whether the customer or the utility company owns, operates and maintains the equipment. The exact status of ownership, operation and maintenance in whole or part of this electrical equipment should be constantly kept in mind by the inspectors.

Do not criticize or condemn customers' equipment, but explain to the representative in a constructive way the existing hazards in and around the equipment and suggest corrective measures.

Usually a customer receives service over an overhead line terminating on a pole or structure supporting air break switches, thence to the substation located on the customer's property.

The equipment generally consists of lightning arresters, fuses, disconnect switches, oil circuit breakers, metering equipment and transformers enclosed in a wire or wooden fence.

The location of the substations with respect to their distance from the streets or highways, walkways, paths, railroad sidings

or crane and truck movements should be the determining factor in deciding whether the enclosures are adequate. If the substations are near streets, highways, walkways or paths, is the enclosure of sufficient height, and designed to prevent passersby from making contact with the equipment with their hands or any object over, under or through the enclosure? If wire fence, is it grounded?

The inspectors should ascertain the movements of cranes, trucks and railroad cars in the vicinity of the substations and endeavor to suggest methods to prevent injury to persons and equipment.

The clearance of conductors and energized parts above the ground should be checked. The location of fuses and the methods and conditions under which they are replaced should be looked into.

The location of the metering equipment should be studied carefully. Can this equipment be tested and the meters read without exposing the testers and meter readers to high voltage conductors, switches, etc.?

Can the oil level in the transformers be checked and the oil filtered safely with the equipment energized?

Are guards and barriers provided to prevent persons inadvertently making contact with energized parts of the equipment?

How is the electrical current transmitted from the substations to the various buildings—is it high or low tension voltage? Follow the course of the line, in this way one may detect hazards to persons and the conductors.

We now turn to the electrical equipment in the buildings or plants. Naturally we start at the place where the leads from the substation enter. They may go direct to a bus, switchboard or fuse panel. The voltage of the equipment should determine the basis of the inspection and the suggested corrective measures.

Can passersby or workmen inadvertently make contact and receive a shock from the equipment?

Is rubber matting installed on the floor in front of switchboards or fuse panels? Are switches properly labeled? Are they accessible? Are exposed parts barricaded? Are unauthorized persons prevented from entering the area around switchboards, large motors, etc.?

Are the leads or wires to the motors or other electrical equipment in conduits or

other approved grounded supports or are the conductors of the old, open type?

Are the leads to the motors exposed? Are the motors and other electrical equipment grounded? Are the machines, etc., operated by electric current grounded to the common grounding system?

The portable leads to large movable electrically operated units, such as cranes, shovels, etc., should be carefully inspected. Also, the connections at the source of power and the attachments at the units.

Housekeeping

Good housekeeping is essential in accident prevention work. Without it no safety campaign can be successful. Therefore, the inspectors must be alert at all times and detect untidy conditions.

Rubber Protective Equipment

It is the inspector's responsibility to inspect and check up on the kind and quantity of rubber protective equipment required for each part or unit of electrical equipment. This is necessary to safeguard the operators and others who may operate or work on it.

Tools and Equipment

Inspections of electrical equipment should also include a check up to find out whether various kinds and correct number of tools and pieces of equipment are provided to operate, adjust and repair it safely.

Methods and Practices

Inspections should include a review of existing methods and practices for operating, testing, repairing, etc., of all the electrical equipment. Without this knowledge it is difficult to make recommendations for barriers, guards, tools and changes in equipment to eliminate hazards to persons or damage to the electrical equipment.

Reports

During the inspection clear and concise written notes should be made, the hazards recorded, and suggested methods for correcting the conditions clearly explained in writing or by a rough sketch.

Many thorough inspections have been nullified by carelessly written reports. Remember, we must show good cause for and justify all additional safeguards and changes in operating and maintenance practices.

ADJOURNMENT

Safety Training

THURSDAY MORNING SESSION

October 14, 1937

The session on Safety Training, a panel discussion, was held Thursday morning, October 14. It was built about the purposes and methods of conducting a program of training to promote safety.

Panel participants included the following:

Milo W. Gray, Safety Director, Weirton Steel Company, Weirton, W. Va.; Ray L. Martin, Director of Industrial Education, State Board for Vocational Training, Austin, Tex.; John A. McCarthy, Assistant Commissioner of Education, New Jersey Department of Public Instruction, Trenton; Charles A. Miller, Supervisor of Safety, The Texas Company, Houston, Tex.; Olaf Newgaard, Personnel Manager, Bethlehem Steel Co., Chicago District, Chicago; G. A. Rohlfing, Safety Engineer, Aluminum Ore Co., East St. Louis, Ill.; A. C. Thompson, Director, Personnel and Safety, Swift and Company, St. Clair County, Ill.

The session was called to order by Chairman S. C. Dickinson, Safety Engineer, Pacific Gas and Electric Co., San Francisco, who presided, introducing the panel participants and directing the discussion.

CHAIRMAN DICKINSON: We are discussing the following subjects:

What are the objectives of safety training? Who shall be trained? What types of training are the most beneficial to industry? Is there any relationship between safety training and safety rules? How can training methods be applied to small groups in remote locations or widely scattered isolated groups? What training methods are most effective? What part, if any, does the safety committee have in the training program? Should visual methods be employed in the training program? How?

MIL0 W. GRAY: What are the objectives of safety training? The reduction of accidents and accident costs. You know why we are all here—to try to save human life and limb. If we can get that across, particularly to the management, that is the main thing.

A lot of you fellows in safety have probably had trouble getting things that you wanted, particularly when there was talk about reducing costs. After all, if you can reduce the accident costs, you have gotten somewhere, because these are hidden costs that most managements really never take into consideration.

Another thing is to bring out the dangers of the human element, namely, carelessness and thoughtlessness. Sometime ago I found that 93 per cent of my accidents could be traced directly to the human element, not to any defect in machinery.

Methods of working safely should be considered in every plant. There are too many employment departments picking a man out of the waiting line if he looks like a husky bruiser, whether he has any brains or not. They say to the foreman, "Here, put this man to work."

The foreman says, "Here is a pick and shovel; get to work."

He doesn't show him how to do it; he doesn't show him what he should do, what the dangers of the job are. He may put him down in a ditch without any shoring. That man doesn't know the difference between shoring and side-walling a ditch. That is where we have to start.

We have to show men what the job should be and where they have to watch out. Until we do that, our accidents are going to continue. Until we get these men safety-minded

and a lot of the young fellows coming in from schools, I think we are going to have a tough job. When we start training them and showing them where the troubles are, we will get some place.

CHAIRMAN DICKINSON: Who shall be trained?

RAY L. MARTIN: *Everybody*. I have always regarded industrial training, safety training, as a cooperative undertaking, one that has to be taken seriously by every individual within a company, from the floor-sweeper up to the general manager. I have seen some sad failures in attempts to put over safety training programs for the reason that the management or the foreman or some person along the line was not in whole-hearted sympathy with the program.

I have seen, and I believe you have seen, efforts to put over safety programs in which the safety engineer concentrated on the working force entirely. I can't see how such a program can be effective. Not only must a program be taken whole-heartedly by everybody within an organization, but we must reach the point where that cooperation shall spread outside the company and become a cooperative undertaking of the public.

Industrial organizations have done a great deal to spread the gospel of safety. In our state our people have been made safety-minded on the highways through the courtesies of men who were trained within industrial organizations.

We are beginning now to look upon safety as a public educational responsibility. As soon as I return to Texas we will release a bulletin on safety training and traffic safety, which will be distributed to all of our public school teachers in the high schools of Texas. We believe that if we can start early enough, if we can indoctrinate in these young people who are just beginning to drive, safe habits of driving, you men in industry will have a far easier job. It isn't enough for you to carry on safety training. You must have the cooperation of public officials, public school teachers, and everybody along the line, to make that thing universal.

CHAIRMAN DICKINSON: What types of training are the most beneficial to industry?

A. C. THOMPSON: Live, up-to-date posters, safety conferences or classes, and personal contacts are very beneficial in the training program. Posters, if attractive and in proper

locations, are read by many, many employees who benefit from the information furnished.

I have in mind the repair department of a certain plant that had no safety organization. One of the men who was safety-inclined took it upon himself to get hold of every safety poster he could get, no matter whether it pertained to his line of work or not, and placard one end of the room with them. He had about forty or fifty posters just tacked up; some overlapped the others. We all realize that any man who would even notice those posters wouldn't get much out of them. To be effective there should be no more than two, possibly three posters in any one location.

Safety classes for a group or department are of great value in educating employees. The conference method is an important training medium, especially for foremen. It presupposes a meeting of employees, foremen or supervisors in which each individual contributes his knowledge to the common pool and benefits from the contributions of others.

Conference training is especially valuable as a means of promoting desirable job procedures and the development of new methods. The conference should be carefully organized, however, or it may develop into just something that will not accomplish anything.

Personal daily contacts by safety inspectors and committees continue the educational work, as they are in direct contact with the employees and foremen and are ready to offer suggestions. It is the man on the job who makes or breaks the safety record. It is useless, therefore, to inaugurate or continue any effort that does not finally influence this key man in the safety program.

In our own plant we were introducing a type of hard hat worn by men who work in locations where objects fall. It was an awfully hard job to get one fellow to agree to wear one of these hats. Finally we prevailed on him. He had worn it only about an hour when a roller fell from a high rail and hit him on the head. That man is thoroughly sold, but I wouldn't advocate that kind of training.

As contacts are made daily by members of the safety committee, they are in a position to offer advice and training to every employee in the department during the entire day. When this is done consistently, it makes employees safety-conscious.

CHAIRMAN DICKINSON: Would any of you

like to ask questions of the men who have talked so far?

MEMBER: The first speaker announced that 93 per cent of the accidents in his department could be ascribed to the human element. That seems very high to me. I have been an accident investigator for the last five years in our plant. When I started out first I think in about 75 per cent of the cases I could blame the man. I found out afterwards that we reduced that to 50 per cent, and last year it was 25 per cent.

I have come to the conclusion now that blaming the man on the job does very little good. I don't mean that the man is never to blame, but if you blame him, your safety work is ended right there, as far as the man is concerned. You get the ill will of the man; you can get no valuable suggestions from him. Tell him instead that you are more interested in how to prevent the next accident than in who was to blame. If you can convince a man that you are sure he is not more than 49 per cent to blame for the accident, the man will talk. If you blame him over 50 per cent, he will not talk.

MR. GRAY: I did not blame the man, but in the investigation for our own particular benefit we found that the human element entered into 93 per cent of the accidents. The man was at fault, although the man was not notified that he was to blame.

MEMBER: The speaker talked about the fellow being hit on the head with a roller. I just wonder whether we capitalize enough in our training work on the things which actually occur rather than telling a man about something that may occur. I believe in pre-accident prevention. You can go before a bunch of men and say, "John Jones got hit with a brick. If he had had a hard hat on, he wouldn't have been hurt so badly." You have something concrete to offer.

I suggest that you have a "historian" in every department with the responsibility of collecting just such instances as this, to be used in your training program.

CHAIRMAN DICKINSON: Is there any relationship between safety training and safety rules?

JOHN A. MCCARTHY: Some of the discussion here indicates a need for training and a need for establishing some procedures whereby safety may be established.

The greatest set of rules known to people in this country are the Ten Commandments.

They are recognized by Christians and the non-Christians as a code that regulates one's relationships to his God, to his neighbor and to himself. We may memorize those, but when we go into action and have to meet those relationships in our daily life, I doubt if we ever remember the Ten Commandments. We function as a result of training based upon those Ten Commandments.

While I think we should have some safety rules, they should be used for the purpose of training and not with the expectation that the individual will memorize them and apply them in his daily occupational life. You can't expect a green worker, a young worker, coming into new situations, to remember a set of rules dealing with safety practices. He is in an environment that is entirely strange to him, where he has to take into consideration the things he has to do, where he has to use a great many judgments that require thinking, and where he has to perform up to production standards. He is not going to remember those rules and regulations. If he stops to remember them, the chances are he is going to get into difficulty.

The same thing is true with the experienced worker. You don't expect him to remember these rules. You expect him to perform on the basis of the experience that he has developed.

I doubt if any of you here, when you are driving your cars, consciously remember any of the safety rules and regulations for driving. There is a learning process involved there, one that is very simple and based upon a stimulus and response. Now I am talking pedagogies, which may be foreign to the industrialist but it is simply taking a group of men, particularly the foremen who are responsible for training, and teaching them some of the simplest and most fundamental things involved in the learning process.

Your posters will be absolutely useless unless they are of the type that will stimulate through the eye and bring into effect the response desired.

The same thing is true throughout your training program. Most foremen assume that when they tell an individual something, their job has been done. But telling is not teaching. In many instances the manner in which the telling is done sets up a barrier which prevents the type of response that you want.

We must have rules and regulations with respect to safety, but these should be a code.

a standard upon which training should be established. Then if we establish that training and condition the worker—by exposing him to the proper kinds of performances, time after time, until these performances become fixed, then we have that relationship of the rules and training.

CHAIRMAN DICKINSON: Does anyone care to discuss the question?

MEMBER: Gentlemen, I think I can prescribe a formula for a poster which will be read. Inject the personal element. Try taking pictures. You don't have to be an expert photographer. I know practically nothing about photography but I can take ordinary snapshots of some unsafe condition and have them enlarged to about 8 by 10 or 11 by 14 size. The result of an accident always makes a good picture. A picture of a smashed foot brings home forcefully to the rest of the boys just how it would be if that were their foot. They will pay attention to the photograph and look at it because it is something tangible within their own plant. It is not an artist's conception of a smashed foot. It is an actual picture. Most of you have draftsmen in your departments. Get them to put whatever lettering you want on the poster. I guarantee they will be read.

CHAIRMAN DICKINSON: Question No. 5 is, "What training methods are most effective?"

OLAF NEWGAARD: The most effective training methods are those which can be taught to the men in simple, easy language, and in a manner which would cause them to want to know more about their plants and industries.

If this interest is not aroused, the training program cannot be successful. Forcing the employee to take an extensive course of study should be tried only as a last resort.

CHAIRMAN DICKINSON: Has anyone a question? If not, let's pass to No. 7: "What part, if any, does the safety committee have in the training program?"

G. A. ROHLFING: I can only tell you our experience on this subject.

The safety committee is the important part in any safety training program. It has always seemed to me that there is a bottle-neck in safety. Between the top, where the educational part comes in, and before it reaches the men, something stops it.

There are various ways of getting this education down to the men. But most of the visual forms have some kind of hitch in them. If you put a poster up, you can't tell all of

your story in pictures. You must have a little writing on it. A lot of the fellows in the plant can see a long way off when they don't have their bifocals, and they walk up to the bulletin board and squint and can't get anything off of it. When a fellow wears bifocals, if you put the poster too high, he has to double his neck back to look at it. Quite a large number read very laboriously. In that case they just pass the poster up.

If you can get someone actually to teach the man by personal contact, it is very important. That is where the safety committee comes in. That is the set-up we have in our plant. The education comes in at the top. We try to get it percolated down to the men through the foreman. We are not always successful, but I guess we are as far as the human element will permit us to be.

The fact that there are about 6,500 delegates here is indicative that most plants come here for their source of safety education. That safety education must go from here back to the plant, down into the top of the plant, through your administration, your supervisory department, out to the men. I don't see any other way to get it there except through your foremen and safety committee.

CHAIRMAN DICKINSON: Have any of you an idea as to whether we should continue with our safety committees or not?

MEMBER: In our plant we use safety committees a lot. One thing we discovered in a survey on the foreman was that invariably, where the safety committee wasn't giving him very much support, he wasn't asking them to do anything.

MEMBER: Some of you have vice presidents and general managers as members of your safety committees; others have the workers out in the field. Where do you get the best support, or where do you sell safety better, through a central safety committee composed of the white-collared guys or the fellows who work in the plant? Where do you get the best results?

MEMBER: My company has a method which might be of interest to others. We have a large number of branches. Mention was made of the educational value of using each accident to prevent further accidents of the same kind. That ties right into this discussion of the best use of a safety committee, because a safety committee needs a method and needs some information and needs something to take back to the departments.

In our case the foremen are always members of the safety committee and must attend every meeting. At the meetings we always have a letter from our district office and from our central office, two letters. Usually these have already been read by all members of the committee, but they are discussed. The gist of these letters is a survey or discussion of any accidents which may have happened at any of our plants. The equipment in most of our plants is similar.

If an accident happens in our plant, we must send in a letter describing that accident in sufficient detail so that the central office can pass it on to all the other plants and all can readily visualize it. That letter doesn't stop with the safety committee. It is passed on to foremen in departments using equipment similar to that on which the accident happened. These foremen must discuss, with every man who works on that equipment, all the details of the accident, no matter where it might have happened.

In that way we take advantage of every accident that happens in the entire company, driving it home by personal contact. You must have that personal contact with the foreman or man, backed up by the safety men, and point out to the boys, "See what happened here on this machine, cleaning it, or doing this or that?" thereby making that man visualize the danger he is up against.

MEMBER: In our organization the turnover of labor is very small. Our men stay with us for years and years, and they represent a very interesting training problem because we can train them carefully. We have a very complete training program connected with our safety program.

We have a 15-minute discussion program for every man in our department on safety or training. Most of the ideas discussed during those 15 minutes come from the men in the field, from an accident or a near-accident. We point out the rule that was violated. The foremen, who are the instructors in our department, take up that topic for 15 minutes and discuss it with all their men, so we know that every man in the department has had that training.

The difficulty of a rule book is that you are not sure the men understand it and you are not sure they read it. So we use that plan to make sure that all of our rules are properly interpreted to the men. Every so often we repeat these rules; that is, one by one and

over a period of years we go through the entire rule book in the discussion periods.

The men respond to this plan because many of the ideas we use come from them. We ask them for suggestions, "What shall we discuss next week?"

We give credit to the man who made the suggestion. That is taking safety training to every man in the department.

MEMBER: How many foremen have you?

MEMBER: Six hundred.

MEMBER: Do you find that all of your foremen are good teachers?

MEMBER: We have made all the foremen good teachers. Before we started this program, we incorporated in our training a supervisory training program, which we called foremen discussion meetings. We carefully, through the conference method, teach our foremen the technique of teaching safety and things pertaining to their job.

MEMBER: We have a trainmaster on the Santa Fe Railroad who pins a rule every week on the bulletin board and on the train register for the men to discuss for each week. Just as an example, you pin on the board Monday morning, "What is a restricted speed signal?" It will surprise you fellows how those men, among themselves, will discuss that particular rule and then go to the trainmaster and tell him their version. He has them all interested. It never grows old.

MR. SPITZER (Columbia Steel Company): We have a method called the Stickman Axiograph. We do not leave it to a man's imagination to read a written description. We draw it by representing the human element as a stickman, just as you drew in kindergarten.

We have found that by putting that on the board, showing the position of the man just before he was injured, as he was injured and after he was injured, in the three elements, the men will look at those bulletins and read them and discuss them where they will pass up written descriptions.

CHAIRMAN DICKINSON: "Should visual methods be employed in the training program? How?"

CHARLES A. MILLER: I do not believe any safety program will be effective without visual methods.

We in the Texas Company depend to a large degree on the visual method, such as moving pictures, charts or cross-sections. In

other words, we go back to the A, B, C's of safety. I have been in this work almost twenty years, and I believe many industries today are making the mistake of teaching the employee higher mathematics, so to speak, when they should be giving him the A, B, C's of safety.

A little boy reads his primer. On the page of the primer there is a picture, a story picture. As he reads (understand, he doesn't know his A, B, C's) he glances at those pictures. If you cover up those pictures, the chances are he can't read a word on the page.

That is how we have to deal with safety. We have to have a thing which is not only visual or a physical picture of safety, but we must be the type of men who can build up that mental picture by which we can guide the individual to keep him free from accidents.

I might describe to you, or you perhaps may read about a tiger or a lion or a horse. Maybe you have never seen one. You would be like the little boy and his reader if you didn't have the picture.

If we can draw these graphic pictures as we talk to our employees rather than go to them with cold, hard facts and say, "This has got to be done," or "We are going to fire you if you don't do that," we show them the benefits of safety to them.

I have never yet seen a group of employees who wouldn't give me 100 per cent cooperation if I could show them benefits. I believe that is true of any organization.

We talk about visual education. Sears and Roebuck—that grand old catalog, in millions of homes, read by millions of farmers. What would be the result on the cash register of Sears and Roebuck if it published that catalog with no pictures in it? Seriously, there is the fundamental of your visual education. I think there is a lesson that we might take back.

In our first aid training course of the Texas Company in which I have some 175 first aid instructors, we are continually at this work. We create an atmosphere. We hang around the walls of the room life-sized pictures of the pressure points of various types of fractures, splints, bandages and what-have-you. We give the man a visual conception of what he is coming into.

Then we lay aside the lecture, and we give him something in his hand, a splint, a bandage, and we show him how to use it. We have found that to be a most effective way. We stand today with more than 13,000 men

trained in first aid in two and one-half years' time. As a result of that training, we have brought benefits to thirteen human beings whose lives were saved.

Visual education ties in with your bulletin service, the right type of posters, the placement of those posters. If you have a bulletin board that is badly arranged, bulletins illy selected, what is the visual picture trying to tell? The employee gazes on the board. After all, that is your safety newspaper, and that board should reflect the news of the day.

If I were to hand you the Kansas City Times this morning, you would read it. If I gave you the same paper tomorrow morning you would look at it. If I gave you the same paper on the third morning, you would tell me to go to hell. Now, that is the attitude of Mr. John Worker.

Make guinea pigs of yourselves. When you get some wild idea that you think is a knock-out, and you are going to tell the boss what a marvelous man you are, go back in the room instead, shut the door, and give yourself a shot of it. If it doesn't work on you, don't try it on anybody else.

One more thing concerned with visualizing safety is dramatics. We have meetings in our organization in which my own department sits on the sidelines. We do not even furnish the script. We furnish nothing but moral support. From three to eight hundred people, women and children, come out to these meetings, and there on the platform they dramatize safety and first aid. They write their own script, put on their own show. The wives will remind the husbands that on the third Thursday of the next month there will be the safety meeting, "and don't you forget it, because we are all going."

That is another avenue you should not overlook.

MEMBER: One question regarding the bulletin board, the number of posters to be placed on it. Some here are in favor of a lot, some not very many, and some only one.

I wonder if the last speaker uses only a limited number of posters and permits the posting of any notices, other than the poster itself.

MR. MILLER: Up to a few years ago we had a rather difficult problem in getting over the idea of using the board as a newspaper, selling one idea at a time. I used to go around and have to fight to take off notices about some

constable running for election, or a notice of a meeting, and sometimes had to pull down a cobweb to find that the bulletin had been there for weeks, and a dozen would be piled on.

Then we established a system that has been very effective in our larger plants, where four or five thousand men are employed.

By actual tests, we have found that by putting a new bulletin on the board every day we got a better reception. We do it for this reason: When a bulletin stays on the board, it becomes a fixture. If you get a beautiful calendar on the first of the year, you hang it in the office. When you come in the first few days, you admire that calendar. It isn't very long until that becomes a fixture, and you never notice that picture unless somebody calls your attention to it. You perhaps have pictures in your own home right now, and you couldn't tell me what was hanging there because you haven't looked at them for months. We give the employees an idea and then change the board next morning. As a result, these men come in on the job and, as they visit from one department to the other, as they work about, they see these new ideas and know there is always something different, just like the newspaper you buy every morning.

MEMBER: Do you let them put anything other than posters on the board?

MR. MILLER: No.

MEMBER: In my company I have approximately seventy poster boards. These do not have to be elaborate. Most of my boards are probably 24 to 30 inches, but they are painted a pretty enamel color, with trim and with "Safety First" at the top. Those boards are kept religiously clean. There is nothing on them except safety posters. If anyone dares to put a notice of a meeting or any other thing

on those boards, it is immediately taken off. Keep the safety boards for what they are intended, safety purposes.

A lot of folks make mistakes in locating these boards. They should be located in positions where they are noticed by the greatest number of employees the greatest number of times. Posters should deal with the department in which they are placed. For instance, in our gas department we wouldn't think of putting a poster dealing with an electrical accident because the man in the gas department is not concerned with that type of accident or that type of poster.

The question has been brought up here as to the number of posters, large or small. I believe that the large, full-sized poster in picture form has the best effect. Some of these are works of art, and are bound to hold the attention of everyone in your employ.

I have in mind a poster that has been in my office for the last 12 years. It shows a little child with a beautiful dog, and the words under it are, "When is daddy coming home?" That poster is in a glass frame in my office, and it has never been changed. I have had a number of employees remark about what a wonderful poster it is. Even the vice president of the company has commented on it. There is a picture; there is a piece of art. It is something that attracts. I don't believe you can get it so well in writing; at least I haven't found it so.

Keep the board clean and change the posters often. We change our bulletin boards religiously, every week. Seventy boards keep one man busy for two days changing the posters and seeing that they are put in the proper place. Never put a poster twice on a safety board; never repeat; always have a new story. You are going to find that the employees read them.

ADJOURNMENT

Safe Use of Acids

TUESDAY MORNING SESSION

October 12, 1937

Chairman C. E. Ralston, Safety Director, opened the session and introduced the speakers.
Pittsburgh Plate Glass Co., Pittsburgh, Pa.

Safe Handling of Portable Acid Containers Such as Carboys, Drums, Jugs, Flasks

By REUEL C. STRATTON

Supervising Chemical Engineer, and Leon L. Goolden, Chemical Engineer,
The Travelers Insurance Company, Hartford, Conn.

In 1936 in the states of Illinois, New York, Maryland, New Jersey and Pennsylvania approximately 13 per cent of all chemical accidents were due to the handling of harmful substances including acids. This percentage was only exceeded by accidents caused through the handling of objects.

In general, certain chemicals in concentrated form (and occasionally in solution and in compound) may cause injury in four different ways:

- (a) Burning, from direct contact with the skin or eyes, or indirectly through the clothing.
- (b) Fume poisoning or suffocation. Some chemical fumes are poisonous if inhaled, while others tend to exclude oxygen and if insufficient concentration in the atmosphere, this atmosphere may fail to sustain life.
- (c) Poisoning when taken internally.
- (d) Fires or explosions resulting from their improper handling and storage.

This paper will attempt to describe various types of portable transportation equipment for acids which are generally used with highly satisfactory results.

In general carboys, drums and other large containers are filled by gravity from elevated storage tanks, the acid being admitted by a hand valve. Such a valve should be constructed of non-corrosive metal or other acid proof material. In certain cases acids

are elevated to upper tanks by compressed air or to the carboy or drum filling station. Such procedure introduces a hazard, first, to see that valves are self-closing when the operating hand pressure is released and that the air pressure is not so great that if the vessel happened to be inadvertently closed, it would rupture it. Twin safety valves limiting the air pressure should always be installed. It is preferable to establish the carboy or drum filling station in the yard away from other manufacturing operations and to cover the station with a roof only so that plenty of ventilation will be had at all times. Filled carboys should never be piled more than two tiers high, either in the yard or in plant buildings.

The transportation of carboys, either by standard railway or by plant railway equipment, introduces a definite problem. The carboys must be securely placed on the railroad car, never more than two tiers high, and securely fastened in place by floor cleats which prevent shifting of the load. When a destination is reached and a car loaded with carboys is spotted, it should be immediately unloaded and the acid carboys placed in the proper storage section of the yard or acid house.

In unloading cars a proper gangplank should always be used, of ample width and securely fastened in place. Transportation of the carboys can be safely and advantageously conducted by the use of a two-wheel

carboy truck which lifts the carboy box by fastening itself under the handle cleats. The carboy should clear the ground at all times.

When flat four-wheel trucks are used, these should be of a low type with wheels of sufficient diameter to ride over floor irregularities without jolting the loads unnecessarily. The truck should be provided with end and side boards so the carboys will not slide or fall off the truck platform. The handling of carboys from and to such delivery vehicles should be preferably done by two men, properly trained in their work; and, where possible, they should be constituted members of the maintenance crew and the only ones authorized to take charge of transportation and storage of acid.

Where it is necessary continuously to replenish acid in tanks using carboys as a transfer medium, it is an unsafe practice to lift carboys and balance them on the edge of tanks while the contents are emptied. Many acid burns as well as severe physical strains have been caused by permitting employees to follow this practice. Either a mechanical tilting device should be installed or the acid may be discharged from the carboy by the use of an air ejector or siphon.

When such a device is used the carboy itself is not under air pressure and consequently there is no danger from rupturing the flask vessel by excessive internal pressure. An added safety feature is that the air pressure regulating valve may be installed at a point away from the operation, taking the operator out of the danger zone.

Acid may be siphoned safely from the carboy if it is placed in an elevated position, having the siphon discharge below the level of the liquid in the tank, thereby eliminating possible splashing. The siphon may be started by creating a small amount of pressure on the carboy by using a small aspirator bulb similar to a typical hand atomizer. The intake valve is removed from the atomizer so that it is necessary to place the finger over the opening to establish a pressure. The operator is required to watch the siphon and only the amount of pressure which is necessary to force the starting fluid over the bend of the neck is created. Siphons are particularly valuable where small containers such as bottles, jugs, and flasks are filled from the carboy.

A pneumatic acid pump may also be used

in such instances, particularly for filling bottles with small neck openings without the use of a funnel. This pump consists of an acid resistive tube which extends into the carboy to a special stopper fitting which is also equipped with a hand-operated rubber bulb. The acid is forced from the carboy by creating a small amount of air pressure on top of the acid by compressing the rubber bulb. While the establishing of air pressure is generally considered an unsafe method for ejecting acid from a carboy, yet in this instance it is permissible because the pressure remains only on top of the liquid as long as the cork or stopper is held in place by hand. When the hand is released from the bulb, the stopper will rise and the air in the carboy is released. It is extremely hazardous to use a high pressure air supply or power-operated air pumps on glass vessels.

When necessary to pour acid from carboys into small containers, a modern inclinometer should be used. The carboy should be securely dogged in position in the inclinometer so that it cannot slip or fall. A gear-operated inclinometer is preferable as it gives the operator safer control over the carboy regardless of position. The inclinometer should be so constructed that it will automatically return to the upright position from the pouring position in case the operator releases his hold. Where acid may be drawn from inclinometers by inexperienced or unauthorized employees, the inclinometer should be provided with a locking device, the key of which is kept by the foreman of the department. When a call for acid is received, it gives the foreman an opportunity to see that the employee is properly equipped for handling acid, also a check upon the amount required.

What has been said concerning the proper handling of carboys, applies in the majority of instances to the handling of drums. Drums filled with acid should not be allowed to roll from point to point, particularly from an elevation, but rather when necessary slide down a skidway onto a proper buffer. When drums are rolled to storage racks, they should always be placed with the bung side up. Drums in storage as well as during transportation should not be left where direct sunlight can increase the temperature to too high a degree. This may cause undue expansion of the contents of the drum or it may increase the rapidity of chemical action within the drum.

Acid drums in storage should be vented periodically by loosening the bungs so that any gas may be allowed to escape. The employees doing this should always wear acid proof gloves and goggles. Open lights or naked flames should never be permitted near acid drums either in storage, in filled condition, or when empty.

Acid drums should never be emptied by the use of compressed air. The drum should have the bung opened, a spout inserted and then be rolled into a cradle where the acid may safely be allowed to empty into a receptacle. It is well to use the small plug in the head of the drum which may be removed when the drum is in a vertical position and a valve plug installed. Extreme care, both in storage and transportation, must be taken that no water gets into acid drums as the dilution of the acid may accelerate the attack upon the metal causing the vessel to deteriorate or the formation of dangerous hydrogen gas which may become ignited or create sufficient pressure within the vessel to rupture it.

Carboys and carboy cases should be tested periodically if these containers are used continuously for transportation of acids, particularly by rail. A properly made carboy is not a fragile container but there are definite limits to its ability to withstand shock. A broken carboy is hazardous to a workman who may not have been informed as to the proper methods of dealing with such leakage. After exhaustive tests, a large manufacturer of acid, developed a swing test machine which gives an accurate gauge on the shock resisting strength of the carboy package. All carboys should be periodically tested.

Acid drums should also be tested periodically. Most drums are built to withstand a pressure of 30 pounds. A certain percentage of all empty drums should be tested to this air pressure periodically, although all drums may not be sufficiently strong to withstand air pressure up to that limit. It is important not to place excessive pressure on any drum.

When operators require only small

amounts of acid, smaller portable containers are required. The chief hazard both in using and transporting such quantities of acid lies in the accidental breaking or upsetting of the vessel. Specially designed carriers are of assistance in preventing such accidents or the container may be a small jug which is loosely fitted into a fibre or sheet metal cylinder and packed with special acid resisting composition or other pliable material. The containers should be provided with a protecting cover and proper carrying handles.

Certain safety precautions are required where small quantities of acid are handled. Good flooring is essential so that workers may carry the containers without danger of tripping or slipping. The floor should be kept in good repair and should drain to a filter or catch-basin. Plenty of industrial light is required, particularly where fumes and vapors are likely to limit dangerously the field of vision. Vapor proof and acid proof electrical equipment is required.

Even with the best of physical surroundings, proper personal protective devices are needed. Where fumes are encountered, approved respiratory protective devices should be issued and all employees instructed in their use. Rubber or acid proof gloves, proper protective clothing, goggles, etc., are essential. It is particularly important that workers using or working near acids, even though handled in small quantities, have proper foot protection. Foremen should be held responsible that all workers handling acids make use of the equipment provided.

All employees should be instructed concerning first aid for chemical burns as well as emergency measures to be applied. The location of deluge showers and other immediate emergency devices or neutralizing agents should be explained to each worker. Foremen should be instructed never to place a man on a job requiring the handling of acids unless he is positive that the worker knows every safety precaution. If the cumulative total of all safety measures are taken, then accidents will be reduced to a minimum.

Discussion following Mr. Stratton's address touched upon the following points:

Does the sun's heat have the same effect on carboys as on metal drums?

The effects of the sun's heat upon the contents of a carboy is not so pronounced as it is upon the contents of a metal drum, because the carboy is somewhat protected by

its case, because the container is not affected by acid reaction, and because it does not have a screw stopper and thus provides a better chance to relieve pressure.

Is it advisable to apply neutralizing agents when acid strikes the eye?

No, it is advisable to use only water in copious quantities.

What procedure should be followed in taking care of hydrochloric acid burns 15 or 20 minutes after exposure?

After 15 or 20 minutes' exposure, this is

no longer a first aid case. The quick services of a doctor are required.

Should pressure be applied to a carboy to empty its contents?

No, it is never possible to tell just how much pressure will rupture a vessel of this kind. Tests conducted at Harvard University showed that carboys will rupture anywhere between 5 and 40 pounds of pressure. Occasionally a weaker one may be encountered which will rupture at a pressure lower than one pound.

Safe Storage and Distribution of Acids Within Industrial Plants

By L. PAUL TURGEON

Director of Personnel, McCord Radiator & Manufacturing Co., Detroit, Michigan.

Acids are usually stored or distributed locally in one of four ways:

- a. Large tanks or vats
- b. Metal drums
- c. Glass carboys
- d. Small jugs

When a new shipment of liquid chemical is received, it is good practice to open the containers at once to relieve any internal pressure which may have developed in transit. Considerable care should be exercised in opening the containers, to avoid getting burned in case the internal pressure causes liquid to spurt out. Only workers who have been instructed should be permitted to perform this operation. The general practice is to slowly back up the screwed cap, which permits the gradual escape of the built-up pressure inside of the drum.

With some chemicals, it is advisable to leave a 10 per cent air space, to allow for rises in temperatures. After this is done, the containers should again be sealed. In some plants, they make it a practice to open each container once a week thereafter.

Tanks and Vats

Acid storage tanks should be placed on concrete foundations, and so located that they will permit easy access for complete inspection.

Every tank used for the storage of chemicals should be so installed as to minimize

the danger in case the tank should rupture and the contents escape. The tank should be so supported that leakage from any part of it would be noticed immediately, and it should be covered on the outside with a suitable protective paint that will prevent corrosion from moisture, fumes or other causes.

Overflow pipes should be provided, and when necessary, equipped with flow indicators, so installed as to shut off the pump automatically as soon as any liquid starts to overflow.

All open tanks or vats should be installed in such a way that there will be no danger of employees falling into them. The top of the vat should be built to a height of not less than 30 inches from the floor or standing level; otherwise, a double handrail, at least 30 inches high, should surround the vat. Walkways should not cross over open vats, but if they are absolutely necessary, they should be equipped with substantial handrails and toe boards. Such walkways should be inspected at frequent intervals, to make sure that none of their parts have been weakened by exposure to the chemicals.

In those plants where pipe lines are used for the local distribution of acids, lines and all fittings should be plainly marked to indicate their contents. Warning signs should be placed at open ends, showing plainly the chemical being handled in the line. Inspections should be made at regular intervals, and all leaks repaired at once.

Obviously, where the liquid is carried through overhead lines, care should be taken to avoid drip from these lines, where they cross over passageways, by the installation of protective devices to guard workers against injury.

Before starting a repair job, the acid valves should be closed and locked, the pipe drained, and sufficient time allowed for the gas to escape. Where a cutting or welding torch is to be used, the pipe should be thoroughly washed with a neutralizing alkali, and then flushed with steam and boiling water, making sure that every possible precaution has been followed before the repair job is started. Otherwise, the flame might cause an explosion.

The same precautions should apply when cleaning or repairing empty tanks or vats. Because of the many hazards and serious problems involved, it is important that only experienced men, familiar with this type of work, should be used. Danger signs should be freely used to indicate when workmen are at work. All pipe lines should be disconnected and blanked off. The failure to observe this elementary precaution has been the frequent cause of serious accidents.

Before entering or starting to repair an empty tank, it should be filled to overflowing with a strong solution of soda ash, after washing it out with steam introduced under considerable pressure by means of a hose. The soda ash solution should be allowed to remain in the tank for several hours before it is drained to permit any one to enter. Gas masks and life lines should be held in readiness for emergency.

At all times, work should be performed according to a well defined and standardized procedure, and extreme care taken to see that instructions are strictly followed.

Metal Drums

Drums used for holding chemicals vary in size. They are usually made of light steel, and may hold from 500 to 1500 pounds of chemicals. They are best handled on round-bottom two-wheeled hand trucks. They are usually emptied by gravity or by acid pumps.

After the contents have been removed, drums should be thoroughly cleansed to remove any possible liquid and free sediment remaining. This is done by spraying live steam through the bung, and flushing with boiling water for several minutes. Drum

should then be drained and allowed to dry thoroughly.

Carboys

Carboys are glass bottles that hold about 12 gallons of liquid and weigh 100 to 300 pounds when filled. They are generally encased singly in wooden boxes to prevent breakage. To prevent unnecessary corrosion, crated carboys should not be stored in damp places, or in open yards where they are exposed to weather. Separate store rooms or buildings are recommended, preferably with a concrete or brick floor, properly drained to the sewer or to a catch basin.

Crated carboys should not be piled one on top of another, but on suitable racks erected for the purpose. When on the floor, they should rest on wooden strips so that, in case of breakage, the acid will not come in contact with the crate.

Extreme care should be exercised in handling full carboys, so that they will not be dropped, unduly shaken, nor struck against or by other objects. Broken carboys have been known to cause explosion and fire, and there is always the danger that the spilled acid will come in contact with the hands, face and body of the person handling it.

Mechanical appliances for handling carboys are nearly all economical, and much safer than the simple picking up of a carboy by one or two men. The choice of these mechanical appliances depends upon plant arrangement and the intelligence of the workers. Ordinary warehouse trucks should never be used, as they are impractical and unsafe because there is no means of securely holding the carboy in place. A better type of truck has a fork attachment, one prong of which passes on each side of the carboy box and beneath the side cleats. It is equipped with large wheels so the carboy can be raised several inches from the floor, can easily be handled by one man, and the carboy need not be touched with the hands at anytime during the operation.

Small Jugs

Some plants require only small amounts of acids, sometimes less than a carboy. In such cases, acid is usually shipped in small jugs. To overcome the danger of accidentally breaking or upsetting such vessels, there has been designed a container that consists of a small jug loosely fitted into a

fiber or sheet metal cylinder and packed therein with a tar composition. The container has a tight fitting cover and a strong carrying handle.

General

Chemical burns are always painful, and sometimes cause death. Workers cannot be too careful in avoiding accidental splashes and direct contact with acids which will cause burns.

Instructions as to the proper handling of acids should be definite, practical and thoroughly understandable. They should contain not only a warning of the dangers of the various acids used, but also fully describe the standard procedure in which work must be performed, and the proper methods of administering first aid in case of injury.

After an accident, a thorough knowledge of the elementary first aid practices is extremely important, as a worker's life may depend upon the immediate administration of relief. And so, first aid remedies, with instruction for their use, should always be readily available.

Floors, where acids are used or stored, should be kept in good repair, and should not be slippery nor made of material that will become slippery with wear. They

should be properly drained to the sewer or to a catch basin.

Working places should be well illuminated. Good lighting is especially desirable where steam, fumes, or vapors are likely to limit the field of vision.

Proper ventilation is essential. Workrooms should be so arranged that all poisonous fumes are eliminated by suitable ventilation, or through the installation of adequate exhaust systems.

Proper ventilation may be secured in several ways. Not all of the methods generally used, however, are equally effective, and great care should be used in selecting the method best suited to any specific condition.

Workers should wear suitable clothing, and all the necessary protective devices should be put at their disposal, to guard against accidents. Men continually handling acids should be encouraged to change their clothes and take a bath before leaving the job at the end of the day.

The big problem in avoiding accidents when handling acids lies in (1) adoption of well recognized safe practices; (2) thorough understanding on the part of the men of these practices; (3) their positive and conscientious enforcement by a combination of careful supervision, proper training of new employees and emphasis on the constant use of common sense.

The following points were mentioned in the discussion following Mr. Turgeon's address:

What can be done about the hazards of overhead acid lines?

Underground lines should be used whenever the plant layout permits. If this is impossible, the acid pipe line should be passed through or housed in a larger pipe which serves as a jacket, draining to a safe place.

A warning that will always bear repeti-

tion is, "Don't look up when you see a wet spot on the floor." Step back, out of the way, before inspecting for the leak. Better still, inspect acid lines periodically, so that there will be no occasion to look up and expose one's self to an acid burn on the face or eyes.

Is the hand control or the foot control preferable in deluge showers?

The foot control is better. It operates more rapidly. The deluge of water starts as soon as a man steps on the platform.

Protective Equipment in the Handling of Acids by the Consumer

By E. G. EBERHARDT

Safety Director, Mallinckrodt Chemical Works, St. Louis, Mo.

The recognized hazards to guard against in handling acids are bodily harm, destruction of property, particularly clothing, and in some cases fire.

Protective equipment is not just a matter of providing the worker with personal protective equipment of some kind. The management should also be provided with protective equipment in the form of study of the method of handling acid and responsibility for the education of the worker.

Providing the worker with the necessary personal protective equipment such as goggles, rubber gloves, rubber aprons or even whole rubber suits will depend upon the manner of handling. However, emergency showers with quick opening valves, making a large volume of water instantly available, should be installed so that they are easily reached.

The method of handling and the kind of equipment to use should be determined after a study of the problem.

Much emphasis should be put on the education of the worker. He should be given the necessary instructions in the clearest terms so that there is no chance for misunderstanding. He should be acquainted with the seriousness of the hazards to be encountered. Personal habits should be checked. Soap and water are the best preventives for infection from small injuries. A daily change of clothes may be advisable.

Some of the more common acids are:—sulfuric, nitric, hydrochloric, the mixed acids of nitric and hydrochloric, hydrofluoric acid, carbolic, hydrocyanic, acetic, picric and oxalic. All of these are liquids, except the last two, picric and oxalic.

The types of containers used are tank cars, tank trucks, drums, carboys and bottles.

Tank cars and trucks: The usual procedure for emptying these is by blowing with air. When the tank is received, the first thing should be to vent the tank through the air connection, not through the discharge pipe, as there may be enough pressure to force acid through the discharge pipe. After the tank is emptied it should again be vented and then all valves closed. Storage should

be not above 15 feet, so it will not require more than 15 pounds pressure.

Pipe lines and valves should be of the proper material to withstand corrosion as well as pressure. They should be inspected frequently. The repairing of pipe lines should be considered hazardous work and warning signs or locks should be placed on all valves. Lines should be thoroughly drained before starting work. Shields through which a chisel can be used should be employed when opening a flange, to prevent spurt, because there may be a low spot in the line and all acid may not drain out. Workmen should always wear rubber gloves, acid tight goggles and other necessary protective equipment.

If it is necessary to repair tanks, they should be washed out thoroughly, then filled with water, neutralized with soda ash. Closed tanks should not be entered without wearing a safety belt with a workman manning the rope outside of the tank. Canister type masks should not be used in closed tanks. The hose type mask should be used, because of a possibly high concentration of gas or a deficiency of oxygen.

Drums: Drums of acid should be stored in a cool place, bung up. When received, and every time they are moved, the bung should be loosened slowly to release any pressure. If stored over a period of time this should be done weekly. A cloth should be placed over the bung to prevent spouting out when releasing the pressure.

It is not considered good safe practice to empty drums by air pressure. This can be done safely, however, provided the air pressure is reduced to 5 pounds and the drums and pipe lines inspected regularly. The most important precaution is—"RE SURE THE REDUCING VALVE ON THE AIR LINE IS WORKING, AND THAT THE SAFETY VALVE WILL POP OFF WHEN THE PRESSURE GETS ABOVE THIS FIGURE."

Carboys: Carboys are covered with porous stoppers to guard against pressure building up and bursting the bottle. This stopper should be wired on to prevent splashing when moved. The wire should be

cut with pliers and completely removed to prevent hand injuries.

If the carboy has a glass stopper, a cloth should be placed over it, and the stopper loosened slowly to release the pressure.

Care should be taken to see that the carboy is not too full. If it is too full, the hazard of "blow out" when removing the stopper and splash when starting to pour is greatly increased.

Carboys should be moved with an approved carboy truck, the long handled truck with the fork attachment, one prong of which passes on each side of the carboy under the cleat. This type of truck places the worker away from the carboy so that if the bottom falls out when moved, and the bottle should break, the worker will not be burned.

Carboys are emptied in several ways, most frequently by use of an inclinator of approved type, by pouring over a triangular block, by forcing out by air, or by syphoning.

Mention is made of the triangular block because in our plant the men prefer this method to putting the carboy into the inclinator. The hazard involved in this method, whether using block or inclinator, is splash, both when starting to pour and when bringing the carboy to upright position.

The following rules for emptying carboys should apply:—

1. Wear acid tight goggles.
2. Wear rubber gloves.
3. Remove stopper. A cloth should cover the stopper on other than the porous clay stoppers, when removing, to prevent blowing out if any pressure is present.
4. Use of inclinator or triangular shaped carboy block. Tilt carboy slowly, holding pitcher or container close to mouth of carboy. When pitcher is full, set it down, replace stopper in carboy and then slowly let carboy back to upright position. If the stopper is not replaced, liquid may be splashed into the operator's face should the carboy slip and tip back with a jolt.
5. See that carboy is completely empty, and then wash out. Failure to do this presents the greatest hazard in handling, because the men consider the carboy empty.

Forcing out by air was mentioned so that this procedure could be condemned. Carboy bottles are not built to withstand air pressure. Ejectors which are operated by blowing air through the exit pipe, thus creating a suction which draws the acid out, should be used.

Syphoning is another safe way to empty carboys. However, no one should ever be permitted to start the syphon by mouth. A suction bottle or hand bulb should be used. If syphoning is attempted by mouth, the possibility of "back up" is present and the worker may get a mouthful of acid.

Small bottles, of course, require the worker to wear goggles and rubber gloves.

Ventilation: In using acids in open vats or tanks for operations such as pickling, proper ventilation should be provided. The suction opening should be below the head of the operator so that fumes do not reach his face. If exposure is for a short time, a canister mask of the approved type may be used. Most of the respirator types are not satisfactory because they use only a piece of cotton or cloth for a filter.

One of the most serious features of fume poisoning is that the effects do not always show up immediately. Some men think they are immune, but these beliefs are without foundation. Precautions should be insisted upon.

Special mention should be made of additional precautions to be taken with some of the less common acids: hydrofluoric, hydrocyanic, picric and oxalic.

Hydrofluoric Acid or etching acid is so corrosive that it can be handled only in rubber, lead or paraffin containers. Skin burns from this acid are probably the worst of acid burns because of the difficulty in stopping the action. I know of a case where some got under the finger nail of a worker and he complained of burning for several days.

Hydrocyanic Acid. This acid boils at 80° F.; therefore it gives off vapors at room temperature. These vapors are absorbed through the skin. Therefore continual exposure may prove fatal.

Picric Acid. This is highly explosive. It should never be brought in contact with metals, since it forms picrates, which are highly explosive. It should always be handled moist, at least 10 per cent water.

Oralic Acid. This is mostly handled and used in the dry or crystal form. Respiratory equipment should always be worn. As a protection against continual exposure the exposed parts, hands, arms, face should be coated with an ointment such as vaseline, lanolin, or a facial cream.

Ammonia. While ammonia is not an acid, but exactly the opposite—an alkali or caustic—it should have mention here. The same general safety measures for handling acids should apply to ammonia. Extreme care should be exercised during the summer months. Because it is sold at the corner grocery in very diluted form as household ammonia, most people believe it is comparatively harmless, even though it may smart the eyes and skin if some is spilled on it. However, it can cause just as serious a burn

as acid if it comes in contact with the skin, and it is the most serious of all eye burns. A technical discussion of burns of the eye can be found in the Ophthalmologic Review, Vol No. 7, year of 1932.

The best first aid for all acid accidents is large quantities of water to wash off the acid. The one exception is for carbolic acid in which case alcohol should be used. Further treatment should be given by a specially trained first aid man or a competent physician.

The safe handling of acids by the consumer can be summed up in one word, CAREFULNESS—Carefulness by the management in providing the best method, providing safe equipment, providing the proper training of the worker; and carefulness by the worker himself in following instructions.

Following the address by Mr. Eberhardt the following points were discussed:

In pickling operations what is the best way to introduce acid into the tanks?

Pouring acid out of carboys held by a crane or lifted over the edge of the tanks is unsafe. What appears to be a safe method is to run the acid to the edge of the tank with a pipe line controlled by a valve, running a rubber hose from the end of the pipe line into the tank, so that there will be no splashing.

In putting water into the eye to dilute and wash away acid that has entered the eye, can any other method be used than spattering the water in the fingers? This method seems objectionable, because there may be some acid on the hand.

A drinking fountain offers the most satisfactory solution. It should, however, throw a stream of water sufficiently high so that the eye will be bathed thoroughly.

Are any special precautions required in handling empty carboys?

Carboys which are supposedly empty are as dangerous as those which are full. Employees should be required to flush carboys thoroughly after the contents have been emptied. They should also be required to tag them as having been washed. Handlers of empty carboys should be instructed not to pick up any which do not bear the tag.

Is the use of welding advisable in pipe joints and in the seams of tanks?

Welded construction on acid work is of questionable safety. Riveted construction is recommended.

ADJOURNMENT

Aeronautical Section

Officers 1936-37

General Chairman—CAPT. E. V. RICKENBACKER, Eastern Air Lines, New York City.
Vice-Chairman—MAJOR R. W. SCHROEDER, United Air Lines Transport Corp., Chicago, Ill.
Secretary and Program Committee Chairman—JEROME F. LEDERER, Aero Insurance Underwriters, New York City.

The meeting was called to order by Homer L. Bredouw, President, Bredouw-Hilliard Aeromotive Corp., Kansas City, Mo., who presided, introducing the speakers.

The Importance of Flight Dispatching in Air Transportation

By LARRY C. FRITZ

Eastern Region Superintendent, Transcontinental & Western Air, Inc.,
Kansas City, Mo.

Flight dispatching may be defined as the control of aircraft both in the air and on the ground to the end that scheduled operation of aircraft may be carried out with the greatest margin of safety.

A résumé of the various factors that enter into flight dispatching will indicate why it is a prominent element in safety in the air.

First, the flight dispatcher, one on duty every hour in the day in the principal zones, is in radio contact with all flights from the time they take off until they land at their destination.

One hour before a pilot starts on his run he reports to the dispatch office. There he goes over weather conditions as reported hourly along his route and discusses the weather situation with the flight dispatcher on duty and one of the company meteorologists. The dispatcher has previously become familiar with the conditions over the entire U. S., having gone over the reports and discussed the recent weather maps with the meteorologist. Weather maps, one of which is drawn every six hours from several hundred reports over the United States and Canada, are supplemented by airplane soundings with a meteorograph, pilot balloon

soundings for wind aloft data, and temperature and weather condition reports received by pilots to round out a broad picture of weather conditions.

The pilot has decided whether the flight can be made with absolute safety and if the flight dispatcher is of the same opinion plans can be made for the flight. In his discussion with the meteorologist and flight dispatcher the pilot has obtained estimates of cloud base and tops, visibility, location of particular storms, their intensity and rate and direction of movement, probable levels where icing conditions may be encountered and force and direction of wind. He determines the altitude to fly to insure safety and comfort for his passengers and secondly to gain the greatest help or least retardation from winds.

If the pilot is not at a main terminal his forecast and flight plan data prepared by the meteorologist are forwarded to him by radio at least one hour before the flight is due to depart, and with latest weather map available he is able to go over conditions in the same manner as if he were talking it over with the meteorologist. If he is in doubt as to the safety of the flight he may telephone the flight dispatcher and discuss

the flight with him prior to making his decision. Thus, he has checked his own decision at least twice with his consultation with meteorologist and flight dispatcher. He further verifies the weather conditions by going over the latest forecast issued by the U. S. Weather Bureau covering his particular route.

The pilot then computes his flight plan from data on wind and temperatures at various altitudes. He computes the speed that will have to be made to maintain schedule or the most economical speed from his wind and temperature data and the per cent power to use. His altitude may be anything from 500 to 12,000 feet, only being restricted by the prescribed odd or even levels of flying and the weather conditions. If he is flying from zero to 179 degrees he will fly at odd altitudes, one, three, five thousand, etc., but if flying from 180 to 359 he will fly at even levels. This provides desired altitude separation of flights going in opposite directions. He computes his time over intermediate check-points and time to his various stops. He computes his gasoline consumption and determines how much he will use to the next refueling stop and determines his radius of action.

Now the amount of gasoline necessary is not just enough to reach the terminal that he is released to. He must have a reserve supply sufficient for cruising at least forty-five minutes after reaching this terminal, if weather is good. If weather is near the minimum requirements he must plan on enough gasoline in addition to carry him to one or two alternate airports where weather is good; airports that he can reach after arriving over his destination and still have fuel enough for an additional forty-five minutes. The dispatcher in conjunction with the meteorologists has selected these alternate airports, taking into consideration the probable weather conditions, the proximity and condition of the alternate fields.

After making these preparations a clearance form is made up giving a written release by the flight dispatcher to the pilot for release to the next terminal. This clearance is first signed by the mechanic in charge of servicing the airplane who indicates that engines and equipment have been inspected and found in satisfactory condition for the flight and indicating the amount of gasoline and oil the plane is serviced with. The

flight dispatcher signs the clearance releasing the flight from a terminal to the next scheduled stop. He also indicates whether the flight is to proceed ground contact or, if weather conditions necessitate, on instruments.

Latest weather reports from the many observing stations along and adjacent to the airway are put on the clearance. A copy of the latest report on field conditions at the various airports and fields is appended to the clearance together with a forecast for the route made by the United States Weather Bureau and a special trip forecast made by the company meteorologist.

Then the pilot signs the clearance, acknowledging receipt of clearance and the weather reports, and indicates that he considers conditions suitable for scheduled flight and that he will conduct the flight in accordance with approved procedure. A copy of the clearance is retained at the dispatch office with a copy of the pilot's flight plan while the pilot takes the original.

Again the pilot and the dispatcher have checked each other.

At each point or terminal where the flight lands a new clearance is prepared and the flight dispatcher after considering the weather and gasoline load releases the flight to the next terminal.

Once in the air the flight dispatcher has not just cleared the flight and forgotten it. From the pilot's estimated times over various check points along the route, the dispatcher, by means of radio telephone, checks the flight's progress from point to point. Continually watching the weather changes, the dispatcher is ready to advise the pilot of any bad weather that has developed along his route. He may, for instance, advise him to detour a thunderstorm in a certain direction, or to change his altitude to avoid reported icing conditions. The dispatcher is aided in his analysis of weather conditions by hourly and special reports from observing stations over the entire United States plus reports from pilots in other flights from coast to coast flying at various altitudes.

Rules and regulations have been promulgated covering every contingency which might arise in flight such as radio failure, engine failure, poor flying conditions and many others. The pilot is trained as to the procedure to be followed in the event any of these occur and the procedure to follow

is nearly automatic. The pilot reports any variation from normal routine in flight and if the dispatcher believes a departure from the calculated flight plan is advantageous, such as landing at an intermediate field, he issues orders for the pilot to land. Since every known contingency has been considered in the procedure laid down by the company in its instructions, the decision of the pilot and dispatcher are identical. Their first consideration is the safety of the flight.

However, there are times when in the opinion of the pilot, or flight dispatcher, or both, flights cannot operate with a large factor of safety. This may be due to fog, thunderstorms, icing conditions or generally low ceilings. Then the flight dispatcher must decide what to do with the flight. If a delay of a few hours will allow normal resumption of flight, the passengers are sent

to a hotel and plans are definitely made for resuming at a stated time. If it appears that unfavorable weather conditions will persist for some time, the passengers are trained to some point enroute where they can again be picked up and the flight continued to its destination.

Twice a day the flight dispatcher, after consultation with the meteorologist, issues a flight advisory forecast in which probable flight movements for the succeeding fifteen hours are planned with regard to weather conditions. These are supplemented by two additional advisory forecasts at intermediate periods and are corrected if weather conditions become substantially changed during the period. Thus the flight dispatcher is able to plan his operations over a period of time in addition to keeping a close supervision of flights actually operating.

Planning for Safety

By RICHARD C. GAZLEY

Chief, Safety and Planning Division, Bureau of Air Commerce, Washington, D. C.

The Bureau of Air Commerce has been particularly concerned with the improvement of aids to air navigation on the Federal Airways System. As there have been few precedents by which manufacturers of this type of equipment could be guided, the Bureau, as practically the sole customer for airways aids, has found it necessary to design a large share of the material needed.

In its planning work, each regulatory official of the Bureau and each executive concerned with installation of airways aids, has tried to carry on his work with one eye on today and the other on tomorrow, so that regulations placed in force today, and airways installed today, should not be antiquated two or three years from now.

That policy worked very well when the industry was small and development proceeded slowly. It was possible to take care of problems as they arose and make adequate provision for them without any compromise with safety. However, in the last year or so, aviation has swiftly become a highly complex and highly technical factor in the transportation world. This growth has come so rapidly that we have had all we could do to take care of problems as they

arose, without an opportunity for the thoughtful planning for the future.

The obvious remedy was to create a division solely to take charge of all work concerned with planning for the future of aviation. In this way, other divisions would be free to carry out their existing duties in connection with enforcement of regulations, construction, maintenance and operation of airways facilities.

The Safety and Planning Division is the planning agency for the Bureau of Air Commerce, with safety as a central theme. The scope of this division is large, requiring as it does a knowledge of the entire field of aeronautical research. In general, the Safety and Planning Division will study trends in the industry and sponsor and coordinate, or initiate, certain types of research and investigation, and on the basis of these studies guide the industry and the Bureau in a long range program. This division will therefore serve as a clearing house and coordinating agency with respect to the research needs of the industry and the Bureau.

One section of the division is devoted to aircraft problems. The field is large, in spite of the fact that great progress has been made in aircraft design and construction.

The handling qualities of aircraft present one problem, especially in the smaller types which have been criticized from time to time as being too difficult to learn to fly. Several contracts, looking toward improvements in this direction, were let prior to the formation of this Division. Whether or not these will provide a clue to the course of further research cannot be determined at so early a date.

In addition to problems connected solely with the mechanics of aircraft construction and operation, there is the problem of weather which has always been with us. A formidable foe of all forms of transportation, weather assumes even more importance in aviation, for in the air a pilot is almost entirely at the mercy of the elements, unless he is armed with efficient and proved safeguards to offset each danger as it is presented.

Ice has been one of the most stubborn and persistent trouble makers, but a great deal has been accomplished in the fight against it. Ingenious de-icing devices, which by a pulsating movement crack ice forming on the leading edges of wings and tail surfaces, have been developed and are in service use. The formation of ice on propellers has long been one of the outstanding hazards. A major advance in the solution of this problem has been brought about by the Bureau of Air Commerce in cooperation with the aeronautics industry, with the development of a simple device known as a "slinger ring" which provides for the continuous feeding of an anti-ice solution to the propeller blades while the aircraft is in flight.

Ice formation in carburetors, equally as hazardous to safe flight as that on propellers, has been the subject of extensive research by Bureau engineers. Ice in the carburetor checks the flow of fuel mixture, and this may occur even when the outside temperature is as high as 50 or 60 degrees F., due to the fact that the vaporizing fuel causes a temperature drop. The development of a type of carburetor that would be inherently ice free was sponsored by the Bureau, and was completed.

There remain, however, some very important problems in connection with ice formation. Ice still has the annoying and dangerous habit of freezing on windshields, thereby obstructing the pilot's vision, and on pilot heads, causing inaccurate instrument readings. Ice formation on certain types of

ailerons can also present a hazard. A number of organizations, working independently, have been busily engaged on these problems and it is obvious that the Bureau should give whatever impetus and help is needed.

Present types of position lights, which protrude from the surface of the airplane, provide a start for the formation of ice on wing tips and present another problem. We believe that a satisfactory flush-type light would provide added safety and work is now being undertaken toward that end. An added advantage of such a light would be its contribution to increased aerodynamic efficiency.

Some time ago an airline pilot brought to the Bureau an idea that was thought of so highly that we are sponsoring its development. Not yet complete, the plan is to provide in the airplane cockpit a properly orientated chart of an airport. When descending through thick weather, the pilot would see by this means an accurate reproduction of the airport below him just as he would see the airport itself in clear weather. Such an idea, if seriously advanced years ago, probably would have been considered somewhat visionary, but it has practical possibilities today.

We would be helpless without proper and sufficient airport facilities. For a number of years the Bureau has maintained a section devoted entirely to airport work. The engineers of this section have been available for consultation with city, town, and community officials interested in constructing or improving their airports. Under the emergency works program, the Airport Section has worked closely with the Works Progress Administration and its predecessors in a nationwide airport construction and improvement program.

The Airport Section, which is now a part of the Safety and Planning Division, will continue this work, and it has been assigned additional duties in connection with future planning.

One of these projects is closely concerned with a problem which will be even more pronounced in the future—the relation of the size and location of airports to the types of operations conducted from them. In an effort to obtain exact information as to take-off and landing distances required by different types of airplanes in varying atmospheric conditions and at different altitudes, motion picture cameras are being

used to photograph various aircraft as they land and take off. The pictures are then placed in a specially designed and calibrated projector which throws the images on a ground glass screen. In front of the screen and directly against it is a glass grid which enables the observer to read directly the rate of climb and angle from the take-off point. This information, together with the recommendations and advice of the Post Office Department, Navy Bureau of Aeronautics, Army Air Corps, private flyers, scheduled airlines and commercial operators, and data from other sources will be the basis for future airport planning.

Another project calls for the compilation of a photographic record of all airports in the United States. These will be assembled from the Army, National Guard and other agencies, and will be brought up to date by field personnel of the Bureau of Air Commerce and scaled. The photographs will show facilities of all kinds, whether zoned or not, area available for expansion, drainage system, length and direction of runways, types of hangars and other buildings, lighting system, communication system, type of field, and storage and transportation facilities. Much of this information will be collected from a nationwide survey and sketched on the photographs. The complete data will be used to determine the classification of various airports in the formulation of plans for development over a long period. By comparison of facilities shown on the photographs and information collected by the survey with the opinions of airport officials, the types of aircraft that can be ultimately handled by each airport can be determined. A financial survey will also be conducted, and this in conjunction with the survey and photographic project will enable the Bureau to determine the estimated cost of the development of a field and facilities to its ultimate capacity.

Somewhat related to airport problems and also of major importance in air transportation are the long range planning aspects of so controlling airway traffic as to prevent collisions and at the same time to keep airports and airways available as public facilities.

About a year ago the Bureau inaugurated an airway traffic control system to relieve congestion along the airways and at major airports. This system is under the jurisdiction of the Airways Operation Division. The

Safety and Planning Division, through its Air Transport Section, will be concerned with the future aspects of this problem, for just as it has become of importance today it will certainly assume a far greater importance year after year as the amount of traffic increases. Therefore, in our planning program we must attempt to ascertain just what proportions this increase will assume, in which direction it will be, and shape our plans accordingly so that we will not be caught off guard with an outmoded system five or six years from now.

Another major field of inquiry concerns the human element. This is a problem to which no existing rules can be applied. We can set up exacting limitations and requirements as to physical fitness and piloting skill, but there we must stop. From then on we are confronted with questions about which little is known. We have designated this problem as "pilot fatigue."

The project which is set up under this somewhat vague heading seeks to determine those factors which impair the efficiency of a pilot, to the end that such factors may be eliminated, minimized or controlled. This is a vital problem, magnified as it is by the increasing size, speed and complexity of modern and projected airplanes. It is obvious that the amazing adaptive qualities heretofore displayed by American pilots cannot be stretched to a mastery of unlimited complexity and it may be true that, even under present conditions, the strain of competently handling their jobs is shortening the useful life of the pilots.

Returning to mechanical problems, we encounter the subject of power plant vibration and its relation to propeller failures. Under some conditions a combination of vibrations in the power plant and engine mount is set up which if allowed to continue may produce a dangerous amount of fatigue in the propeller.

In present types of aircraft we know the points at which the vibration will become dangerous, and the necessary precautions are taken to avoid the danger zone. Our problem then is not concerned so much with the elimination of vibration in present types, but with finding means to predict and avoid dangerous combinations in new designs now in the jig and on the drawing board. The Bureau has given full recognition to this problem and is conducting studies in cooperation with the industry to develop means

for the prevention of propeller failures due to this cause.

The projects assigned to the Power Plant Section relate to its general responsibility of determining the hazardous factors in power plant operation with respect to both forced landings and fire, and finding means to eliminate those hazards.

You are familiar with the role played by radio in the navigation of aircraft. As aircraft operations have been extended, radio has become increasingly important. On the Federal Airways System more and more emphasis is being placed upon radio. In former years, contact flying was more or less the rule in aircraft operation, as the aids necessary for flying for long periods out of sight of the ground had not been perfected for extensive use.

However, the use of radio has diminished the weather hazard from year to year as new devices and new means of replacing visual contact with radio information have been perfected. Now aircraft fly more or less as a matter of course above the clouds and away from sight of the ground, but still receive all the information needed to conduct the flight safely and without dependence upon ground landmarks. However, it must be pointed out that certain restrictions still limit this type of flying. Regulations forbid the starting of any flight in the face of known dangerous weather conditions, but if a pilot should encounter such conditions unexpectedly while in flight, it is possible for him to complete the flight although his vision may be shut off for protracted periods.

Many improvements have been made possible by research and development work on the part of the Radio Development Section. It has been concerned largely with the indexing of future requirements and the carrying out of experimental work necessary to perfect new ideas. Because it has been concerned with requirements of the future, it is now possible for the Bureau to go ahead with its modernization program which will place in service use equipment which was in the laboratory several years ago.

Further improvements are still in the laboratory or just emerging from it. For instance, a large amount of work has been devoted to the perfection of a means by which teletypewriter machines could be operated by radio and reliability equal to land line operation has been obtained. The Bureau's radio development engineers are now

seeking means by which teletypewriters may be placed in aircraft and the information transmitted directly to the pilot. The pilot will receive written messages in flight, thereby preventing misunderstanding, and also leaving the crew free to examine the messages later.

With the growth of radio, the question of frequency allocations in the bands now assigned for aviation purposes has become a pressing one. In order to get around this problem, and also in an effort to obtain certain distinct advantages, the utilization of ultra-high frequencies is now under serious investigation. Two new types of radio marker stations developed for airway traffic control purposes operate on ultra-high frequencies and consideration is now being given to the utilization of these frequencies for radio range use.

The radio range stations, upon which a pilot is dependent for directional guidance along the airways have a tendency in some localities to present bent and multiple courses which give the pilot false indications of his position with respect to the airway. Static, which sometimes blankets out the signals, is also a disadvantage.

It is now felt that the use of frequencies in the ultra-high zone would eliminate many of these disadvantages or at least minimize them to the point where a greatly increased efficiency and reliability would be obtained. Projects concerned with the development and test of ultra-high frequency radio range transmitters and receivers have been assigned to the Radio Development Section for immediate consideration.

Also in the field of radio is the problem of landing aircraft when low visibility makes it impossible for the pilot to make a normal landing by visual contact with the ground. While in the air, the pilot can navigate by means of his instruments and radio if visibility is lowered by fog or other conditions. It is possible for him to locate the airport by instrument and radio, but he must be able to see in order to land his airplane.

We are confronted, then, with the problem of finding some means to replace the necessity for visual contact with other means of furnishing the information necessary to complete the landing.

At present, if a pilot learns by radio that the airport at which he is to land is closed in, he must land at another airport, and on all airline flights certain airports are desig-

nated in advance as alternates so that he can complete his flight safely even though it does not end at the scheduled stop.

This, of course, seriously interferes with schedules, although it is imperative that safety be considered first of all. But, it causes inconvenience to passengers who must wait until the weather clears at the terminal airport or proceed by some other means of transportation.

The Bureau of Air Commerce and the aviation industry have been concerned with this problem for a number of years, and active work has been under way in an effort to perfect a practical instrument landing system. During the past ten years several types of landing systems have undergone development and tests and a considerable fund of information concerning the advantages and disadvantages of each has been obtained. A survey of all types has been made and it is now possible to fulfill the requirements of a satisfactory system by combining the best features of those proposed in the past. The major airlines, the Federal Communications Commission and the Bureau of Air Commerce are now in agreement as to the features necessary in a practical instrument landing system.

While radio is becoming more and more important to air navigation, effective airway and airport lighting is still of prime concern and the Bureau is conducting research looking toward the improvement of facilities of this type. It has assigned to the National Bureau of Standards, research projects looking toward improved airway beacons, aircraft landing lights, runway illuminators and other problems in lighting.

Rating of Instructors

By ELWOOD B. COLE

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The Air Commerce Act of 1926, as amended, authorizes the Secretary of Commerce to certificate airmen as to their competency. The ability of a man to fly an airplane is determined by certain theoretical examinations and practical tests. However, the proof of such ability and the issuance of a certificate of competency do not imply that the man is also competent to impart

Laboratory work in connection with carrying out projects adopted by the Division will be performed by agencies outside of the Bureau of Air Commerce, preferably commercial laboratories, under the general supervision of the Bureau and supported in part or wholly by our funds. Where it is necessary to determine specifications to guide outside agencies, the Bureau will do some development work, but it seeks to avoid even such activities if the result can be satisfactorily obtained otherwise.

The most important project of all has not yet been touched upon. It consists of a determination, study and classification of the present and future needs of the industry, the results of which should form the basis for our future program. In other words, it is largely futile for us to attempt long range planning for the industry or the Bureau until we have first conducted some intelligent planning for ourselves. This work is now under way and should provide intensely interesting results. It will never end, of course, but perhaps that is the secret of the fascination of this profession.

These problems are not the Bureau's concern alone. They are of importance to the entire aviation industry and to every one who makes use of aviation in any form. The Bureau is acting chiefly in a coordinating capacity and is furnishing facilities for the prosecution of this work so that it will be carried out along definite lines. It cannot carry the entire burden alone, and, therefore, we are extremely anxious to have suggestions and information from any informed source so that we may truly be in a position to aid the related causes of aviation and safety.

such knowledge to others. Further tests are needed and, under the new Civil Air Regulations, will be given. Upon the satisfactory completion of such tests, the applicant will be certified as competent to instruct and such certification will take the form of an instructor rating on his pilot certificate. This rating by itself will be subject to denial, suspension or revocation for cause.

There are practical reasons for the rating of instructors. The outstanding justification of such action lies in the inadequate or poor quality of instruction being given by pilots who are unable to convey their knowledge to others or who, in an effort to earn enough money to build up their flying time, are instructing students before they, themselves, have acquired sufficient knowledge and experience.

Under the present regulations, only a transport pilot may instruct for hire; while a private pilot, regardless of the amount of time he has accumulated, may instruct, but not for hire. This arrangement has been the direct cause of many accidents.

The instructor rating requirement should eliminate most of these evils. All commercial pilots (now called transport) will be eligible, as will private pilots who have acquired 200 hours of solo flying time. The same commercial privileges will apply as at present. A limited commercial pilot will not be eligible, since, having secured his 200 hours, he is then ready to take his commercial pilot rating examinations, after which, if successful, he will be eligible for an instructor rating. If he wants to instruct, not for hire, he should then change his rating to private. An earnest effort is thus being made to establish a definite line of cleavage between commercial and non-commercial activities and to examine and certificate airmen accordingly.

Cleveland Airport Radio Traffic Control

By JOHN BERRY

Commissioner of Airports, Cleveland, O.

With the design of the Cleveland Airport in 1928, it was foreseen that a central control point for a method of traffic control on and in the vicinity of the airport would be a prime necessity; so a control tower was constructed overlooking the airport. Manual signals and lights were used until 1929 when, during the National Air Races at the Cleveland Airport, there was concentrated one of the largest groups of Army, Navy, marine, commercial and itinerant aircraft ever assembled. In controlling this great number of planes, we discovered both our manual and light signals to be inadequate.

In the past, two private pilots could fly together in a dual controlled aircraft. Under the new regulations, this may also be done provided one of them is the holder of a proper instructor rating. The same applies to any two pilots flying in a dual controlled aircraft—one of them must be a certified instructor. This ruling should tend to decrease materially the number of accidents in this type of flying. The only point of contention will be whether or not the pilot is abiding by the commercial privileges of his particular pilot rating.

One of the most important features of this new rating lies in the fact that the certification of an instructor carries with it an actual protection of the man who can so qualify. It also establishes a recognition of the importance and responsibility of those pilots who are carrying on in this field.

As to the actual procedure necessary for a transport pilot to secure his instructor rating, it should not impose any particular hardship. On the effective date of the new regulations, or as soon thereafter as possible, the transport pilot will be given his new commercial pilot certificate together with an instructor rating. Both will be in full force and effect until the next regular renewal date. At that time, the pilot rating will be renewed upon proof of the necessary renewal requirements, but the instructor rating will not be renewed until the applicant has passed the required examinations and tests.

Much thought had been given to radio, so, enlisting the facilities of RCA, which generously offered cooperation, design of equipment was instituted, resulting in the latest models of airport transmitters and receivers. In the control tower we placed our equipment, and the control tower, since that time, has been manned 24 hours a day.

The traffic situation from 1929 until today has rapidly increased. During 1929, the movement of ships and passengers through the Cleveland Airport totaled 14,455 ships and 15,825 passengers. This movement of ships and passengers increased yearly until

in 1936, the movement of ships numbered 33,140 and passengers 184,017.

Our original tower therefore was deemed inadequate and a new tower was designed which allowed unlimited visibility, more efficient operation and a higher degree of safety. In this tower was placed every control necessary to safe operation on the Cleveland Airport. The radio equipment, which has been constantly improved, now consists of two AVT No. 1A-RCA airport transmitters with an RCA-AVT No. 8 amplifier unit and an RCA-AVA No. 3 radio beacon attachment for blind or instrument approaches. These insure continuous operation in any emergency. Also, six RCA-AVR No. 11 receivers with crystal attachments for standing by on the day and night frequencies of the air lines using Cleveland Airport.

Besides the radio equipment, in the tower were placed all controls for airport lights, floodlight, both arc and incandescent, interphone to airline radio dispatchers, hangars, airport traffic control, weather bureau and ticket office; a public address system, instruments for wind direction and velocity; barometer and thermometer.

The personnel employed are experts in their line with a good background of education, air operation, radio and pilot experience. They carry the necessary type of radio license and there are two men on duty 24 hours a day, working eight hour shifts—with three extra men, experienced and licensed, available for relief at all times. Incidentally, the original three operators who opened this station in 1929, are still the nucleus around which the increased personnel has been built.

Safety of operation is the first principle of tower efficiency. Speed of operation is secondary. All instructions from tower to pilot are given in the nature of helpful suggestions, never as orders or commands; in the last analysis, the pilot is his own captain.

This has resulted in the 100 per cent co-operation of all pilots, transport and itinerant. Careful phraseology is used to avoid misunderstandings, such as pilot's name, line, trip and ship number. A pilot, after being released by Airway Traffic Control, contacts the tower upon entering the Airport zone, which is about 30 miles or ten minutes distant, giving his name, line, trip and ship number, stating his position and altitude in relation to the airport. The following is the standard procedure and phraseology used at the Cleveland Airport and adopted at Washington as a standard:

"WRDT answering Peeples in United One. No traffic reported between you and the field. The winds at the field are South, Southwest, S SW at 15 miles per hour. Occasional gusts to 20. Field clear. I'll be standing by."

When in sight of the airport, the pilot calls again.

"Peeples, United One, to WRDT. About three miles northeast."

"WRDT to Peeples, United one, all clear for your landing," and when on the ground, "All clear to keep rolling, nothing around you, and taxi to gate No. 7 please."

The operator, with his unlimited visibility and radio equipment is, one might say, in personal contact with each pilot, and can then handle all types of traffic, whether transport inbound or outbound, or local flying as well, relieve congestion and help the pilot maintain his exacting schedule. At Cleveland Airport, it is not unusual to land five or six ships at one time and in perfect safety, due to the large all-way hard-surfaced landing mat which facilitates fast ground movements, besides providing excellent take-off and landing conditions. The pilot is relieved of traffic worries and may give his entire attention to the plane itself.

ADJOURNMENT

American Society of Safety Engineers—Engineering Section

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 S. E. WHITING, Liberty Mutual Insurance Co., Boston, Mass.
 WILLIAM P. YANT, Mine Safety Appliances Co., Pittsburgh, Pa.

WEDNESDAY LUNCHEON SESSION

October 13, 1937

The annual meeting of the ASSE-Engineering Section of the National Safety Council followed a luncheon and convened with D. L. Royer, Ocean Accident and Guarantee Corporation, New York City, general chairman, presiding. All reports had been mimeographed, and copies were distributed at the luncheon.

A report of the address delivered at the meeting by Elmer A. Holbrook, dean of the Schools of Engineering and Mines, University of Pittsburgh, Pittsburgh, Pa., will be found elsewhere in this record.

The report of the nominating committee was presented by C. W. Smith, chairman. Other members of the committee were A. S. Regula, S. E. Whiting, Dr. M. G. Lloyd, and R. F. Thalner. The committee's list of officers, as elected, will be found in this section of the Congress Transactions.

Other sessions sponsored by the ASSE-Engineering Section included those on "Safe Use of Acids," "Industrial Dusts," "Pressure Vessels," "Industrial Fumes, Gases and Vapors," "Safety Training," and "Safety Inspectors."

Engineering and Industrial Accident Prevention

By E. A. HOLBROOK

Dean, Schools of Engineering & Mines, University of Pittsburgh, Pittsburgh, Pa.

The essence of early safety work was the safety education of the worker. Education has ever been one of the two legs supporting safety.

We did not go far in our safety program until we discovered that safe materials, safeguards, safety standards and safe equipment were equally potent with worker education in reducing accidents. These material things constitute the second leg of our safety body.

I notice with pleasure a wide diversity of use of the term "engineering" in the world of safety. There is nothing to tell you that a man must go to college to be a safety engineer. Nevertheless, an engineering college is perhaps the place where a man may learn easiest how to design a safe boiler or building or of the thousand and one material factors of safety that we associate with engineering. He learns there also how to draw conclusions from his facts, and we trust he may later in practice act with professional wisdom.

When we remember the efforts of the Red Cross thirty years ago, or we read again the first mine inspection act in Pennsylvania, there was little to indicate that safety ever would be of professional engineering interest. Today when you consider the enormous accumulated data on the material side of safety, engineering of its writings, its myriad standards, its exacting practice, you must admit that to absorb, interpret and apply this world of material requires a mind trained to the college or equivalent level. As a parallel example, electrical engineering was unheard of before 1880, yet in the past 50-odd years, it has through research and practice, accumulated data, writings and standards of such importance and variety that the single human mind cannot in a lifetime span its whole field.

Think again of those modest beginnings of safety, mostly in the minds of men in the mining, metallurgical and railroad industries. Slowly it felt its way, largely with a humanitarian background. Then came workman's compensation, giving the work a definite economic background. Finally, and with increasing acceleration, the methods and practices of safety have penetrated today not

only into every corner of our industrial world, but into our individual daily life. Certainly as regards industry, I am ready to admit that Safety Engineering has arrived; that in its historical development, in its penetration of organization and management, in its influence on production, economics and design, and by its high standards of research and practice, Safety Engineering is on a plane where it demands a place in our engineering college curriculum.

The curious fact remains that in general the engineering colleges of this country have not yet assigned to safety engineering any definite recognition.

Several years ago it seemed that the time had come where in a great industrial center like Pittsburgh we should offer a course in Safety Engineering on a college level. We determined in this course not to deal with safety as applied to any specific industry, for we believe that in these industries themselves, the special application of safety principles best can be mastered. Rather we tried to uncover the basic principles or essence of safety engineering, common to and of interest in all industries. Thus our year's outline for the subject covered purposes, origin, growth, agencies, and organization for safety work; industrial hazards, management responsibility, and safety education. Then came individual accidents, their causes, costs and prevention; accident classification, machinery and the human factor, design as affecting safety; safeguarding the working place, inspection, and materials handling. Finally, we studied safety codes and standards, workman's compensation (origin and rate making), and methods and results of safety work in typical industries.

This class has gone on for some seven years; first under its founder, the late Dr. J. W. Hallock, and for the past two years under Irvin Brinkman, safety director of the McIntosh-Hemphill Company. The classes have varied between 20 and 70 men enrolled. A curious difficulty has been the absence of a satisfactory text book. Is it not noteworthy that although there are hundreds of college text books covering almost every conceivable engineering subject, I know today of

no text suitable for a college course in safety engineering. The Armour Institute of Technology has admirable courses in fire prevention engineering, and Harvard University has undertaken extensive work in traffic and highway engineering and recently has offered 15 fellowships to men wishing training in this field. These exceptions bring out by contrast how little attention most engineering colleges give to safety.

Perhaps it will take another generation of engineering teachers to recognize that today safety is a part of every engineering problem and as essential as the items of cost, good design, probable life, and general usefulness.

You of the National Safety Council have done a great work in educating employees and employers, insurance companies, standardization agencies, the child in the school, the man on the street, and the woman in the home. But for some reason you have not made the engineering colleges safety conscious.

You have accumulated writings and data so vast that no single mind can absorb them.

You know that your continued success depends upon diffusing safety knowledge this year and next, yes even from generation to generation. You should have at work men trying to explore for that essence in safety problems which I sometimes think cannot wholly be expressed—it can only be felt.

May I call attention here to the fact that, so far as we know, a college or a university is likely, next to the church, to be the most enduring agency of civilization. Even in this young country, Harvard University has celebrated its three hundredth anniversary, reminding us that it has outlived changes in government, in religion, and in peoples. Essentially it has been the repository of great ideals and truths, equipped to pass the torch

down from generation to generation, undimmed and often refueled. For this reason alone, I say to the National Safety Council that you ought to form an alliance with one or more American engineering schools, trusting in this way to insure the perpetuation, without fear or favor of all that is at the heart of safety.

I believe also that within a college, and away from the stress of economic struggle, where research in safety principles can best be carried on, you would find, through support of a chair of safety engineering, that out of it would come a sifting of wheat from chaff, an extraction of the essence from the mass of material things.

Of a more practical nature, an engineering college department interested in safety should be able to put out text books on safety, more valuable therefore to the student than the general references we now have to use.

On this foundation must come courses in the principles of safety engineering offered to the undergraduate engineering student. Whether you like it or not, the truth is that the bright young boys of today go to college, most often to an engineering school, whereas the similar boy of 30 years ago generally entered industry after high school. This means that the future safety engineers and industrial leaders are largely going to be products of a four year college engineering course.

Safety engineering can't just be discussed like politics. It must be felt, it must be lived, it must be instilled into these young engineers firmly. Then and then only will they react instinctively to safety in engineering. I do invite, most earnestly, the attention of the Executive Committee of this Council to the need, through cooperation with the engineering colleges, of educating our future engineers in safety.

ADJOURNMENT

Automotive and Machine Shop— Power Press Sections

Automotive and Machine Shop

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TUESDAY AFTERNOON SESSION

October 12, 1937

Sessions of the Automotive and Machine Shop and Power Press Sections were held jointly. A list of officers of the Power Press Section will be found on page 535 of this volume.

The opening session was called to order by Acting Chairman M. J. McCarthy, Safety Director, Fisher Body Div., General Motors Corp., Detroit, Mich., who introduced the speakers.

Developing Safe Workers Through the Employment Office And Job Training

By HARRY C. BIGLER

Personnel Director, Research Laboratories Division, General Motors Corporation, Detroit

The employment man is in the best possible position to instill safety consciousness in the minds of new employees. He is the first representative of the company to contact the new employee. His responsibility for safety is as great as that of the safety engineer or foreman, due largely to his opportunity to observe the physical and mental qualifications of the applicant. He

meets the new man when he is in the most receptive frame of mind.

While he may not be able to judge a man's ability to perform a certain operation efficiently and it may not fall within his line of duty to teach the rudiments of the job, he should explain company policies and place special emphasis on safety. There should be no hesitancy in explaining that

the company will not tolerate accident-prone employees, for they are distinct hazards to themselves, their fellow workers, and to company property. The employment man should be thoroughly familiar with conditions surrounding the job for which he is selecting a man. He should know the fatigue elements and the types of workers required for the job, remembering that upon his ability to select men depends the functioning of a smoothly running organization. The employment office itself can be an important factor in creating the correct impression on the new employee—neatness and orderliness of the office and surroundings can indicate the type of good house-keeping in the plant, so essential to proper safety conditions.

The prospective employee is undoubtedly anxious to obtain the job and make good. Since he has his mind set on conforming to the requirements of a new job, new associates and new environment, he will undoubtedly react to new ideas on safety, especially when the benefits he will derive are explained.

No man will deliberately cause injury to himself or another, nor do I like to charge an injury to carelessness on the part of the person injured. Carelessness might be the under-lying cause of an injury—but whose carelessness? Did the employment man do his duty, or simply provide a book of safety rules containing a hundred or more don'ts?

I recall an incident where a new man was being "written up" in one of our plants. He was handed a book of rules on safety and told to read them carefully. After going over them slowly he laid the book down and indicated that he understood their meaning. When asked to sign his name to the employment card he made an X. What good were written rules in this case? The man could neither write nor read, and yet he could not be denied the right to work.

Experience has taught us that a little extra time spent by the employment man and departmental foreman with a new employee before he actually starts work will not only pay dividends in the form of quality and quantity of workmanship, but will greatly reduce human suffering and accident costs. In early years, an attempt on the part of anyone to encourage selective employment was often frowned upon by the employment man who considered it an en-

croachment upon his authority. However, the introduction of compensation laws and labor legislation in many states, the tremendous labor turn-over costs in industry, and the increases in insurance premiums helped to bring to the attention of managements the idea that some medium of control had to be exercised. Consequently, the safety engineer, thought of in terms of a necessary evil or disease, slowly found his way into the spotlight and his job from then on was definitely outlined.

The plant physician can also take a place among those responsible for the development of safe workers in industry. The final selection of any man is subject to the approval of the medical staff. While the employment man concentrates on the mental and experience qualifications of the new man, the physician decides on the physical fitness angle. The plant physician, in other words, acts as a double check on the proper selection of a new employee.

The railroads were among the forerunners of the safety movement and soon realized the value of educating the workers on accident prevention and accepted as an integral part of their program the selective training of engineers, firemen, brakemen, and round house employees. Their program designated special training periods for each employee and the employee was advanced accordingly.

The metal working industry finally took a leaf from the railroad manual and used it as a pattern to organize and develop safe workers. It was a good experiment indeed, for a review of the industry's accident experience shows the success in the reduction of industrial tragedies that plagued the industry in the early years. Taking General Motors' record, our frequency rate in 1937 is only one-sixth of that in 1925 and the severity rate only one-third. I'm sure other units of the automotive industry can show a similar improvement.

At one of our plants a very effective plan was recently adopted and has been successful in developing safety consciousness among new as well as older employees. This plan held regularly scheduled "executive training" meetings for the purpose of developing the best possible kind of leadership. Company policies and their effect upon good workmanship and production schedules were discussed. Accident prevention methods were suggested or at least discussed in an

abstract way until the personnel director decided that such a group could become the very backbone of all the safety activities in the plant. The result was that the last thirty or forty-five minutes of each meeting were devoted to the elimination of specific injury-causing hazards. Each one present was asked to prepare a list of all the accident cases with which he was familiar and make specific recommendations for their elimination.

I was present at one of the very first safety sessions of this new group, and was surprised at the enthusiasm and sincerity with which the subject was discussed. I learned that accidents are sometimes caused by poor supervision or, let us call it lack of proper supervision. The safety session idea worked but the results were not so marked until it was decided to bring into these meetings a number of men from the shop and allow them to express their opinions as to the causes of accidents. Meetings of this sort were repeated week after week and are still being held. A list was compiled and boiled down to twenty-one specific causes of plant accidents, namely:

1. Carelessness.
2. Congestion.
3. Type of work.
4. Poor housekeeping.
5. Departmental and general activities.
6. Improper storage of material.
7. Inexperienced help.
8. Short schedules.
9. Ignorance.
10. Equipment condition.
11. Poor supervision.
12. Haste.
13. Failure to follow instructions.
14. Horseplay.
15. Taking chances.
16. Thoughtlessness.
17. Nature of work.
18. Attitude of "It can't happen to me."
19. Hazardous conditions, such as lack of space and equipment.
20. Fatigue.
21. Curiosity.

The important thing about this safety meeting type of program is that every man in the plant, from supervision down, takes part in it and shares the responsibility for accident prevention. Their suggestions do not go unheeded, but are given the same treatment and handled with the same dispatch as other important company matters.

Accidents are too often charged to the wrong account. In the last few years the trend has been to place responsibility for accident prevention with supervision, particularly the foreman, but what happens when an accident occurs? If the accident results in damaged property, and not necessarily in injury, the employee is disciplined accordingly. On the other hand, if the accident should result in injury, steps are usually taken to discipline the person directly responsible. Supervision, though only indirectly responsible, should not be exempt from such measures.

I am pointing this out to show that responsibility for accident prevention properly placed, plus a thorough investigation, and followed by justifiable discipline, will add immeasurably to your plans for an alert and efficient personnel. Eternal vigilance should be the pass word with which a man enters his place of employment and it is the employment man's job to impress it on his mind.

An analysis recently made of all our 1936 accidents showed that: 9.5 per cent were eye injuries, accounting for 27.8 per cent of the days lost. 32 per cent were hand injuries, resulting in 58.3 per cent of the days lost. 25.4 per cent were foot injuries, causing 5 per cent of the days lost. In other words, eyes, hands, and feet accounted for 67 per cent of all accidents and 91 per cent of all lost time. Such information should be given each employee, particularly the new ones. What better type of ammunition could the employment man have at his disposal to drive home the importance of being alert?

In plants where safety contests are held frequently, the nature of the contest should be fully explained, especially the part the new man will play. Most of us possess that competitive spirit and the desire to win, or at least to be on the winning side, but only by working safely can we hope to win.

It is both impractical and impossible to point out to a new employee each specific hazard he may encounter in connection with his job in a certain department, just as it is impossible for one to be conscious of each separate danger he might encounter in an automobile trip over a new road. We must, however, teach the worker to be alert 100 per cent of the time and to be constantly on the look-out for hazards which are not usually connected with the type of work he is doing. Rules should be kept at a minimum.

General precautions applying to a certain kind of work, plus 100 per cent alertness to unusual hazards, are adequate instructions for a new employee, if properly administered.

It is a difficult job to teach a man how to be alert, but it can be done. First, let him realize that he will be working with people who are willing at all times to give any necessary assistance. Remove that tension which results from working among strangers and make him feel relaxed. Rigid enforcement of the principles of helpfulness on the part of older employees should be insisted upon, for without the full cooperation of these older employees any effort toward safety training will be futile. The safety program in any plant should begin in the employment office but by no means end there. Plant the seeds of safety and let them grow out in the department where others might benefit.

The foreman's job begins where the employment man's job ends.

A change in surroundings always carries with it a certain amount of uneasiness, due to different types of machines and, most of all, a difference in company policies. All this must be overcome as soon as possible. Therefore, instructions as to safe and proper operation and the conditions existing in the department should be given freely. Generate an incentive within the man by teaching him to devise ways and means of improving the operation or product. You will find that every man takes pride in his work if he is doing a job he likes. He will

take the same kind of pride in the fact that he does his work safely.

Demonstrate the principles of machine operation, what results are expected, and explain what may happen in case the instructions are violated. Most of all, let him see you actually doing the job.

Turn the job over to the man and observe him closely; then by constructive criticism and patient helpful hints, try to make him correct his faults and don't fail to hand him a bouquet if he does a good job.

The first three steps require a relatively small amount of time, while the fourth must go on indefinitely. There is still another step, discipline, which will be exercised only when the foreman's instructions have been violated. The degree to which disciplinary measures are to be inflicted should depend upon the violation and I wouldn't attempt to suggest a standard list of penalties.

Now, in summary, I'd like to stress one or two points which to me seem very important. First, the employment man can get the man he wants if he knows what kind to look for. Then he can light the flame of safety consciousness which may have been extinguished since early childhood. It has been stated that an early and provident fear is the mother of safety; therefore, safety is an inherent quality sometimes awaiting development. You never heard of anyone who refused to seek a job in that plant because it's too safe. Any safety program begins with the interview of a prospective employee.

Visual Education Methods

By R. H. FERGUSON

Manager of Safety, Republic Steel Corporation, Cleveland, O.

The general educational methods available to the safety man and followed in many plants are bulletins, posters and such materials and devices which call attention to the importance of safety. Practically all of us use the splendid poster service of the National Safety Council. Perhaps even this service could be improved if we, as members, would cooperate more with the Poster Division in the preparation of the material.

We could help them to be considerably more specific than they are for many of us at present. There are many types of posters available also from insurance companies and persons interested in the sale of educational information.

Your particular attention is directed to the homemade poster prepared by some man in the plant. These posters cover certain types of hazards—perhaps some particular

accident which has occurred—and they always draw attention because both the men involved and others in the plant are acquainted with the details. By all means use this homemade poster idea. The drawing may be crude, but after all, it's the idea you are trying to put over.

Within the past few years, the National Safety Council has made available a service of posters of a large or outdoor bill board size. These are about 10 feet by 12 feet. They carry general slogans and one is made available each month. Many plants are using this service and to my mind, this "Jumbo Poster" has a very definite place in your accident prevention activities.

In all cases where you are using posters and bulletin boards, it is essential that the board be kept neat and clean, well painted, well lighted and changed often.

A second method of using the safety reminder idea is by the use of various types of signs at several locations in the plant. For instance, we have painted signs at certain locations carrying such slogans as "THINK", "DON'T GET HURT" — "WORK SAFELY." These same ideas can be worked into revolving or moving signs. They can be placed on electric or gasoline lift trucks that move through your plants. They can be used on life-size figures which may be moved from place to place. All of this is intended only to remind the personnel continually of safety and of the importance to them of preventing accidents and injury. Few plants have made the fullest use of electric signs and flashers for safety purposes.

In all of this, we should never overlook the fact that mechanical displays, used widely in some plants, are of untold value. By this I mean the diorama and its various uses in explaining safety rules, unsafe practices, and specific accidents; the use of animated figures never fails to attract attention. The placing of safety signs, etc., on trucks to be pulled through the plant once or twice a day has been found quite useful.

From the visual educational standpoint, we now come to the specific methods which may be employed for training supervisors and personnel.

Professional motion pictures that fit your needs are few and far between. Even though you develop particular pictures from a commercial standpoint today, with the rapidly changing industrial methods and

processes, these may be of little use tomorrow. The only alternative, where professional pictures do not fit your needs, is the use of amateur pictures. These are extremely valuable where you go into your own plant and actually take pictures of plant conditions. It is quite essential that you let your imagination have play, and while your picture may not have the finished appearance, yet you will be able to put over many details impossible to touch otherwise. Remember, you are actually dealing with your own conditions which your own men usually know so well. Such motion pictures of either the 8 millimeter or 16 millimeter size are relatively inexpensive and will be found most helpful.

Film strips have been developed on a fairly wide scale by the National Safety Council. These strips are in a definite sequence, and talks have been prepared to go with each of them. These will be found very valuable, but this service of the Council could be of more use if members would work with the Poster Division in further development on specific subjects.

Recently the Travelers Insurance Company, in cooperation with the National Manufacturers Association, developed several film strips to which sound has been added. One of these covers an industrial safety subject and one public safety. These are splendid for general purposes.

I have now in process a film strip of this nature. This strip will be composed of pictures of our various operations and we believe it will be of general interest. Our General Safety Orders will be touched on briefly, as it is with these orders that practically every employee is familiar. The introduction of this strip will show a picture of our Operating Vice-President and our Director of Industrial Relations. Each of them will stress the importance of safety and the prevention of injuries in our operations. Every time this picture is shown, you will actually hear the recorded voices of these two men.

In the use of film strips, the Contax camera should not be overlooked, because in many instances the small pictures taken in your plant of actual conditions can be projected easily and inexpensively. These pictures should be taken in sequence and present actual plant conditions.

In the use of all of this material, it is well to visualize specific rules to better carry

out your general educational activities. The ordinary photograph has been of great help in bringing out such ideas as housekeeping and safety. In some cases, it is possible to use such photographs in projections, and right along with that you should keep in mind that glass slides are mighty useful and inexpensive.

Many organizations use publications or magazines. While much of such material is lost, this is a method of presenting safety which has been of great benefit. We do not use the employee publication method but issue instead specific information sheets relative to safety instructions to our foremen. This is material the supervisors may use in their group safety meetings, and it is so prepared that it may be passed on to their men.

Perhaps the idea I wish to touch briefly upon now is one which should have been discussed at the beginning of this paper. Of what avail are all of the posters, bulletin boards, lights, flashers, beautiful signs, and what have you, if the men in the plant fail to see and understand them? So many of us today look but do not see. I do not intend to undertake a psychological discussion of this problem, but there are one or two little things we can do to get our workers to observe what they see.

1. Use only short slogans; that is, get your idea across with just a couple of words. If you use more, it will not register in the human brain.

2. Make it easy to read. Educational material which is hard to see or grasp is wasted. That is why I like bright colors in posters, and bulletin boards that are clean and well-lighted.

3. Use only items or subjects that are clear to the people you are trying to reach. Remember the example of the homemade poster and place yourself in the worker's position. If you knew the artist, knew the thing he was attempting to picture, surely your interest would be much greater.

4. Change your signs and posters—move them around and your people will get the habit of glancing at the sign or board for a few words of a short reminder about the job—and safety.

The real visual training for the prevention of accidents and for efficiency on any job is job analysis—and teaching the man to observe what he sees. This phase of our

subject is the most important. To teach the job, the foremen must know how to do the job; how to do it safely; how to do it efficiently. In addition, he must know how to teach the men under him to carry out such instructions to the letter.

So many safety men overlook the limitations of a foreman and forget the foreman's many responsibilities. I believe it is the safety man's obligation to make sure the foreman realizes the hazards of the various tasks which his men must perform. Never have I known a foreman to fail to accept a safety suggestion which was properly presented.

The safety man must be sure that the foreman knows how to get the safety story over to every one of his men, and above all, that the foreman actually knows the safety story involved. This calls for visual education by the safety man, and unfortunately, many holding such responsibility fail to measure up.

The matter of job study has received much attention in this country. During the last two or three years, we have developed a method in safety meetings of talking about specific items where we possibly can, explaining just how things occur and how unsafe practices can be eliminated. We are trying to tell men what to do and thus make them think.

In one particular plant we were having trouble in closing car doors. Pinched and broken fingers were experienced. Car doors were being pushed from the rollers. Men were falling between the dock and the car and so on. A thorough study of the method involved indicated that the foremen were in disagreement, but the happy suggestion was offered that light chain fall could be used to good advantage for this work. This was developed, discussed, and explained in a group safety meeting, and has practically eliminated the difficulty. We actually demonstrated the difficulty and showed how it could be eliminated. Incidentally, we secured a number of good ideas on loading and unloading cars which might not otherwise have come to the management's attention.

In this same plant we were experiencing difficulty with piling objects of various sizes and shapes on trucks. For production and safety purposes, it was essential that routine be followed. However, considerable adverse experience led us to call the men

involved together in order to demonstrate, by actually showing them, how to load a truck and then explaining the reasons for it. The difficulty was eliminated, the hazard eliminated, the men understood and cooperated for the benefit of all.

You have all known of many instances where the protective devices provided were not employed by the parties to whom they were issued. This, of course, is a problem which must be continually kept after, but in many cases, after the proper use of the protective device is explained to the worker—just how it is to be used and what it will do for him—you will very often find that the equipment will be used regularly. Only by actually demonstrating, by doing, by showing, can you get such points across to the man on the job.

Developing Safe Workers in Metal Working Industries Through the Regular Supervisory Force

By VAN B. HUNTER

Supervisor of Safety, International Harvester Company, Chicago

Safe workers can be developed in no other way than through the regular supervisory force. The supervisor must be the key man in any successful safety program.

Too often supervisors are prone to think of safety not as an opportunity, but as an added responsibility—something apart from their already varied and exacting duties. But accident prevention effort goes hand in glove with every other supervisory activity, can be controlled by exactly the same methods, and many times by the identical effort that is used to control production, costs and quality. There must be, first of all, painstaking instruction backed by employee support and day-by-day supervision that is both sufficient and efficient.

The mere fact that a supervisor must accept the responsibility for accident prevention does not mean that he must personally watch over each member of his group every hour of the day, any more than he would be expected to stand beside each workman to see that he does his work properly. Actually, the supervisor is responsible for the result, and in like manner is responsible for carrying out the program aimed at

The contest or the arousing of a competitive spirit between departments is always useful. Dramatics, such as playlets and skits, have been found of use in more formal meetings. The use of first-aid demonstrations has been found of considerable advantage in a number of plants. This gives the men something specific to do and has a great teaching value for safety.

This is particularly true of the demonstration and teaching of artificial respiration. An example on the use of stretchers, telling the men the location of the stretchers and how to set them up and how to handle injured men can also be used. This has a very definite benefit from a visual standpoint in getting the idea across—to get men to think in terms of safety.

the result. It is obvious, then, that any safety program, to win the support of the foreman, must be designed so that it will be a help and not a hindrance to him. Above all, it must be in keeping with good industrial relations.

In considering this subject from the industrial relations as well as the supervisor's viewpoint, we must recognize that we have been and still are passing through one of the most trying periods in industrial history. Few, if any, of us have ever faced a similar situation. What we have passed through during the past seven years has vitally affected all industrial relations, and has left a mark on safety relations as well.

We are now faced with the problem of rebuilding safety organizations under new conditions. There can be no doubt that the supervisor and the employee alike have felt the impact of these sudden social and economic swings. In too many cases the net result may be a change in philosophy on the part of both that will tend to increase the feeling of indifference on the part of the employee and a feeling of helplessness on the part of the supervisor.

We must also keep in mind that the pres-

ent-day supervisor is held responsible for many other things in addition to safety. The chances are that he was selected for his job because of his ability to produce rather than on his record for safety accomplishments. Yet the supervisor cannot be relieved of his safety responsibility without at the same time relieving him of his authority. When this is done, he is no longer a supervisor.

With a job to be done that is exacting as to quality requirements the supervisor obviously would pick the most dependable employee to do it. He would make sure the employee was fully equipped and properly instructed before starting. Under these conditions the chances are a hundred to one that the job will be done safely, because the same elements that assure quality are a guarantee against accident. Lack of instruction, or failure to follow instruction, and improper methods continue to be the cause of mishaps to men that result in injury, just as they cause mishaps to material that result in spoiled work. We are constantly reminded that accidents to men and accidents to material spring from the same source.

Costs are another thing of major importance. It would be difficult to visualize a department or an industry with a high severity rate showing a low cost of production. A reliable authority tells us that the indirect cost of accidents amounts to four times the direct or reported cost. It is quite unnecessary to emphasize how an accident, particularly a serious accident, can disrupt the morale of employees, stop the flow of production and increase the cost of the product. You all know, too, that no case of serious injury can be fully compensated so far as the employee is concerned. In the final analysis, preventing accidents is not only good human relations, it is just good business.

The time has long since passed for using shotgun methods in preventing accidents; what we need is sharpshooting practice. There was a time when accidents were so numerous that almost any kind of effort, if pointed in the right direction, would show results. As the number of accidents has decreased, however, the problem has become more specific, and we must adjust our method to suit these conditions.

Two things are necessary: First, we must convince ourselves that accidents can be prevented. Ask yourself, for example, how many accidents have occurred in your plant, or within your knowledge, that could not

have been prevented. We all know too well that after an accident, means can be found to prevent the same kind of accident from occurring again. Second, we must train ourselves and those who work with us to anticipate the probable accident and do something about it, or we will continue to send men home to face their families and their futures as cripples.

I have said that we must be more specific. Let me suggest that each job, regardless of its nature, be thoroughly studied for accident possibilities and that a definite, systematic method be followed to make sure that something is done about it before an accident is caused. At first this may seem to be a large order; yet if it is done in an orderly and systematic manner it can be done quite easily. For example, if one job or operation is covered each week, a total of more than fifty different jobs can be taken care of within a year. When we consider that this work would be carried on by each department doing the same thing, it is apparent that the task is not at all impossible of accomplishment.

Make "Exposure Studies"

Generally speaking, every operation must be studied through its various cycles by the industrial engineering and time study departments before the method can be established and before a price can be set. Isn't it just as practical and just as necessary to consider each job and each cycle of the operation from the standpoint of the hazard involved? Why not adopt—at least in principle—the method of time study, but instead of thinking of the time element, consider each cycle from the standpoint of exposure? You may be surprised to find how many times there is absolute harmony between safety and efficiency. We have found it the rule rather than the exception.

Let me illustrate by an actual experience. An employee performing a gang punching operation on steel parts got his finger under a punch. After the accident an investigation disclosed two things that contributed to the cause:

First, improper stripper equipment had been used; that is, instead of using a stripper for each punch in the gang, a stripper was used for each end of the bar. The result was that in placing the stock the chance of the operator having his finger under the punch was increased.

Second, the operator was reaching with his right hand for another piece of stock which was beyond easy reach and he pulled his left hand out of position, so that it was directly under the punch. Both of these causes could have been apparent before this accident, if someone had studied the set-up then as was done afterward.

Before this job was started again two things were done to make it safe, and incidentally both of them contributed to a better product or improved efficiency.

First, a stripper was provided for each punch, with the result that the chance of accidentally getting a finger under the punch was practically removed, and the chance of the bar seizing the punch on the up-stroke, due to the bending of the piece of material, also was removed at the same time. Second, instead of reaching for each piece of stock from the truck, a shelf or holder large enough to hold 20 or 30 pieces was provided in front of the press just below the lower die. This permitted the operator to do the job with much less effort and faster.

Requires Cooperation

To be really effective, this analysis of accident causes should be done with the full cooperation of the employees affected, or a group of employees doing similar work. Such a method will not only take advantage of many opinions, which is desirable, but also

will prove to be highly educational to both the supervisor and the employees.

We have recently conducted an industrial hazard survey, designed to point out and to record occupational hazards where a process or an operation creates a condition that may result in health impairment. This has been done by the close cooperation of the engineering, medical and safety departments. As a result, in most of our operations we now have a record of all such jobs with a specific recommendation for correction. These recommendations are being carried on tickler until completed. An analysis of jobs for accident hazards might in the same manner result in a series of departmental operating rules to prevent accidents, just as we now have rules based on accident experience.

Accidents are caused by exposure to danger. Sometimes this exposure results from deliberate chance-taking, but a far greater number of exposures result from unseen hazards which are part of some established operation. Far more significant is the fact that the number and severity of accidents are likely to bear a direct relation to the number and extent of the exposures to danger.

It is obvious, then, that if accidents are to be reduced, the exposure to hazards must also be reduced by systematic, orderly procedure aimed squarely at accident possibilities, and removing them before an accident is caused.

WEDNESDAY AFTERNOON SESSION

October 13, 1937

The Placement of Men from the Standpoint of Physical Fitness

By HAROLD A. VONACHEN, B.S., M.D.

Medical Director, Caterpillar Tractor Co., Peoria, Ill.

The purpose of pre-employment examinations is not to accept only those who are physically perfect, but to find the true condition of the employee and place him in an occupation in which he will be able to pro-

duce the work required of him without detriment to his own health or that of his fellow-worker.

During the past ten years we have had experience with 40,000 pre-employment and

periodical examinations. Our routine is briefly this: Following the acceptance of the applicant by the employment department, he is submitted to the medical division for examination and the results with recommendations are then submitted to the personnel division. If an employee has been absent for seven days, regardless of reason, he must again submit himself for physical examination.

Our rejections have varied between 5 and 8 per cent, the average being approximately 6 per cent.

Reasons for complete rejection of an employee will vary with the type of industry, but every medical director should bear in mind that rejection should only be made when the physical condition of the individual indicates that he would be unable to perform the duties required of him or that he might further injure his own health or jeopardize the health and safety of his fellow employee.

Complete inguinal hernias, ventral and umbilical hernias, acute venereal infections, contagious dermatoses, hypertension, either essential or associated with kidney damage, cardiac diseases associated with signs of decompensation, visual disturbances which cannot be corrected, tuberculosis, silicosis with modifications, varicosities of lower extremities are only a few of the conditions which have caused us to reject the 6 per cent of applicants. The remaining 94 per cent were not all in perfect physical condition but were aided in the correction of their physical defects and when complete corrections were impossible, were placed in occupations suitable to their physical condition.

Defective vision is most common. The men must submit themselves to an oculist and are not placed on the job until suitable adjustments are made. All hernias are not rejected; if a weakness of the fascial wall, an enlargement of the rings with a slight impulse are noted, the individual is informed of his condition and asked to sign a statement to the effect that he has been informed at the time of employment. Then he is instructed that certain ways of lifting and twisting are apt to aggravate his difficulties.

Cardiac disease is not a cause for outright rejection. If the heart is compensated and if the applicant can be placed in an

occupation that requires no marked exertion, he may be a valued employee over a long period of time.

In all cases where there are correctable defects, we instruct the individual to consult his family physician for treatment and then to report to our department in a month for a further check. Many defects are found of which the applicant has no knowledge; he is grateful for the opportunity of correction and is impressed with the fact that the examination is for his benefit as well as that of the employer.

Our plan for dealing with the syphilis problem is unique. This plan is by no means accepted as final in our organization, but it is humanitarian and has for its sole purpose the health and future of the employee. Every physical examination in our routine is not complete without a Kahn test. If this is found to be positive, the employee is instructed to present himself to his family physician for a recheck of his blood and asked to bring the report to the medical division. If this checks with the original findings, he is employed with the understanding that he must take treatment continuously and that in six months his family physician will be consulted as to his faithfulness in treatment and a further check will be made by our medical division. Of course, no men are accepted who are in the stage where they would be a menace to their fellow worker, nor do we retain anyone who presents any signs of contagion.

Now immediately there will be the cry that we are accepting cases of syphilis who are allowed to associate with other employees. But all of you are also accepting cases of syphilis, only you are often ignorant of the fact because in the vast majority of cases ordinary physical examinations fail to disclose syphilis. Our cases are receiving treatment, thereby in many instances avoiding total disability, avoiding neurological changes which make them a menace to themselves and their fellow employees, while your cases are slowly and surely becoming worse with the result that many will be charges of the state as inmates of insane hospitals.

Let us remember that a perfect physical condition is not absolutely necessary for employment, that the employee should be instructed and aided in the correction of his

defects and not rejected until every reasonable means has been exhausted to place him on a job which will not be detrimental to his health or the health and safety of his fellow employee.

But an equal problem now presents itself after we have placed the man in employment, and that is to help him preserve his health.

The health of the individual must be considered from every angle because many accidents on machinery have been due to faulty reaction time of the individual as a result of ill health. Naturally, no mind will function normally in a diseased body and I strongly hope that the time will come when yearly examinations among all employees will be compulsory.

I realize that there is much opposition to this thought at the present time in certain quarters, but some day the employee will realize it is for his benefit that such proceedings are instituted. In those organiza-

tions and industries in which I have had the pleasure to function as yearly examiner, I find that the employees are extremely well pleased with such periodic examinations and are asking that they be continued. If men are made to understand that they will not be taken from the pay roll because of their physical condition, but merely advised as to what steps should be taken to preserve their health, then I am sure that eventually this goal will be reached.

Habits also are an important factor for we know that excessive drinking or smoking slows the reaction time of the average individual and makes him more susceptible to accidents. The home environment again must be considered. If an individual is unhappy in his home life, if he is confronted by sickness and death in his immediate family, there is naturally a mental disturbance and he is unable to concentrate, and the consequence of a lapse of memory sooner or later is a serious accident.

Point of Operation Guards for Metal Working Machines

By SAMUEL S. DIBSDALE

Safety Engineer, The J. G. Brill Company, Philadelphia

It has always been my opinion that a plant engaged on a mass production schedule has less point of operation hazards than the smaller plant. Usually each machine in a mass production plant has some specific operation to perform day in and day out, and aside from changing the tools for sharpening occasionally, the general set up for the machine is seldom changed.

In shops of this type, precautions for guarding at the point of operation can generally be coordinated in the design of the tools, dies, and jigs, providing the safety engineer is consulted; but how many of us are consulted about these requirements when dies or tools are being designed? We usually have to recommend them after production is started and then, if our recommendations are radical, we are reminded that they will slow up production.

Production can be measured at the end

of the day or week in the value of the dollar. The cost of saving fingers and limbs can not be credited. We only hear about the cost of an accident after it occurs.

It will repay every company, whether large or small, to have its safety engineer, insurance company inspector accompany the production engineer or superintendent whenever new machinery is to be purchased. The specifications of the machine should not be confined to production alone. An accident or two on a machine, due to inadequate or poor guards, will cost much more than the expense of sending the safety engineer to see that it is equipped by the builder with the necessary guards.

The small plant is usually at a disadvantage in installing guards at the point of operation, although there are many guards on the market that can be purchased and applied to standard machines.

The variety of operations and the necessity of changing the set up of the machine, in some cases several times a day, make it impractical to install these guards without adding considerable cost to the operation.

Those interested in purchasing guards can secure any information desired from the Associated Guard Makers, with headquarters in Chicago.

Often plants with a well-organized safety program have their safety record upset by an employee who had generally been considered a careful workman. An accident of this type took place a short time ago in a machine shop I was visiting in Philadelphia.

The shop had a well-organized safety program. The housekeeping and general safety conditions could be noted the moment you entered the building. Shortly after entering the room where this man was employed, we heard a commotion and saw the man being helped to a seat. He was on the verge of collapse, having narrowly escaped a very serious accident, with apparently no one to blame but himself.

He had been operating a 24 inch engine lathe, his job requiring him to drill and tap some cast steel washers. As it was a piece work job, he took a 14 inch universal chuck and removed the back plate, since it did not fit the spindle of his machine. After removing the plate, he chucked the universal chuck in the regular chuck of his machine. Unfortunately the chuck wrench and the screws of the larger chuck were badly worn, and it was impossible to get a tight grip upon the universal chuck. Consequently, after he had drilled and tapped a few of these washers, the universal chuck became loose, flew out of the larger chuck and just missed striking him in the stomach.

It is almost impossible for any safety engineer or member of any safety committee, unless he minutely inspects every part of the machine tool equipment, to protect the operator of a machine from an accident of this character. You and I must secure the help and the assistance of the operator himself. There was no good reason why this man should have used a wrench that was worn badly. Since neither the wrench nor the chuck is returned to the tool room for inspection, we must rely on the mental alertness of the operator to prevent accidents of this kind.

In Pennsylvania, to safeguard workers at the point of operation, a law has been passed, giving the Department of Labor and Industry authority to draft new rules and regulations to eliminate hazards which might be created in an industrial establishment.

This was enacted to replace the old Factory Act of 1905. It enables the Department of Labor and Industry to promulgate regulations to guard the operators of saws, planers, punch presses, rolls and all other machinery where a serious accident might occur. The inspector from the Department of Labor and Industry can order a guard placed at the point of operation or the machine shut down entirely.

There is apparently no short-cut in guarding the various machine tools at the point of operation. It is largely a matter of meeting the conditions as they are found in individual shops and being governed by the operations performed on the machine. It very often occurs that a guard successfully installed on one type of machine will be totally unsuccessful on the same type of a machine performing another operation.

Designing for Safety*

By B. E. ROCKHOFF

Designing Engineer, Detroit Steel Products Co., Detroit, Mich.

I want to drive home one point. It is this: Every plant has its peculiar die and tool hazards, and it is up to the tool designer to find out what they are and provide means to overcome them.

*Read by W. H. Cox, Secretary-Manager, Essex-Kum Safety Association, Windsor, Ontario.

What should the tool designer do to design for safety?

1. *Accept your responsibility.* There are some designers who feel that designing for safety is not their job. "My job is to design tools that work, to make them safe is the safety engineer's job." Not a bit of it. The

safety engineer's job is to spot hazards and report them to the proper authority to have them removed. The teeth in the punch press are only one of his problems. He cannot design safe guards for all your tools; that is your job.

2. Educate yourself. There are certain broad principles of safety that every tool designer should know. Read the *National Safety News* regularly and carefully, it is an education in safety. This Convention is one of the greatest schools of safety that there is. Here you are informed concerning safety in general, here are discussed specific problems that others have encountered. I would like to see every chief tool designer in the country come to this convention to learn about safety and, what is equally important, be fired with the enthusiasm that is apparent in others here.

Methods of Learning

There are three ways of learning: By information, by observation and by experience. You can get plenty of information right here and now.

Much can be learned by observation, but, whereas information can be brought to you, to learn by observation you must go to the scene of operations, and that means plant visits. Don't miss an opportunity to see what the other fellow does.

Experience is not the best teacher, it is merely the most impressive one. If you could only be sufficiently impressed by the information and by your observations you could avoid the bitterness and costliness of experience.

Profit by Experience

But there are things that are learned only by experience. When these experiences come, do not miss the opportunity of profiting by them.

3. Study your problem. As a tool designer your vision must be broad enough to look beyond the mere provision of a guard on a die. You may be confronted with the duty of handling large fixtures or jigs. That is a problem you can often solve. It may mean no more than providing holes for screw eyes. But they should be in the design. Show them on the detail drawing with a clear note as to what they are for, so that some economically minded tool

maker does not omit them. On the other hand it may mean the design or purchase of elevating trucks for handling heavy tools and it may mean redesigning them so that the tools cannot slide off because the tops are oily. It may mean providing a small jib crane or a trolley track.

And it may mean that you must FIGHT with another department to get these safeguards.

That is your job in designing for safety.

Investigate Immediately

When experiences come in the form of accidents, do not miss the opportunity to profit by them. Investigate every accident—at once. See the injured man and be impressed by the horror of accident. Some designers shrink from this. I did, too, but I decided that I would let each specific major accident make an indelible mark on my mind.

Also see the JOB and find out for yourself definitely why that accident happened, so that you can work out a remedy in the design of the tool rather than by issuing another shop rule which can be broken. The safest safety is the kind that is designed into the tool.

For an example here is one of those "queer" accidents. A new operator was hired to run a press on which there was an overhead mechanical device connected with a crank shaft to operate a device on the die. The foreman, a man of average height, operated the press for the new man and then walked away. He had hardly turned his back when the new man was knocked out cold.

Cure Is Simple

This is what happened. The overhead mechanism, on its down stroke came to within 5 feet 10 inches of the floor, which was sufficiently high so that it did not strike the old operator or the foreman. But the new operator happened to be 6 feet 2 inches and the first time he tripped the press the lever struck him on the head.

This problem calls for a solution by the tool designer who must provide in the design plenty of clearance under such moving parts or guard them completely. Make detail drawings of safeguards as a part of the permanent record.

THURSDAY AFTERNOON SESSION

October 14, 1937

Recent Developments in the Safety of Internal Transportation Equipment

By B. F. McAULEY

Material Handling Engineer, Western Electric Company, Hawthorne Works, Chicago

Manual transfer of materials within a manufacturing plant in addition to being inherently hazardous generally calls for strenuous effort. Industry has recognized this condition and the trend is to reduce the number of heavy manual handling operations through the introduction of mechanical equipment, thereby making employment more agreeable and satisfactory. In this improvement industrial trucks are taking an important part.

Industrial truck manufacturers have been alert to the needs of industry and to the possibilities of this type of equipment. One has only to look back at models that were considered the last word only a few years ago to realize that the last ten years have been a remarkable period in this industry. Several important developments have been introduced which have made trucks applicable to operations unthought of only a few years ago.

An interesting example of the progress in this field is the high capacity truck designed for use at continuous sheet mills. The output of these mills is large and trucks have successfully met the requirement that a smooth connected flow of large coils or rolls be maintained between major processes. Ram and platform trucks are particularly suited to this class of work and units with capacities ranging from 10,000 to 40,000 pounds have been designed especially for this service. Wheel pressures on these trucks are high and the larger units are equipped with effortless power steering for ease in maneuvering. Sixty-volt motors are generally used in this heavy duty service and many of the power plants are gas-electric units.

Another important application of electric trucks is in the handling and changing of heavy dies used in forming automobile bodies. Formerly such dies were in general

handled with overhead cranes but especially designed electric trucks and auxiliary equipment have simplified die changing operations and lessened the accident hazards associated with handling and transfer of dies weighing up to 20 tons or more. Another advantage of handling with trucks is that dies can be easily transported to other sections of the plant for storage or repairs.

Other outstanding examples of electric trucks that have reduced accident hazards are telescopic tiering trucks which permit safe handling and storage of materials at heights that were formerly considered impractical or exceedingly dangerous. Trucks are also being used to transport ladles containing molten iron from cupolas to molding floors in foundries. These ladles are fitted with splashless safety covers, and an additional safety factor is that the flexibility of trucks permits hot metal to be carried closer to the point where it is to be used, thus reducing the distance it has to be carried in small ladles by hand.

The industrial truck industry is comparatively new and until recently manufacturers have for the most part concentrated their attention on engineering developments and improvements in design, but it is evident that safety is now receiving serious consideration as is evidenced by several of the more recent designs which provide better visibility and protection for operators.

Other features that have been found to be of special value to safe operation of power trucks are dynamic and regenerative braking, first-speed foot-control of the travel motor on three motor units, and over-running clutches on tiering trucks.

Dynamic braking on the travel motor is of particular value where ramps must be negotiated. This feature provides for governed speed on descending ramps and under normal conditions also takes much of the

burden of stopping away from friction brakes. Thus the possibility of complete brake failure is practically eliminated and friction brake maintenance is reduced.

Control of hoist motors on high lift trucks has been improved by adoption of regenerative braking, that is, when loads are being lowered the hoist motor acts as a generator thus providing a braking action which permits lowering the load under control in addition to returning a small amount of energy back into the battery. This type of braking greatly reduces the possibility of dropping loads due to the failure of the mechanical brakes.

A recent design of control interlocks the first speed travel control with the brake pedal. This is of particular advantage on tiering trucks and other three-motor trucks, as it permits "inching" the truck forward or backward with the foot pedal while leaving the hands of the operator free for elevating or lowering the load and steering the truck.

Over-running clutches on the hoist motor of high-lift trucks practically eliminate jamming during the lowering operation. Jamming may seriously affect the stability of piles of tiered material and thus introduce the possibility of accidents caused by falling material.

Experience has shown that the introduction of protective equipment such as steering lever and pedal guards occasionally encounters opposition from some of the more capable and experienced operators. This reaction, no doubt, is due to the assumption that installation of guards reflects on their ability to handle trucks without endangering themselves or others. However, after they have had an opportunity to drive guarded trucks practically all are soon convinced of the benefits of the protection provided.

As a result of the greater use of power trucks, many injuries such as strains and hernias inherent in hand trucking operations have to a large degree been eliminated, but some new hazards of an entirely different character have, of course, been introduced. Industry is taking prompt action to combat these hazards. The best general preventive is, of course, training. No employee should be allowed to drive an industrial truck until he has demonstrated his ability to operate his vehicle in a safe manner and has become familiar with the rules and

regulations governing the operation of trucks within the plant.

The time required to train operators varies, as some are naturally better qualified for this work and become proficient in a very short time. However, in every case it is well to bear in mind that the more efficient operators will always be those who anticipate possible interferences and above all react speedily and without confusion in emergencies.

The structural characteristics of buildings used for storing raw materials sometimes do not readily lend themselves to overhead cranes for unloading, storing and handling sheet, strip and coil stock. Consequently the safe and efficient handling of relatively large quantities of such raw materials presents a problem which has been simplified by the development of unit load and pallet shipments. Most of our sheet and strip stock is 96 inches or less in length and therefore can be loaded crossways in freight cars. Suppliers ship these materials securely bound in unit bundles weighing approximately 4,000 pounds each.

Individual bundles usually have cleats strapped to the lower surface and sides to permit handling with fork trucks. The side cleats separate the bundles and reduce snagging when the width of bundles is less than the length of forks. When cleats are not attached, bundles are laid on runners placed on car floors and vertical spaces are generally inserted between bundles. Unit bundles in each end of the car are usually chain-tied with strapping, or blocked to prevent excessive shifting in transit. Sufficient clearance is left opposite the doors to permit a truck to enter and turn into position. Individual bundles are picked up by the fork truck and placed on platforms or live skids, which are then removed from the car to the storage area with a low-lift platform truck.

The time required to unload an average car has been reduced to one hour for three men as compared with five hours for five men unloading by hand. With mechanical handling fatigue has been largely eliminated and the accident frequency has, therefore, been greatly reduced.

Handling scrap material has long been a serious problem from the standpoint of safety. Scrap from those of our punch presses that are not equipped with roll feeds and scrap cut-offs is placed either on stake

trucks or in box trucks and delivered to the balers. The bales are placed in tiering skid bins and stored until a car-load has been accumulated. A rotating fork truck is used to tier the bins and later to load the baled scrap into gondola cars. Turnings and other scrap materials which may or may not be baled are handled in much the same manner.

Another very interesting and practical development is our method of handling stacks of pig lead with electric trucks. Under the old method pigs weighing approximately 90 pounds each were loaded in jumbled piles in box cars and there was no other alternative than unloading by hand. Minor changes to a tilting fork type truck and the attachment of a three-sided box enclosure to the lifting mechanism provided a very satisfactory means of handling thirty-five pigs of lead, stacked five wide, cross piled seven high and weighing approximately 3,200 pounds.

Refiners who supply the lead use loading equipment of a somewhat similar design which also handles units of 35 pigs each. These stacks are set adjacent to each other in two or three rows at both ends of the boxcar in which they are shipped. Each row is placed on wooden sliding strips and securely bound with two steel straps. Thus each row is free to slide back and forth as a unit, and unless the car is subjected to very rough handling in transit, there is little change in the relative position of pigs in the individual stacks or rows.

The operation of unloading after bands have been cut is relatively simple. Dimensions of the lifting box provide slight clearance over a stack of thirty-five pigs, and each side has a flange extending inward at the bottom. To unload the stacks of lead the lifting box is lowered so that flanges fit under the lugs on the ends of the pigs in the bottom row. The truck is then moved forward and the box raised and tilted backward. In this manner each stack of thirty-five pigs is lifted and removed from the car as a unit. Trucks have proved particularly well suited for this service as they not only reduced the time and physical effort involved, but also practically eliminated such hazards as hand, foot and back injuries that are inseparable from heavy manual handling operations.

Probably one of the most notable advances from the viewpoint of safety was

the design and application of electric trucks for handling three-wheeled cable-core trucks having a gross weight of 10,000 pounds. Structural details of a portion of the building in which these trucks operate limited the concentrated floor load to an amount that would not permit lifting the core truck entirely clear of the floor. It was therefore necessary to design a lifting mechanism strong enough to support a portion of the weight of a loaded core truck and sufficiently manageable to permit operation in restricted areas.

Cable core trucks have a fixed axle in front and a swivel caster in the rear and can be pushed or trailed with equal ease from either the axle or caster end. The electric truck grips either the front axle or lugs on the swivel caster and lifts that portion of the core truck free of the floor. The lifting mechanism consists of upper and lower jaws for gripping the object to be raised.

The operation consists of aligning the gripping jaws with the core truck axle (or with the lugs on swivel caster) advancing the electric truck until the jaws are above and below the axle (or lugs) then moving the lift controller into the "UP" position. The lower jaw, which is connected to the lifting mechanism, raises the axle until it comes in contact with the upper jaw which holds it securely. The gripping pressure depends upon tension of coil springs at inner ends of the pivoted upper jaws, the normal setting of which is 1,500 pounds.

When lifted, the core truck in effect becomes an integral part of the electric truck, which then carries a portion of the core truck load. The installation of this equipment has completely eliminated burns, strains, and the unavoidable fatigue associated with manual handling of cable cores in and out of vacuum drying ovens and the cable drying room, which is maintained at a temperature of 125° with a relative humidity of ½ to 1 per cent.

For years our industrial trucks had been painted a dark green that blended with interior backgrounds. Although collisions had been remarkably few and of minor consequence, a more contrasting orange-yellow has been adopted as standard color to make the trucks more conspicuous. When instituted, this change stood out as a radical departure but the marked contrast soon wore off and the bright yellow color has

undoubtedly made trucks easier to see and thereby reduced the possibilities of someone being injured by moving trucks.

From the standpoint of safety, our experience with industrial trucks at Hawthorne has conclusively demonstrated that types of hazards long associated with man-

ual transfer of material have been reduced to a very low figure and that accidents chargeable to industrial trucks have remained considerably below what might reasonably be expected when the activity and quantity of materials handled on these units is taken into consideration.

Prevention of Accidents in Repetitive Operations

By DR. JAMES S. THOMAS

President, Chrysler Institute of Engineering, Detroit, Mich.

There are three rather definite approaches to the solution of the problem of accidents in repetitive operations. (1) Selecting the operatives; (2) educating them once on the job; and (3) the wide adoption of safety devices on machines.

Investigation of accidents in factories and workshops is more than 100 years old. The Factory Act of England was passed in 1833. Under this act government inspectors of factories were appointed. At first they had to do with long hours of work for women and children; but accidents caused by unguarded machinery were reported by these inspectors. Under a subsequent Factory Act passed in 1844, regulations were laid down designed to reduce accidents in factories and workshops using machinery.

Later these laws were further extended, and inspectors were given a still wider range until about 1878 shipyards were brought under supervision and accident control. By 1895 laundries, docks, warehouses, electric stations, and other buildings were included.

By 1901 the Home Secretary was given power to certify manufacturing and machine processes used in factories, and to say when they were dangerous, and to make such regulations on the prevention of accidents as he deemed necessary.

In our own country legislation had made great progress. This has been brought about by accident prevention organizations and their educational programs.

There are so many factors in the problem of preventing accidents in repetitive operations that no single track of approach can be made to it.

Before making suggestions for the prevention of accidents it will be well to examine briefly some of the causes.

Negligence

There is ample statistical evidence that accidents are due more to negligence of the workers themselves than to defects in the machinery. There are two classes of accidents, those caused by defects in the machine and those caused by the negligence of the workers. Accidents due to the human elements offer the more difficult problem and our efforts should be definitely concerned with this human factor.

Accident Proneness

Accident proneness is particularly important to those who manage employees engaged in repetitive operations.

In 1919 Greenwood and Woods investigated the accident frequency in groups of workers engaged in various machining operations in the manufacture of shells. While some suffered no accidents at all, others suffered once, twice, and a few more frequently, even though all were engaged at the same machine and on the same operation. Chance might explain such a phenomenon, but it would be very unsatisfactory. Workers might start equal, but suffering one accident, a worker might then from nervousness or fear have his accidents increased or decreased. If accidents increase to such a person, they may be called *biased* accidents. But some workers would start already nervous, or more prone toward accidents; in this case, the accidents occurring would be classified as *unequal* accidents.

In a study of a group of 648 women in a shell factory working over a period of 13 months, it was found that two-thirds had no accidents, about one-fifth suffered 2 accidents, while the more frequent accidents, from three to five, were suffered by 26 workers. If, now, these accidents had been figured on the "laws of chance," only 8 would have suffered these multiple accidents. Unquestionably, some workers are prone to accidents.

Personal Qualities

The influence of age and experience on accidents is very definite. These are generally studied together for the simple reason that they cannot be separated. Experience generally runs parallel with age. There are ample statistics showing that the experienced workman has fewer accidents than the inexperienced.

Inexperience is at a maximum, of course, when a worker starts upon a factory operation. He should be carefully started on a "fool proof" machine and under the most careful supervision.

Stamping presses are especially dangerous and should be carefully guarded. Reliable statistics prove that the accident rate of groups of both men and women are 6 to 8 times as great on the first day as during the next 5 days, and from 400 to 800 times greater than they are after 6 to 12 months' experience. Practically all metal trades show the same tendency percentages. Experience is a very important factor in the prevention of accidents in repetitive operations, and *beginners should be given most careful supervision.*

Mental Attitudes and Pre-Disposition

Accident proneness is often influenced by the mental attitude and the disposition of the worker. Statistical records indicate that the accident prone are likely to be insubordinate and disregardful of accidents. They may be excitable, too, and tend to do the wrong thing in an emergency.

Such workers have many characteristics a little hard to classify, but they clearly indicate defects in the personality and lack of aptitude on the part of workers for their occupation.

On the Boston Elevated Railway, for example, it was found that 39 per cent of high-accident men were defective as measured by their record of "uncooperative behavior," as

compared to 5 per cent of low accident men. Again, 40 per cent of high accident men showed lack of aptitude, but only 12 per cent of the low-accident men showed the same lack. These results were obtained by serial-action laboratory tests and are fairly accurate for general conclusions.

An investigation of 167 men of the Cleveland Railway Company was made, and the 50 drivers with the poorest records were subjected to careful clinical study. This revealed that only 12 per cent of the men were suffering from such disabilities as high blood pressure, defective vision, organic disease, or senility. The commonest causes of accidents were: impulsiveness and irresponsibility, 18 per cent; faulty attitude, 15 per cent; failure to recognize personal hazards, 12 per cent; faulty judgment of distance and speed, 12 per cent; failure of attention, 10 per cent; nervousness and fear, 6 per cent. These tests indicate the importance of the man's attitude and pre-disposition in the prevention of accidents in repetitive operations.

Differences of Nationality

Undoubtedly, the ability to speak the language of the country in which one works has something to do with accidents. After an 8-year study of some of our largest iron and steel mills it was found that among 12,600 American born workmen, the accident frequency was 91; among 18,700 foreign born workmen, but speaking English, the accident frequency was 99; while among 22,900 foreign born, but speaking no English, the frequency jumped to 213.

Influence of Fatigue

Extreme fatigue is a conclusive cause in increase of accidents in repetitive operations. Imbert has pointed out that accidents increase during the last two hours of the morning and afternoon shifts. LeRoy affirms that the increase of accidents toward closing hours of the shift is definitely due to fatigue. Bogardus states that 82 per cent of 2,678 accidents studied by him were to some extent due to fatigue. Large amounts of data have been collected in England and in the United States, showing that accidents increase as the work spell lengthens and that the maximum of accidents occur during next to the last hours of the shift.

Vernon, in his study of 50,000 accidents incurring in four large munition factories in England during the World War, found some

striking evidence of fatigue influence on accident rates among 10,000 workers in a large fuse factory: for three months, November, December, and January 1915-1916, workers were on a 12-hour day, 75-hour week. Then for 15 succeeding months they were on a 10-hour day and a 64½-hour week. He found that among the men the "fatigue period" accounted for only 14 per cent more accidents than the subsequent period. But among the women workers accidents were 173 per cent higher in the "fatigue period" than in the subsequent period. This undoubtedly proves that men are "tougher" than women. However, it is definite evidence that fatigue has something to do with accident prevention and should be taken into account.

Alcohol

The consumption of alcoholic liquors greatly increases accident liability, even though the quantity taken is insufficient to produce intoxication. There are ample statistics to prove this point taken from conservative studies made in half a dozen different countries in the world. Such studies have been made in Prussia, Sweden, England, and America.

Most of the evidence relates to excessive drinking, and it is difficult to obtain proof of the effects of moderate drinking on accident liability. Yet Vernon concludes, after a somewhat conservative study of the workers of England during the World War, that the consumption of alcohol in moderate quantities often reduces motor coordination and the capacity of attention and concentration and is, therefore, a contributory cause to accidents.

Influence of Lighting

Poor artificial lighting will surely increase the accident rate in any factory and is particularly noticeable in repetitive operations.

The Travelers' Insurance Company, after a study of 91,000 accidents in factories in the United States, tabulates no less than 24 per cent of them due to poor lighting. As a result of eight years of safety work, these same accidents were reduced to 18 per cent, but not until the services of 108,000 men were lost for a period of one full year!

The Departmental Committee of the English Home Office found after a study of 161,000 accidents an excess of 25 per cent during the hours of artificial lighting as

compared to work done during daylight with natural lighting. Among dock workers this accident rate rose to 51 per cent.

A great deal of study has been devoted to artificial light in the factories, and this phase of our safety work cannot be overemphasized.

Machine Tools

Machine tools for metal working are responsible for a large number of accidents in repetitive operation. Nearly one-half of all machine tool accidents are due to lathes, one-sixth of them to milling machines and power presses, while the remainder are due to miscellaneous operations. Some of these accidents are caused by lack of guards on moving parts such as toothed gears, chain gears, belts, and pulleys. However, the machine tool builders are more and more perfecting the efficiency of guards to enclose the most dangerous parts of the machine. For example, a turret lathe is now made with a guard for intake of driving pulley and belt, completely enclosed gear wheels, enclosed chain belts, and metal guards for most of the other moving parts.

Yet most lathe accidents are due to the operator's failure to replace the guards after changing gear wheels. Some are due to articles flying from the lathe because they are not properly secured by the chuck, but a much larger proportion are caused by contact of the fingers or hands with sharp edges of the metal, nashes between projecting parts of the revolving piece and fixed parts of the lathe, and some entanglement of the workman's clothing with the revolving article. Only a few of such accidents could be prevented by any form of guards however carefully designed.

Power Press

Power presses are dangerous because of their moving dies and tools. Much ingenuity has been used in designing tools and fencing for machinery of all sorts. There are some who feel that such guards interfere with output. On the contrary, production is, in certain processes, increased as much as 25 per cent due to the confidence inspired in the operators by these devices.

All press machines need guards for flywheels, gear belts, and pulleys; and where roll feeds are required, it is important to provide guards against pinching the fingers in gear wheels and nipping fingers between

the rolls. Clutches are often dangerous and require different forms of guards. Safety clutches should be used in conjunction with sufficient guards. Presses are usually set in motion with feeders or one-hand levers. These need suitable guards. Likewise, an efficient brake is necessary for every press and demands almost constant attention.

Press work consists of feeding, holding, and removing the pressed article. The methods chosen for these operations should obviate as far as possible the necessity of placing the operator's hand under the tool. The use of stops, spring trippers, and pressure plates all help to reduce accidents in such repetitive operations.

At the Chrysler Corporation our safety efforts are based upon two general principles, the recognition of accident prevention as an essential part of the organization of our factories, and the common interest and endeavor on the part of the employers and workers in the individual plants in seeking constantly to promote higher standards of safety.

It is utterly impossible to get accident prevention in plants without recognizing fully the educational nature of the problem. This means that we must recognize the importance of safety organizations and the functions of safety organizations. The entire safety movement is essentially, basically, and perpetually an educational movement. It is designed to teach both employer and employee the ways in which accidents are caused and the best methods of preventing them.

Since this is true, it is vital that employers should be thoroughly convinced of the importance of safety education and that they should see that foremen, superintendents, and workers alike share their enthusiasm for safety and for the safety organization. To bring this about, the organization should have representatives of employers, superintendents, foremen, and workers in its make-up. The safety organization should be headed by men who have a practical knowledge of the plant, who know men, and who have the qualities of leadership to secure warm cooperation of all the forces.

The educational purpose of such an organization is: (1) to secure the cooperation of the departmental managers and foremen; (2) to educate the workers, especially the young

ones just come into the plant, in all methods of accident prevention; (3) to inspect safety devices and all guarded machinery and to improve safety devices constantly; (4) to keep a record of all accidents, whether large or small.

This work can best be done by working committees, and it would be advisable to change the personnel of these committees every six or eight months to provide a more intimate contact and knowledge of the problem to as many men as possible.

Ways and Means

Posters

Since accident prevention work is so largely educational, the safety committee should utilize every opportunity to carry on an educational program. One efficient way is to use posters. The poster must be attractively designed, properly displayed, and kept fresh and interesting.

The poster should be applicable to the types of hazards arising in almost all industries. Some should be especially applicable to hazards arising in a particular operation. The picture or the actual wording is not so important as the mental impression associated with the poster. The picture may represent a piece of machinery never used in the factory, but the slogan, if applicable, will create the impression just the same.

Psychological investigations have shown greater interest on the part of the workers in negative posters than in positive ones. At one such investigation, for example, 20 posters were selected in such way that each subject was treated on two posters, one showing the advantage of foresight and the other showing the results of failure to have foresight. A number of persons were allowed to inspect the display, and the time spent before each poster was recorded without their being conscious of the fact that they were being observed. The average time for each person per poster revealed a 30 per cent higher interest in the negative poster than in the positive ones.

Such slogans as "A moment's thoughtlessness may mean years of misery," "The best safety device is a careful man," "Accidents are somebody's fault. Don't let them be yours," "Any fool can be careless," "Safety always—all ways," "The time to prevent an accident is before it occurs" can be printed

on the pay envelope or on a slip of paper inserted in the pay envelope.

The slogan must not be subject to question. For example, "Recklessness is no indication of courage. Brave men are always careful" is not true. Brave men are not always careful. Or, "The wife of a careless man is almost a widow." This is too exaggerated to carry conviction.

Very effective use can be made of the moving picture.

Paint

Machines on which repetitive operations are performed should be painted a challenging color. Some striking color, such as yellow, constantly reminds the operator that the machine is there. It would likewise demand attention. The Chrysler Corporation has some 400 of its big service trucks painted yellow. It took this step to reduce traffic accidents with these trucks. It has been remarkably successful. Accidents have decreased materially. Likewise the little service trucks in our plants are all painted a bright yellow, and this color is a constant warning to all people in the plants. Their presence is too obvious to be overlooked.

A brightly colored machine must be kept clean. A bright shop is a clean shop, a clean shop is an orderly shop, and an orderly shop is a safe shop. There is such a thing as "visual acuity." An attractively painted machine keeps crying out to the operator. I am satisfied that some experiments conducted along this line would reveal striking results.

While on this matter of cleanliness, coming into a clean factory is like leaving a clean, orderly home in the morning. Safety starts when a man gets up in the morning. If the house is clean, orderly, well conducted, he leaves home in a safety mood. If he enters a factory that is clean and bright and orderly, he continues in that mood.

Foremen and bosses sometimes fail to appreciate the value of a little good cheer in this matter of accident prevention. There is such a thing as "Safety Sunshine" in a factory, and this can best be spread about by bosses. Supervisors and foremen in plants can get a good educational leaf out of the flight surgeon's book. Flight surgeons are constantly alert to the slightest lack of attention on the part of the pilot. When this goes up to a certain point, the pilot's attention is directed to it by the flight surgeon.

It is the business of the flight surgeon to study flying, to watch the pilot for fatigue, rough landing, for plane bounces, and whether or not the pilot is completely in charge of the operation. The pilot must at all times be master of the plane. In this same sense, the operator must always be the complete master of the machine. The safety engineer is, therefore, the flight surgeon of his factory. He must always be alert, always helpful, and always at the business of watching his machine pilot to the end that no mistakes may happen.

Fitting the Man to the Job

Care should be exercised in selecting workers for specific tasks. Regard should be had for accident proneness. This is a highly technical and difficult field, but it should be all the more challenging for that reason.

Vernon discovered accident proneness to be identified with seasons. Of 136 workers who had no accidents in February of a certain year, the total number showed only 0.16 accidents during the next five months. While 62 workers who had one or more accidents during the same February suffered 0.35 accidents or more than twice as many as during the subsequent five months.

If, in 100 workers, 80 are accident free, and if all are subject to the same risk, then the mean number of accidents should be 22 for each 100 workers. Now, if the number exceeds this, it is due to some accident prone workers who by reason of personal qualities are exposed to risks, or because some of the groups are exposed to more risks owing to the character of their work.

No matter how long the statistical period or how great the number of workers, the observed excess of accidents is still due to accident proneness or environmental conditions or both.

It is possible to identify persons subjected to unique environmental conditions if they are at all pronounced.

Newbold's survey is reasonably conclusive. He studied 22 factories with a total of 6,938 men and 2,024 women workers. Records were made on specially prepared cards, and they covered periods of three months to two years. The articles included electrical apparatus, textile machinery, automobiles, general engineering products, soaps, candy, tin boxes, cardboard boxes. There were 16,188

accidents, and the number of accidents was very definitely influenced by a comparatively small number of workers. There was evidence that part of the result was due to personal tendencies.

Since there is no doubt about the existence of accident proneness, some psychological tests should be devised and adopted which would enable us to identify accident prone persons and shut them off from the more risky occupations. Some good work has been done along this line by Dr. Charles Drake and reported by him to the American Association of Applied and Professional Psychology at the University of Minnesota last August (1937).

But further work must be done in devising tests. Farmer and Chambers have pursued this matter for 12 years, and their main conclusions have been published by the Industrial Health Research Board. These reports should be studied by all who are interested in the problem.

But the most skillful psychologists still find great difficulty in discovering accident prone persons, and we shall, for the present at least, have to rely largely upon the trial and error method; hence if a worker on a

repetitive operation is found to incur more than one or two accidents in a limited course of time, he should be transferred to some other job.

To identify accident prone persons we shall need to keep accurate records of all accidents, even the most trivial. A trivial accident is as important as a serious one and may even constitute a better guide to proneness.

In conclusion, all inventions have three important characteristics: They result from a crisis, they are the work of a slightly different or superior mind, and they succeed or fail in their work depending upon the attitude of the people at the time and place the invention is made.

It should be observed, too, that we invent institutions as we do our machines.

The safety movement is a pure invention and exhibits the three fundamental characteristics. The advancement of our industrial techniques created the crisis. Slightly different or superior minds began to think about the accidents, and out of it has come the safety movement. The success of this invention will depend upon the attitude of the people toward it and their acceptance of its educational work.

ADJOURNMENT

Cement and Quarry Sections

Cement Section

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Engineering Committee Chairman—WILLIAM MOELLER, Lone Star Cement Corp., Dallas, Texas.

Highway Committee Chairman—M. A. KOFFMAN, Southwestern Portland Cement Co., Los Angeles, Calif.

Membership Committee Chairman—H. A. RENINGER, Lehigh Portland Cement Co., Allentown, Pa.

Poster Committee Chairman—J. W. KENNEDY, Huron Portland Cement Co., Detroit, Mich.

Members at Large—

P. N. BUSHNELL, Missouri Portland Cement Co., St. Louis, Mo.

R. B. FORTUIN, Pennsylvania-Dixie Cement Corp., Nazareth, Pa.

GORDON C. HUTCH, Universal Atlas Cement Co., Chicago, Ill.

E. POSSELT, Lone Star Cement Corporation, New York, N. Y.

F. E. TOWN, Medusa Portland Cement Co., Manitowoc, Wis.

J. B. ZOOK, Great Lakes Portland Cement Corp., Buffalo, N. Y.

TUESDAY AFTERNOON SESSION

October 12, 1937

Sessions of the Cement and Quarry Sections were held jointly. A list of officers of the Quarry Section will be found on page 557 in this record.

The opening session was called to order by Fred B. Hunt, Nazareth Portland Cement Co., Nazareth, Pa., general chairman of the Cement Section.

Analysis of Accidents in the Cement Industry

By A. J. R. CURTIS

Assistant to General Manager, Portland Cement Association, Chicago

Twenty-five years ago a special committee reported to the Portland Cement Association at its annual meeting at the old Waldorf-Astoria in New York City the results of an investigation of our industry's accident experience. That pioneer committee obtained unanimous approval of a course of action to be undertaken to reduce the number of disabling injuries and fatalities, rolled up its sleeves and went to work.

It is fitting on this, our silver anniversary of safety, that we review briefly the quarter-century of progress made.

The original accident prevention committee queried 56 cement companies and obtained from 41 of them information about their accident experience for the years 1909, 1910 and 1911. This is what it found: of 6,207 persons employed in 1909, 1,206 or 19.4 per cent suffered disabling injuries; of 8,521 employed in 1910, 1,144 or 13.3 per cent were injured; and of 8,827 employed in 1911, 1,358 or 15.4 per cent were accident victims.

The program inaugurated by that far-sighted group of six cement company executives in the fall of 1912 has been broadened and developed by successive committees with the splendid cooperation and support of the member operating units. Last year, by no means the safest in the history of our industry, less than 1.3 per cent of the approximately 25,000 persons engaged in the manufacture of portland cement suffered injuries severe enough to cause them to lose time from work.

Progress in the First 10 Years

By 1922, at the end of ten years during which emphasis was placed largely on physical

safeguards, protective devices, and the development of safety rules and regulations, the number of disabling injuries and fatalities was reduced to a point where there were 41.7 for each one million man-hours worked by the industry. This was a decided improvement over estimated accident frequency rates of 97.0 for 1909, 67.0 for 1910 and 77.0 for 1911.

Contests and Campaigns

In 1923, the Portland Cement Association's safety trophy, 7,000 pounds of carved and polished concrete bearing the inscription "Safety Follows Wisdom," was first offered to the plant operating during the calendar year with fewest accidents. The winning plant had a record of three disabling injuries at the close of that year, the finest performance recorded up to that time. No one gave much thought to the possibility that a cement plant could operate an entire year with a perfect safety record, but in 1924 one plant accomplished this. And because perfection cannot be improved upon, it was announced that safety trophies would be awarded to all plants reporting perfect calendar year records. In the 15 years the awards have been made, 117 cement plants have won the trophy, many of them repeatedly, and a grand total of 351 plant years have been worked without a single disabling injury.

The June No-Accident Campaigns, introduced in 1925, have contributed in large measure to the success of the industry's safety program. Conducted when plant operations are heaviest, these intensive drives have been responsible for substantial reductions in acci-

dents not only for the month of June but also for the preparatory months of April and May. Also interest and safety enthusiasm carry over for a number of months.

As one plant after another demonstrated that it was possible to operate an entire year without a disabling injury, the old tenet that accidents are unavoidable and that the employee who was able to work safely month after month and year after year was "lucky" were thoroughly disproved. In one year, 1933, trophies were awarded or reawarded to 54 plants. In other words, over one-third of the cement plants in the industry operated without a single disabling injury that year.

The second decade of consistent progress, from 1923 through 1932, saw the frequency of disabling injuries and fatalities reduced 89 per cent to the all-time low of 4.5 per million man-hours in 1932. For that ten-year period the severity of injuries was reduced 75 per cent to the low mark of 1.80.

The Past Five Years

The four unsettled years from 1932 through 1936, however, saw the frequency and severity of disabling injuries in an upward trend, for the first time, to an extremely unfavorable high in 1936. You will be pleased to know that this elevated trend has been sharply reversed in 1937.

A look at the record for last year will sharpen our appreciation of this year's much more favorable accident experience. Three of the most significant points brought out by a precise analysis of accidents for 1936 are, briefly:

1. One hundred twenty plants reported 35 per cent more accidents during 1936 than 124 plants reported during 1935. Frequency of accidents was the highest in six years, severity greater than it had been in a like period with the exception of one year, 1934.

2. Three departments, Quarry, Raw and Burning, worked only a little more than one-third of the total man-hours operated by the industry but were responsible for fully one-half of all accidents reported and 53 per cent of all actual time lost on account of disabling injuries. Also, three-fourths of the total fatalities for the year occurred in these departments.

3. The most startling fact for 1936 was that

one-fourth of the cement workers who were hurt had not been in the employ of their plants one year before the injury occurred! Only five per cent of the total employees in the industry were in this group. And practically one-half of the injuries occurred to workers whose length of service ranged from a few hours to five years. Only 16 per cent of all employees in the industry had less than five years' service. The need for better safety training and more effective supervision of workers in our industry is unmistakable.

But 1936 is history. What is the trend of accidents in the cement industry in 1937?

1. The total number of accidents for the first eight months of this year is 22.5 per cent lower than the total for the first eight months of 1936. There has been no similar reduction in the number of accidental deaths, however; the total of fatalities to the end of August stood at 11, one less than the total killed during the same period last year. The U. S. Bureau of Mines reports that cement production from January through August is 15 per cent in excess of production for the same period in 1936, and shipments are about 8 per cent heavier, indicating that man-hours worked, or exposure will exceed last year's total. A 10 to 15 per cent increase in man-hours operated and a 22.5 per cent decrease in total accidents reported should show a substantial reduction in accident frequency rate at the end of 1937. Forty per cent fewer permanent partial disabilities and lower monthly totals of actual days lost indicate that, if the present trend continues, the end of the year should see a marked reduction in severity rate.

2. The three problem departments, Quarry, Raw and Burning, have contributed 39 per cent of the accidents reported to the Association during the first eight months of 1937, an improvement over last year when they accounted for fully half of the total accidents recorded in 12 months. Six of the 11 fatalities reported in eight months have occurred in these three departments. Credit for practically the entire improvement in accident frequency of this trio goes to the Raw department which has reported about seven per cent of the disabling injuries and fatalities so far this year compared with 12 per cent last year. However, four of these were fatalities.

Quarry has experienced 19 per cent of all injuries and fatalities reported during the eight months compared with 21 per cent of

the 1936 total. The Burning department has been responsible for 13 per cent of all accidents compared with 17 per cent last year. One key to the problem of effectively stopping accidents in our industry lies in better control over these three departments.

The greatest increase in per cent of total injuries this year over last has been in connection with plant railroads outside the quarry, indicating need for prompt regulation and enforcement of safe working practices among trainmen. Railroad is the only department, other than Raw, to report more than one fatality so far in 1937.

Yard, Shops and Finishing departments in that order, show the next greatest increases in per cent of total injuries for 1937. Aside from Quarry, Raw and Burning, the Packing and Shipping, Power and Cement Storage departments are the only ones in which there seems to be better control over the incidence of injuries this year than last.

3. The record shows that imperative need for training of the new worker in how to do his work safely is just as unmistakable at the end of the third quarter of the current year as it was at the end of last year. One-fourth of the cement workers who were hurt these past eight months had not been in the employ of their plants one year. And men having less than one year's service make up only one-twentieth of the total employees in the industry.

The cement industry can not and must not overlook the development of safe methods of performing operations, the careful training—the careful teaching—not telling, of men how to do their jobs properly and safely. Better control must include careful follow-up by competent supervisors to make sure that the worker thoroughly understands his work and what he is and is not to do in connection with it in order to keep safe.

Falls, falling and sliding cement and other objects, hand tools in hands of injured, flying or moving cement and other objects, electrical equipment and improper piling and handling of objects are the leading causes of disabling injuries in 1937.

While falls of persons continue to lead the list of causes, as in industry generally, fewer falls in relation to total accidents have been reported this year than last. Twenty per cent of the injuries that occurred in the first eight

months resulted from falls compared with 23.5 per cent all last year.

Special mention should be made of the increased frequency of injuries resulting from handling of power lines and electrical equipment. In three-quarters of 1937, two deaths and ten cases of severe burns have resulted from contact with electricity compared with two deaths and the same number of injuries from the same cause during the entire 12 months of 1936! Only experienced, alert men should do electrical work.

Fractures and severe cuts, burns and bruises show why the severity rate of the cement industry is usually so much higher than its frequency rate.

Now a word about the smaller plants. In 1936 the group of 75 larger plants operating more than 250,000 man-hours per plant, had an average frequency lower than that for the industry as a whole. The group of 45 smaller plants, representing but 22 per cent of the total man-hours worked by the industry, had a frequency rate 42 per cent higher than the industry's average. And history will repeat itself at the close of 1937, according to information now available.

It is true that fewer man-hours operated give greater weight to both accident frequency and severity rates.

But the work of preventing accidents in small plants differs from large plant activities, not in principle, only in detail. The principles, as such can not be altered.

a. Management's unqualified interest and support.

b. Knowledge and pertinent accident facts.

c. Appropriate and effective action based on those facts.

The technical disadvantage experienced by the small plant executive and supervisor when injury rates are figured is offset by the opportunity he has of making direct contact with employees at frequent intervals. By his intimate knowledge of his men and of their work he should be in a position to speedily diagnose accident-producing conditions. He is not obliged to set up complex and expensive procedure. In short, if he is guided by accident prevention fundamentals and a keen interest he may proceed directly to the determination of pertinent facts and take action on these facts with confidence that the control of accident frequency and cost lies in his hands.

Let's Go Into This Accident

By W. W. DEADMAN

Superintendent, and Fellow Employees, Lone Star Cement Corp.,
Bonner Springs, Kan.

Thorough study of the accidents in the cement industry, as disclosed to us by the monthly Round Table discussions, leads the inquirer to ask why or how come? Pulling aside the curtain that lies between the printed page and the actual facts and happenings at the plant invariably brings to light a failure in the safety set-up. This may be singular man-failure, it may be group man-failure, or it may be organizational failure.

We are giving here our conception of the cause or causes which underlie the great majority of accidents in our industry, and have chosen from last April's Round Table discussion a simple, unnecessary and all too prevalent type of accident. We have taken author's license to change the pertinent facts where necessary to make our points clear, for the prime requisite in analyzing any accident is the "why" frame of mind.

The injured man was an American with a good command of English; age 23; length of service, one year; and was employed as a laborer in the raw tunnel. His duties consisted of watching the raw bucket carrier, keeping the tunnel clean, and assisting in repair work as necessary. Spare wheels for the carrier were stored on a portion of the frame work above the bucket carrier at a height of about six feet from the floor. A nearby step ladder was used when necessary to obtain these wheels. This employee climbed the ladder, obtained one of the wheels, and, on descending, fell when one of the steps of the ladder broke. His injury consisted of a mashed and broken left thumb resulting in a loss of time of ten days, and terminating a long accident-free record.

The scene now is the superintendent's office the morning after the accident.

CHARACTERS

S Superintendent
MF Gen'l Mill Foreman
SF Shift Foreman
Inj. Injured Employee
SI Safety Inspector

S. I have called you men here to discuss yesterday's accident. It is to be regretted that such a trivial matter should spoil our excellent safety record, and it definitely proves that these trivial matters are possibly much more important than we have been giving them credit for. (Supt. to Mill Foreman) Did you request the injured man to report here this morning?

MF. Yes sir, I did.

S. Were you there when the accident happened?

MF. No, I was not.

SF. I was there. I had taken a repairman and gone up to replace four broken wheels and was using Blank as a helper.

S. What time was it?

SF. Around ten-thirty. We had taken off three of the wheels and had started to take off the fourth one when I told Blank to get me four wheels from the stock pile. He took the ladder over, set it in front of the pile, and apparently climbed up, picked a wheel off the piles, and was stepping down when the second step broke, causing him to fall.

S. How did his thumb get mashed and broken?

SF. He said he stuck the middle finger of his left hand in the hole of the wheel, and when he fell he couldn't let go and his thumb was caught between the wheel flange and the concrete floor.

S. Did you see him fall?

SF. No, neither the repairman nor I saw him actually fall. We had our backs turned and were removing the fourth wheel when we heard the step break and turned just as he was picking himself up from the floor.

S. Had Blank ever helped on this work before?

SF. Yes, we have changed a number of wheels on this carrier on two previous occasions, and he acted as helper, getting the repairman the new wheels, oiling them when they were put on and in general making himself useful.

(Knock is heard)

S. Come in. How are you this morning?

Inj. Pretty good.

S. We are sorry that you had this accident yesterday, and we have requested you to come here so that we may learn all of the details of what happened yesterday. Why, in your opinion, were you injured?

Inj. Because the cracked step in the ladder broke and I fell.

S. Did you know the ladder step was cracked?

Inj. Yes.

S. How long did you know this ladder step was cracked?

Inj. About ten days ago when I was stacking some new wheels, one fell on the ladder and cracked the step.

S. When this happened did you report it to your foreman?

Inj. Yes sir. I told the shift foreman.

S. (To SF) So you knew this ladder was cracked?

SF. Yes sir; now that Blank mentions it, I recall him telling me, but I was busy at the time and the incident clearly slipped my mind.

S. Did anyone else know the condition of this ladder?

SI. Yes, I found it in the condition stated on my inspection four last week, October 4th, eight days ago.

S. Did you report this to the mill foreman?

SI. Yes, I told him about it at the time, and he said he would have it fixed.

S. (To Blank) Why did you insert your finger in the hole of the wheel when you lifted it off the pile?

Inj. My gloves were greasy, and I felt that it would be a better way to hold the wheel than to grip it in my hand.

S. Why, when you knew the ladder was cracked, did you use it?

Inj. Because it was all I had to use, and I had to get up there to get the wheel, and in stepping down I made sure to step on the side away from the crack; but I guess that wasn't enough.

SI. Yes, and in doing this, you violated Safety Rule No. 19 which rules that a man must not use or permit the use of any known defective equipment.

S. Blank, are you familiar with this rule?

Inj. Well, no, I guess not.

SI. Truthfully, Blank, are you familiar with any of our safety rules?

Inj. Well, eh, when I went to work here the timekeeper gave me a booklet about some safety rules, but I never did read it.

S. You have been attending our regular monthly safety meetings and have heard much about us not wanting you to take any chances; couldn't you have gone about getting this wheel down in a safer way?

Inj. Yes Sir; but I thought the step would hold me.

S. You mentioned that one of these wheels fell when piling some new ones last week; did this ever happen before?

Inj. Yes Sir. The place where we store these wheels in over the carrier is quite hard to reach. I think we could pile those wheels in a more convenient place as there is plenty of room along the west wall where they could be carefully stacked on the floor.

S. Thank you Blank. I feel that is a good suggestion and appreciate your coming here and giving us your opinion. What did the doctor say?

Inj. He says if all goes well, I can come back in about a week.

S. That's fine and that will be all today, Blank.

(Blank exits)

S. Well, men you heard Blank's statement. Let's hear what you have got to say for yourselves. (Addressing MF) You knew about this ladder. How come you did not have it fixed when the safety inspector told you about it?

MF. My carpenters were busy on that roof job for we wanted to get it finished before bad weather. I intended to get one of them on it as soon as they had finished the roof.

S. Couldn't you have taken one of them off and had this repair made? It wouldn't have taken very long.

MF. Yes, but you wanted that roof job in a hurry, and I was trying to get it finished.

S. You think that roof job was more important than taking a chance with an accident hazard?

MF. Well, we have often put those small jobs off for a rainy day, and I thought we could this time; but it is obvious now that it was the more important as it would have

prevented an accident. But still, if we hadn't got that roof finished and it had rained, we would have caught hell, wouldn't we?

S. Yes, you probably would; but I can still see no reason why you couldn't have had someone fix that ladder as it would have only taken a short time.

MF. You are no doubt right; probably we old timers are lax in seeing the importance of these rigid safety measures and still have some of our old habits acquired during the early days when safety was of minor importance. I, for one, am going to resolve to pay more attention to these small details in the future.

S. Good! They are important, but this doesn't dispense with this accident, yet. (Addressing SI.) You stated that you caught this ladder last week and that you reported it to the mill foreman who said he would have it fixed. Did you check later to see if it was taken care of?

SI. No Sir.

S. You are supposed to make a weekly inspection, which was yesterday. Why didn't you check up on this at that time?

SI. I was in a hurry, and as this was an out-of-the-way place, I skipped it.

S. Why were you in a hurry?

SI. Because I had other work that I wanted to get finished that day.

S. Was this work important?

SI. Well, it was that report on Accident Statistics that you wanted.

S. Which do you think was the more important now, inspection or an early report?

SI. It is obvious that the thorough inspection was more important as it would no doubt have prevented this accident; but I wanted to please you by getting out the report that you wanted early.

S. Since this occurred, what do you intend to do in the future to prevent its recurrence?

SI. Make thorough inspections at all times regardless of other duties.

S. There is one point that Blank brought up where we have all been negligent, and that is the location and the manner in which we pile those spare wheels. Here we are, four so-called safety minded men who have for a long period of time been tolerating a hazard that should be obvious to almost anyone. (Turning to MF) Do you think

this location that Blank mentioned a suitable one for the purpose of storing wheels?

MF. Yes, that is an ideal place and I can't see why we didn't think of it before.

S. All right, let's change this pile immediately. (To SF.) You mentioned Blank as helping you on these repairs; what kind of a worker is he and what is your impression of him?

SF. He is a good worker; however, he is inclined to take a chance and is rather impulsive at times.

S. Have you ever discussed this impulsiveness with him and endeavored to show where such action might lead to trouble?

SF. No, Sir.

S. Don't you know that part of your duties is to learn the characteristics and nature of each one of your men so that you can correct any inherent tendencies they have to go off half-cocked, and to show them personally every detail of their work which includes acquainting them with the safety rules and regulations?

SF. Yes Sir; but we wouldn't get anything done if we had to follow every movement of every man to be sure he didn't make a false step. We can't be wet nurses.

S. I realize that, but you are charged with the training of these men, their morale, their attitude towards safety as well as maintaining production and quality.

MF. Whee! This is sure different than it used to be!

SI. Well, it's not so hard. We have discussed this matter before. You fellows know our set-up; but I do think this meeting this morning is bringing a lot of things to light that we should have seen before, and I refer chiefly to the fact that apparently our safety work is not reaching every man in this organization.

S. Exactly! That is obvious to my mind from Blank's attitude in taking a chance and not familiarizing himself with our safety rules, and in your apparent disregard of the matter of a cracked step on a ladder which you assumed to be a trivial thing. But what shall we do to improve matters?

MF. Well, I have an enlightened idea as to our duties and I am sure the shift foreman has. In the future, I am going to pay more attention to these trivial matters and get in closer contact with my men and see that the shift foremen do likewise.

SI. I believe that our general safety meetings will mean more to the men if, instead of having outside speakers all of the time, we should make the programs more our own organization; using our own men as speakers and possibly working up considerable discussion in taking cases from the Round Table that is put out by the Association; also devoting a part of the time in the study of our safety regulations.

S. That is an idea, and I would suggest that you work up next month's program along that line. Has anybody else got an idea?

SP. I have one. I suggest that we have a rule requiring any faulty ladder or other tool to be taken to the storeroom; and let it be the safety inspector's responsibility to see that such a tool does not go back in the tool

room until properly checked and repaired by some craftsman.

S. That's a good one, and we will give it immediate consideration. In addition, I suggest that we pick out a man from each department and bring him in to our safety committee meetings, rotating these men so that we can eventually have them all meet with us, thus giving these men a closer insight as to our safety work and permit us to get their ideas. Also, I will, until further notice, hold weekly meetings with all the foremen wherein we can make clear the additional duties that you men must assume, one of which will be to see that your men are acquainted with our safety rules and the training of new employees. We can also discuss various individuals who do not seem to be cooperating one hundred per cent.

Is Training a Vital Factor in Effective Safety Work?*

By F. M. PEPPER

General Plant Employment Supervisor, Illinois Bell Telephone Co., Chicago

Much of the effort spent in safety work has been more or less inspirational in character, with considerable stress placed on selling the idea of safety.

Too much time and effort have been spent in stimulating our people to do something to prevent accidents and in inspiring them, and too little time and effort in teaching them how. The job is essentially one of adequate training, both for the supervisor and man. The essential considerations in those management functions which are concerned with doing the job safely are no different from those management functions which are concerned with securing a product for which the industry is organized.

Effective supervisory training means securing effective supervision for the job as a whole. When a job is well done, preventable accidents will be at a minimum.

There should be a tendency to set up procedures which are apart from the usual supervisory functions. Prevention of injuries on the job is a matter which lies almost entirely in the hands of the direct supervision of the job.

*Editor's Note: This is a brief abstract of Mr. Pepper's address.

One of the most difficult problems facing us today is to return to the foreman his responsibility for the safe doing of the job which, by various measures, we have taken away from him. He must feel that the safe doing of the job is his responsibility and feel that he is the man to do something about it.

Rarely, if ever, is there an accident on a job which is considered particularly hazardous.

We must not assume that the foreman or supervisor knows how to conduct the work safely. We must be sure that he does and assist him through a proper training program.

It is safe to assume that a majority of all fatal and serious accidents are directly or indirectly attributable to the failure of supervision at some level to function properly. It is quite evident that supervisory training as a means of avoiding accidents is necessary.

The development of a supervisory training course is a much more difficult procedure than the development of a technical or vocational training course. Apart from the technical features involved, there does not seem to be any general formula. There is, of

course, some similarity of procedure in directing the work of any man on any job; but different industries employ such different types of people, under such a wide variety of circumstances, and place such a divergence of requirements upon them that the problem of supervisory training in its more comprehensive aspects is peculiar to each type of industry.

The general treatises on leadership give the groundwork, but the subject matter for

any supervisory training course for any particular industry lies within that industry. We must go out and see how our job is being supervised now; analyze the procedure of every foreman and supervisor; compare them and select the best; look upon supervision as a process in itself, and see how best to direct the work of the people. It is a long, tedious, and costly process, but one which, carried through to completion, will pay dividends in the end.

WEDNESDAY LUNCHEON SESSION

October 13, 1937

The Wednesday Luncheon session of the Cement and Quarry Sections was addressed by Hazrah Hale, Superintendent of Safety, Atchafalaya, Topeka and Santa Fe Railroad, who spoke on "The Common Sense of

Safety." The address was substantially the same as another address by Mr. Hale before the Steam Railroad Meeting. The complete paper will be found in the Steam Railroad section of this volume.

WEDNESDAY AFTERNOON SESSION

October 13, 1937

Work of the National Silicosis Conference

By R. CAMPBELL STARR

Assistant Safety Engineer, U. S. Department of Labor, Division of Labor Standards, Washington, D. C.

Silicosis is strictly an occupational disease. Medical science has not reported silica dust as affecting any individuals except those who, over relatively long periods of time, have worked in an atmosphere where the air which they breathe contained excessive concentrations of free silica.

The interest of the U. S. Department of Labor in a broad social and economic problem such as this has its origin in the Organic Act, effective March 4, 1913, which created

the Department. This act, among other things, gives the Department of Labor the duty "to foster, promote, and develop the welfare of the wage earners of the United States, to improve their working conditions, and to advance their opportunities for profitable employment."

With this in mind, and believing that through joint effort of all concerned, much could be done to eliminate the hazard, the Secretary of Labor called together in Wash-

ington on February 26, 1936 a group of about 75 men representing leaders in industries having a silica problem, labor leaders, and outstanding representatives of the medical, legal, and engineering professions, as well as insurance carriers and State administrators.

After considering various phases of the silicosis problem, this group generally agreed that through a pooling of knowledge and a frank discussion through the conference method important advances could be made toward, first, overcoming the hysterical attitude on the part of employers, labor, and others; second, after careful investigation, to consolidate in one place all known data with regard to the preventive engineering methods; third, analysis and recommendations in connection with adequate standards of compensation for those workers disabled as a result of the disease.

As an outgrowth of this initial meeting, another group, similar in composition to the first conference, but expanded to include some 200 individuals, was invited to come to Washington on April 14, 1936 to outline ways and means of attacking the problem. After hearing silicosis discussed from the standpoint of the employer, labor, and the medical profession, by outstanding experts in the field, this large group endorsed the conference method as proposed, and as a result four main working committees were appointed by the Secretary of Labor with the advice and consent of the group to investigate and report upon the outstanding phases of the silicosis problem. These committees were:

- (1) Committee on the Prevention of Silicosis through Medical Control,
- (2) Committee on the Prevention of Silicosis through Engineering Control,
- (3) Committee on the Economic, Legal and Insurance Phases of the Silicosis Problem,
- (4) Committee on the Regulatory and Administrative Phases of the Silicosis Problem.

A fifth committee, known as the Correlating Committee, was named. It was under the chairmanship of W. H. Cameron, Managing Director of the National Safety Council, and consisted of the chairman of the four technical committees just mentioned and two ad-

visors, one on labor problems and one on mining matters.

These committee members served without compensation and gave freely of their time and effort in studying the problem from their respective viewpoints. After nine months of careful and searching study, these committees advised the Secretary of Labor that they were ready to report. Consequently, on February 3, 1937 the Second National Silicosis Conference was called in Washington. At this time summary committee reports were presented to the Secretary and considerable discussion was given them.

Shortly after this second national conference the Department published, as Bulletin No. 13 of the Division of Labor Standards, the summary reports of the four committees referred to above, together with an abstract version containing the principal findings and recommendations written in non-technical language.

The full reports of the committees, comprising several thousand typewritten pages, are now being edited and will go to the printer very shortly. It is expected that they will be issued in four separate volumes sometime during the fall or early winter.

Nature and Extent of Silicosis

Physicians generally agree that silicosis, in the layman's language, is a disease of the lungs, caused by breathing air containing silica dust, in which the normal lung tissue is replaced by fibrous or scar tissue.

Silica dust is found in many industrial operations, but the hazard is acute only in such industries as metal mining; anthracite mining; quarrying, drilling, and tunneling in granite, gneiss, and sandstone; smelting and refining; foundries; potteries; glass works; stone-products industries; grinding; buffing; and sandblasting.

Of the 49,000,000 workers in the United States, only 1,000,000, or 2 per cent, it is estimated, are in any way exposed to the hazard of silicosis. About half of this number, or 1 per cent of the total number of workers in the country, are exposed to a serious hazard, and approximately 110,000 of these have silicosis in some degree. Medical examination of men actually at work indicates that between 4,000 and 5,000 workers are seriously affected by the disease, in addition to

those already permanently detached from their employment by reason of disabling silicosis.

The status of the 1,000,000 workers exposed to the hazard of silicosis was analyzed thus by the committees making the survey:

A percentage of the 4,000 to 5,000 workers having silicosis are completely or partially disabled because of this disease and have their difficulties further complicated with tuberculosis.

The remainder of the 4,000 to 5,000 have silicosis and disability in some degree, but no tuberculosis.

Approximately 105,000 have silicosis, but no disability and no tuberculosis.

Approximately 900,000 are exposed to silica dust, but have not contracted the disease.

Contrary to popular belief, silicosis is slow to develop. Usually it takes seven years or more of exposure to silica dust for a worker to contract the disease. A few cases that have been known to develop in as short a period as one and one-half years occurred under extreme and unusual conditions. On the other hand, many workers have labored under ordinary exposures to silica for more than 30 years without demonstrating any trouble whatever that could be diagnosed as silicosis.

Silicosis Prevention

Silicosis can be prevented in three general ways: First, by preventing the creation of silica dust; second, by preventing the dispersion of dust into the atmosphere of a working area; and third, if it is impossible to apply the first two methods, by the use of personal protective equipment such as respirators, to prevent the inhalation of the dust.

In carrying out a prevention program, many agencies must cooperate. In the view of the committees studying the problem, the employer is called on to do most of the work and to spend most of the money. But his work and money will never accomplish the maximum results unless the worker is willing to cooperate and carry his share of the responsibility for helping to control dust and for using the personal protective equipment.

In addition, physicians can play a definite part in preventing silicosis, as can also en-

gineers, insurance companies, legislators, administrators, and others.

The reports of the conference committees on engineering control and medical control recommend specific procedures for attacking the problem through those two avenues of prevention. A partial list of these recommendations follows:

Survey the working conditions to determine the severity of the hazard and indicate what needs to be done to decrease it.

Secure information on best procedure.

Design plant for dust control.

Provide building ventilation.

Store dusty materials in dusttight bins.

Enclose material-handling equipment.

Isolate dusty processes.

Provide wet methods of operation.—

Water, oil, and other liquids may be used effectively—

1. To suppress dust at the point of origin in such operations as rock-drilling; handling, pulverizing, and milling rock and ore; grinding metal on grindstones; abrasive-wheel cutting of granite and sandstone.

2. To prevent the redispersion of dust that has settled on the floors, walls, and other surfaces such as in the granite industry and in foundries.

Design equipment to control dust.

Establish good maintenance and house-keeping procedure.

Provide respirators.

Instruct the workers.

Responsibility of Workers

The cooperation of the workers is necessary if the hazard of silicosis is to be reduced to the minimum. The worker should realize that the safe practices recommended and the equipment provided are designed to prevent injury to himself and to his fellow employees. The equipment should be used as directed and every effort should be made to maintain it in good working order. Furthermore, the worker is frequently in a position to observe faulty equipment and unsafe practices, and he should make it a point to report all such conditions to his supervisor.

Statutory Regulation

While the primary approach to the problem must be the prevention and diminution

of the hazard, the fact must be recognized that until silicosis has been wiped out, workers who now have the disease, as well as those who may contract it, must receive workmen's compensation just as do those workers who are injured in accidents.

Accordingly, the committees of the silicosis conference were unanimous in presenting the following recommendations:

Coverage for silicosis in the compensation acts of all States.

This coverage should be compulsory.

Rec. . . of competition between the same or similar industries in various States, the laws, rules, and regulations of the several States should be as uniform as practicable.

Should Be Insured

The employer should insure his obligation for compensation either through self-insurance subject to the posting of adequate funds, or with an authorized insurance institution.

Insurance should not be denied any employer, provided the State authorities certify that he complies with the State requirements as to proper safe working conditions, and pays the premiums involved.

Workers having active pulmonary tuberculosis and silicosis should be removed from employment. Such workers should be granted suitable compensation payments and medical care.

Workers disabled from silicosis (but with no tuberculosis) should ultimately be granted the same amount of compensation as those disabled by accidental injury.

Two years is a reasonable minimum limitation period for filing claims subsequent to the date of the last exposure.

Further Activities of the Department of Labor

In carrying out its duty as stated in the basic law, the U. S. Department of Labor has conceived that there is immediate need

for the conversion of known facts in the medical and engineering fields working toward prevention, and in the legal, insurance and regulatory phases looking toward adequate workmen's compensation, into a practical, readily understood program which will adequately take care of the silicosis problem.

In its program of cooperation with the 48 States, the Department of Labor has included a section covering silicosis and similar dust diseases. This breaks down into three main sub-headings: (1) Assistance in the preparation of reasonable and adequate codes, rules, and regulations prescribing methods of prevention; (2) assistance in the establishment of equitable standards of workmen's compensation for those employees disabled as a result of the disease; (3) a general educational program among State officials, factory inspectors, etc. so that they will be equipped with adequate knowledge concerning the disease, its method of prevention, and its proper treatment under the workmen's compensation law.

Follows Two Lines

This application program, which is just now getting under way has been commenced along two principal lines: (1) The compiling of practical information concerning actual dust control installations in typical silica hazardous plants, together with approximations as to cost, not only of installation, but also of maintenance of dust control equipment in such plants; (2) a program of visual education supplementing the summary and full committee reports of the National Silicosis Conference. It is contemplated that in this field such media as film strips, lantern slides, posters, illustrated bulletins, etc. will be utilized. Further, in connection with the various exhibits of the department, shown at various large expositions, trade association meetings, labor and technical organization meetings, etc., it is contemplated that much factual information will be used, pointing toward ways and means of correcting the hazard and of establishing adequate standards of workmen's compensation.

hazards in quarry operation took place. This concluded the Wednesday program.

Following the address by Mr. Starr a round table discussion of outstanding

THURSDAY AFTERNOON SESSION

October 14, 1937

Methods Used by a Sand and Gravel Company to Win the National Safety Award

By H. A. KOOP

Safety Director, Lyman-Richey Sand & Gravel Corporation, Omaha, Neb.

The Lyman-Richey Sand & Gravel Corporation operates 22 plants, located throughout the state. Each plant is operated as an individual unit, normally employing one foreman and from three to six men on each shift. Total annual employees number 200 to 250, with an average of 275,000 to 325,000 man hours.

All production operations are by lake type dredges, involving such hazards as usually result in electrocution, falling, burning, and drowning.

Although our safety problems were the same as those of most small operators, our record in the year prior to the safety program was 79 lost-time accidents in 163,275 man hours' exposure. In fact, there were so many accidents reported that we received very unfavorable comment from the State Compensation Commission, and some insurance firms flatly refused to insure us.

It was evident that the system of each plant looking out for its own safety was all "haywire," so a safety program for all plants was decided upon and put into operation in the following manner.

First, an old employee, well versed in all plant operations was selected as safety director, devoting his full time to safety work.

Second, all employees were required to pass a physical examination. Most of the employees passed this examination, but a number were found to be physically unfit.

Third, all machinery and equipment were made as mechanically safe as possible; guards placed on gears and around open moving parts, ladders carefully inspected and guards built over them, hand rails and toe boards placed around platforms and on stairways, electric equipment checked for improper size switches and faulty wiring.

Fourth: An annual meeting of all foremen was decided upon to discuss safety plans, and plant operations. This proved

very profitable, since from experience we had observed that the attitude of the foreman is reflected in the workman.

Fifth: In addition to the trophy to be won in a safety contest, substantial cash awards were given the foremen having the best plant safety record; and we honestly believe these cold, round dollars did more than anything else in keeping up interest in safety and plant competition.

Sixth: All plants were provided with bulletin boards, posters and first aid kits.

Seventh: The policy was adopted of holding each foreman directly responsible for his plant and each operator responsible for the condition of that particular part of the equipment he was operating.

It was the duty of the safety director to go from plant to plant, making routine inspections, observing, and instructing when necessary in methods of safe operation, and conducting plant safety meetings.

At these meetings all plant safety problems were discussed, and the men encouraged to make any suggestions in regard to equipment or its operation that would tend to eliminate future accidents. Many good ideas, successfully executed, originated from this source.

One of our greatest problems has been in getting men to use their heads for something other than hat racks—to think. This is especially true of new men.

New men are prone to apply safety measures to other than themselves, and the alert foreman proves his worth in directing and cautioning until unconsciously the men become safety minded.

In 1934, as a member of the National Safety Council, we entered the National Safety Contest and although we did not win an award several of our plants had no lost-time accidents in an average of 30,000 man hours' exposure at each plant.

In 1935 we entered the safety contest sponsored by Rock Products and under the auspices of the U. S. Bureau of Mines. In this contest, the 10 Lyman-Richey plants winning awards had no lost-time accidents in a total of 124,324 man hours' exposure. However, our total man hours' exposure for all plants in 1935 was 349,423, with 13 lost-time accidents reported.

During the year 1936, 11 minor lost-time accidents were reported with a total expense for compensation and medical fees of less than \$1,000.

In 1937, up to date, we have had but two accidents, both minor eye injuries with a total lost time of only five days, no compensation.

Safety Practice of the Inland Lime and Stone Company

By ALFRED W. HEITMAN

Assistant General Superintendent, Inland Lime and Stone Company,
Manistique, Mich.

The Inland Lime and Stone Company is located in the Upper Peninsula of Michigan approximately 25 miles east of Manistique. The principal parts of the operation include a large quarry where the stone is drilled, blasted, and loaded into cars, eight miles of railroad, and a modern crushing and screening plant where the product is crushed, sized, and stored ready for shipment by rail or water. The entire plant, including the haulage system, is electrified.

When the company started to operate, it was faced with a unique safety problem. Sound engineering in design had reduced to a minimum the mechanical and electrical hazards. Guards and other safety devices were employed to protect workers from every possible injury. Nevertheless, there was an acute safety problem due to the nature of the men whom we were forced to employ in this highly mechanized plant. They were the local inhabitants, and had been for the most part lumber jacks or farmers—men who worked alone and were accustomed to thinking only of their own safety. Now they were suddenly thrust into new and strange jobs, in close contact with other men, where a careless or reckless act might cause serious injury to several fellow-workers.

We knew that the principles of safety must be taught and kept constantly before these men, and therefore initiated plans for thorough safety education. Fortunately our foremen had been previously employed in companies active in the safety movement and were already "safety-minded." They were the nucleus about which we built our safety program.

This consisted of bi-weekly safety meetings of the entire personnel, at which the importance of safe practice was stressed and safe working habits were demonstrated in short talks. All men were instructed in first aid by the United States Bureau of Mines, and this training is repeated about every three years. A safety engineer, who also directs the safety programs of other Inland properties on the Michigan and Minnesota ranges, was made available. His duties are to inspect all properties regularly, see that all machinery is properly guarded, that safety regulations are being followed, and that unsafe practices and unsafe conditions are eliminated. He also furnishes material for the bulletin boards and supplies safety literature for meetings or safety talks.

At the same time we instituted a system of safeguarding the general health of employees. Many were in need of medical, surgical, or dental attention. The city of Manistique was without a hospital, but when the scope of the company's medical service was realized, a hospital was provided. Every employee was given a physical examination and required to return for re-examination annually. Our first examinations exposed many cases of hernia, defective eyesight, poor teeth, and other ailments. Recommendations for the correction of these troubles were made and a continuous health record kept for each man. These records soon showed a gratifying improvement in the general health of the community.

Our accident record for the first few years was far from satisfactory, and indicated that the prevention of accidents is a problem that

primarily involves the human factor. Mechanical safeguards are by no means the chief consideration. Men have to form safe habits to govern them all the time they are at work. Many of our early accidents may have been the result of inexperienced men reacting too slowly to new environment, but as late as 1932 our accident record had improved only slightly. In the year 1931 we operated 354,680 man hours, had 16 lost time accidents, 12 of which were compensable, with a frequency rate of 45.1 and a severity rate of 32.9, costing \$16,040.42 in compensation. During the year 1932 our record had improved but was still poor.

It was at the end of 1932 that we altered our safety practice and embarked upon the improved program which is now in effect. Its immediate result was to give us 27 consecutive months, a total of 684,440 man hours, without a lost time accident. This achievement enabled us to win The Explosives Engineer Award in the National Crushed Stone Association for the years 1933 and 1934, a certificate of honor from the Joseph A. Holmes Safety Association, and a certificate of honorable mention from the United States Bureau of Mines.

Our revised safety program incorporated many of our former ideas on safety education but was specifically aimed at the problem of encouraging the worker to form safe working habits instead of forcing safety down his throat. Numerous methods were employed to accomplish this purpose.

It was decided to divide the men into several groups under the different department heads and foster friendly competition between these groups by means of monthly safety premiums. These premiums are given in the form of cigarettes, cigars, chewing gum, or snuff, to each man in any department which completes one month without a lost time accident. Each department head is responsible for keeping his group eligible for these premiums. The general safety meetings were abolished and the safety instruction work delegated to the department heads, who deal with the smaller groups and can give more attention to individuals.

A definite attempt is made to have each employee assume his share of the responsibility to promote safety. The foremen select one man each week to act as safety inspector in his department. His duties are to report infractions of the safety regulations and any unsafe practice or conditions which

come to his attention. The inspector's recommendations, when sound, are acted upon immediately by the foremen in order to convince the men that they are really participating in their own safety campaign. Although many of their suggestions are of minor importance the inspectors do succeed in reporting and correcting unsafe practices which the men develop from time to time and which might eventually lead to accidents.

The safety premium idea is carried still further. When a man has worked for five years without a lost time accident he is eligible for membership in our Five Year Safety Club and is given a jack knife suitably inscribed. For the foremen a safety dinner is given at the end of each operating season. At that time any foreman who has had no lost time accidents in his department for three years is presented with a properly engraved wrist watch. Four of our foremen already have won these awards. When the entire plant completes a year without the occurrence of a lost time accident, turkeys are given to all employees at Christmas.

Still wider in scope than the departmental competition is the Inland Safety Trophy. For this award our company competes with the inland-owned iron mines in Michigan and Minnesota, and the coal mines in Kentucky. To achieve equality in competition among such dissimilar operations, an appraisal was made of the relative safety hazards inherent in each type of operation and the contestants are handicapped accordingly. The trophy itself arouses wide interest in this competition. It is a striking bronze plaque on which are sculptured, from actual photographs, typical scenes in each class of operation.

Penalties as well as premiums are necessary for the effectiveness of a safety campaign. Men failing to observe safety rules and practices are disciplined by means of a temporary lay-off, the length of which varies with the seriousness of the offense. Repetition of an offense is punishable by discharge.

We are convinced that the vital points of our safety program are putting the safety problem in the hands of the men themselves, letting them take active part in correcting unsafe practices and keeping up their interest by means of the monthly and yearly awards. However, we are constantly adding to our safety precautions in an effort to protect the men in every phase of their work.

First aid treatment is administered for slight injuries at the plant, and the injured person sent to the doctor for further attention if it is considered necessary. Both the doctor and foreman make reports of the injury to the general superintendent and the safety director. Attention to small injuries is extremely important, for all trivial accidents are potentially serious. To emphasize this, men who are involved in slight accidents are sent letters by the general superintendent, analyzing each accident, suggesting a safe practice by means of which it could have been avoided, and urging greater care in the future. Safety clothing is compulsory. Hard toe shoes are worn through the mill and quarry, goggles are furnished in any operations where there is danger of flying materials, and respirators are used in places with high dust concentration.

Bulletin boards furnish another medium for focusing the attention of workers upon safety. We have installed, at the gate of the plant, a large general bulletin board designed from one illustrated in the *National Safety News* and attractively illuminated with neon lights. A green light burns day and night to indicate the absence of lost time accidents, and is changed to red for the duration of any time lost. Men passing this board daily become so accustomed to the green light that when the red does appear it serves as a daily reminder that an accident has occurred, and results in increased caution everywhere. In the large board, and also in smaller bulletin boards in each department, are displayed standings in inter-company competition, the honor roll, lost time accident statistics, and National Safety Council posters. The con-

pany slogan "Always Work Safely" is painted prominently on every locomotive, railroad car, and power shovel used in any of our operations so that it cannot fail to come to the attention of men who work on or near this equipment.

To complete our safety program, we recognize that special attention must be given to new employees in order to make them "safety-minded" at the very outset. The foremen, upon hiring new men, instruct them in the safety policy of the company and caution them to observe it well. Each new employee is given a safety pamphlet.

The effect of this is to make the man extremely cautious during the period when he is new on the job and his chances of being injured are greatest. He will pay as much attention to safety as to the performance of his work if he knows that both are equally important in deciding whether or not he is to become a permanent employee.

Another pamphlet, containing blasting rules, is issued to quarry employees whose work involves the handling of explosives. These rules are similar to those recommended by the powder companies and in use at most mines.

In conclusion it must be said that variety, as well as being the spice of life, is the key to the success of any safety program. No single plan, however well conceived, can hold the interest of a group of workmen for any length of time unless sufficient variety is introduced to overcome their tendency to become inured to constant repetition of the same thing. The resourceful executive must continually seek new ways to present old ideas.

Graphic Method of Portraying Accidents

By EARL SPITZER

Safety Engineer, Columbia Steel Co., Pittsburg, Cal.

For years we have posted our accident investigation reports on the bulletin boards of our plant with the hope that the workmen would read and study the reports and correct their ways. We noted that very few of the workmen would take the time or make the mental effort to read and study out our

very complete one, two or three-page reports. The few men who did study the reports were our super-safe men who were thoroughly safety conscious, while the average workman and the accident-prone type would read very little, if any, of the report.

We decided to try to find a way to interest

our men in the accident reports. Remembering the attention always given home made drawings, we made a drawing of our next time losing accident, showing one position of the workman as he was injured. We placed our typewritten report, giving the basic cause, recommendations to prevent repetition, etc., alongside of the drawing and then watched the results. We found the drawing did attract a great deal of attention, but still the important summary in the report was ignored.

We came to the conclusion that it was not altogether laziness or lack of interest on the workmen's part. We found it was difficult for men, accustomed to using their muscles rather than their minds, to build up the necessary mental picture from the written description. Often the terms we used were strange to them. Others, our foreign workmen, could not read English. I thought of my own experience at reading written reports of accidents occurring at other plants of our company and the U. S. Steel Corporation. Often I was confused with the terms used and found myself taking the lazy man's way of "just skipping it." I reasoned that other safety engineers must experience the same reaction.

From an accident analysis standpoint we break our accident down into its three elements describing the position of the workman and his surroundings before, during and after the accident, just as the majority of you probably do. We therefore decided to draw a series of sketches depicting these three elements, accompanied by just a few lines of description for each of the elements.

As I am not an artist, having had only the free hand drawing experience which accompanies an M. E. course at college, and since I had no artist in my department, it was necessary for me to resort to the use of the stickman to represent the human element in the picture. This was the same figure you and I used to draw in kindergarten—sticks or straight lines representing the various parts of the body, and a circle representing the head.

At the investigation of the next time losing accident which occurred in the plant I had a witness go through the motions of the injured man in the three elements. I was surprised at the ease with which I could sketch the man in the different positions. Immediately the idea seemed prac-

tical from a report angle. I reported my discovery to Wm. Cohn, our general superintendent, and he approved the idea.

We had our mimeograph operator cut a stencil from my sketches, including a brief written report, and the reprint was posted on all bulletin boards. Immediately the idea was popular. Practically all our men stopped and read and studied the report. Some came in and complimented me on the idea, said it was the first time they really understood how accidents occurred. Some of our foremen told me they could read the pictures and learn how the accident occurred. We knew, finally, that we had solved the problem. All our workers were interested.

The "Stickman" sketches embodied the necessary elements to command their attention and provided the necessary simplicity in order that the workmen, as well as the foremen and others in a supervisory capacity, would at a glance grasp the fundamental lesson to be learned from the accident. Being a series of graphic pictures of the accident, portrayed by a "Stickman," we called it a "Stickman Axigraph."

One of the most important results from the use of the Stickman, which developed very shortly after we adopted its use generally in the plant, was that we found our accident investigation committee must be very definitely certain of the movements of the workmen in all phases of the accident; that the basic cause for the accident had been found and that the recommendation to prevent repetition was correct, before the committee could safely allow its findings to be graphically portrayed. An error in such conclusions would be quickly detected.

Thus the Stickman Axigraph acts as a stimulus and at the same time as a check on the safety committee. Another unexpected result was the general favorable reaction of the workmen. We have never, to my knowledge, had one complaint from an injured workman or his relatives and friends because of his name and actions being made public all over the plant.

In cases where the cause of an accident is definitely self-evident and the fault of the injured person, we have found a good wave of thought is produced and good industrial relations engendered by asking the reader to supply the cause or causes, rather than criticizing the injured in the report. On the other hand, if the company is involved, directly or indirectly, be frank with the men.

It is to be understood this axigraph is supplementary to and does not take the place of the regular accident investigation report with its complete details giving witnesses' statements, etc.

The Stickman Axigraph is divided into two parts—the graphic part and the brief written description. Any person with a high school level training in free hand drawing or with natural drawing ability can make these sketches.

Remember that your stickman is the star actor in the tragedy. Keep the rest of your picture as simple as possible. Show only one stickman figure, unless it absolutely cannot be avoided. Depend upon your written description to explain persons and things indirectly involved. Remember the stickman, although made only of lines, can be made to represent various natural angles of the human body in various positions.

A good average height for your stickman

is 1 inch in order to get three sketches on a standard letter size $8\frac{1}{2} \times 11$ sheet.

First draw a horizontal line to represent the floor line.

Second draw a vertical line about half the height of the finished man—about $\frac{1}{2}$ inch long and $\frac{1}{4}$ inch above the floor line.

Then draw in two legs—each point about $\frac{1}{4}$ inch long. We don't try to show the pelvis. Then draw his feet. Then the shoulders—a horizontal line a short distance below the top of the body line. The two arms with dots for the hands, and then a circle for the head, and you have your stickman.

This idea can also be used to portray near accidents and unsafe practices.

My final plea is—keep the stickman figure and sketch as plain and simple as possible. Don't even put features in his face unless you have an eye accident to portray.

The Psychology of Safety

By GEORGE W. HANLEY

Safety Director, The Perfect Circle Company, Hagerstown, Ind.

Mathematics and other sciences are governed by principles which always give the right answer. When these principles are used, it is impossible to get anything but the right answer. Two and two are always four—never five. Do you, as safety engineers, anticipate the same accurate results from the principles of safety which you employ?

Perhaps you will say, one should not expect as definite results from a program of safety, because you are dealing with a human element which is variable and does not have the definiteness of mathematics. But behind every human activity there are unchangeable principles similar to those governing mathematics. If you wish to use electricity you must be familiar with its principles and know how to apply them to get the best results. If you wish to grow grass, you must understand and put into operation the principle governing vegetation. In everything we do successfully, we study well the principles and work in harmony with them. To present safety successfully, then, we must know how to present the thoughts which will obtain the results desired.

Man—the fellow to whom you are trying to sell safety—is a composite of good thoughts and nothing else. What about all the bad which is so evident in those whom we know? Those qualities never came with man. They are only educated beliefs, which he has acquired. Carelessness or lack of safety practice is also an educated belief. The only reason you know the correct rule of mathematics is because your teacher wouldn't let you learn anything else but the right rule. It wasn't your fault that wrong answers were kept out. You tried hard enough to put them in. Thus you learned that mathematics is not a combination of right and wrong answers—but only of right answers or positive qualities.

This same rule applies to man. Man is a product of environment and experiences. He has built his human existence and individuality on his own observations and conclusions, and this has, in a more or less degree, obscured his real self and his spiritual qualities.

A man is careless, not because it is natural for him to be careless, but because he has

acquired the habit of thinking in a careless manner. He is safety minded because for some reason he has been convinced of its value and wants its advantages. As the results of his daily experiences, man—any of the men you deal with—has established a set of standards of his own. This we may call his individuality. He has his own standard of honesty, truthfulness, responsibility, and safety. These may not agree with yours, because each man sets up his own standards, based on his own experience and education.

If your safety program is not based on principles which will exact definite results from human thought, then your program is a hit and miss program, designed to meet the human opinions which surround you. Your standards of safety thinking and program must be higher than those of other individuals. You can't teach safety until you understand the basic principles of safety yourself.

Very seldom are mental reactions taken into account in placing the cause and responsibility for an accident. You say a man's hand was injured and the hand must be cared for in order to correct the results of the accident. But have you traced mental reactions through sufficiently to be sure that the hand could not be injured unless that mental picture was first entertained in thought? If you have, you have arrived at the logical conclusion that everything you do is mental—that is, it is thought expressed. The injury to the hand was only effect, it was caused by the possibility of such an accident entertained in thought.

When you realize that you are wholly mental, or thought expressed, and think of and recognize your body as being only your identification mark, you will realize that your body and its actions can be kept under complete control of your mind—doing only what you wish it to do. Then, when you think safety you will express it; and the opposite thoughts—accident and death—cannot be present. You must remember that two opposites cannot be present in the same place at the same time. When light is present darkness disappears, sorrow cannot exist in the presence of joy, truth cannot entertain a lie, and love annihilates hate. In every case it is your decision as to the nature of the thoughts you entertain which determines the results you obtain.

How does your safety program reach the man 40 years old, who has never had an

accident? He thinks he never will have an accident, and he thinks he is doing all that is necessary to keep from having an accident. This usually is the fellow who has one of those unexpected accidents which go to make up 70 per cent of your accident record. If such a fellow finally does have an accident, what caused it? Surely his 40 years' experience should have taught him how to avoid it. If you press him for a reason for the accident, he will probably tell you it happened so quickly he couldn't prevent it. But you men who are professional detectives of hazardous thoughts should know immediately that the cause of the accident was due to the standard or lack of standard of his safety thinking. His standard of safety thinking was not sufficiently developed to recognize certain types of hazards. Thus for him, at least, the accident was unavoidable.

But do you admit some perfectly plausible accident is unavoidable? If you do then you have no principle governing your safety program. In building your safety program have you studied your people, and "set in" the proper safety approach which will register in each individual consciousness; or, is your program a general spread of safety ideas, hoping that some of them will find lodgment in the consciousness of your workers to the extent that your accidents will gradually be reduced?

In building a safety program two distinct lines of thought are usually used; one is fear, the other is logic. When you use fear you must leave out logic. Fear and logic are opposites. Fear makes one do things for fear of the consequences. It is an impelling blind force which scares one into doing something. Logic is the result of a mental debate which takes place in one's consciousness, out of which reason gives you a logical motive for doing or not doing certain things. Physical "stunts" may be amusing or entertaining, and even slightly educational, but they can never take the place of pure logic, presented to man in the same manner as he received the fundamentals of education when he went to school. Have you ever listed the attributes of intelligence which produce a constructive safety program and will make a man safely conscious, or conscious of safety? Without a list of such constructive thoughts and their proper classification it is impossible to build a satisfactory safety program.

This list would contain such ideas as, protection; enjoying the use of normal physical faculties, such as hands, feet, eyes, etc.; ability to earn full supply; life and its sweet pleasures—not handicaps; elimination of pain and suffering due to accidents; pleasant normal appearance; alert analytical thinking; and many other such positive constructive thoughts.

The place for safety to begin is down where individuals live and work. The safety Utopia is when every worker becomes so safety conscious that he thinks safety, practices safety, lives safety and knows why he never has an accident. How to get safety to the individual is your problem. If you adopt the premise that your safety program is purely mental and if you are just an ordinary psychologist, you can easily build up a safety program, which can be put across with very positive results.

When you prepare such a program and make a correct analysis of thought, you may be surprised to learn that fear or gruesome details don't teach safety. You will also find that the guarding of dangerous machinery does not teach safety. You will find that guards only cover up hazards, they don't remove them. You will find that only as you plant the idea of logical safety, for safety's sake, in the consciousness of individuals and it becomes a definite part of their habitual thinking, will people actually become safety minded. Is not this the way you became safety minded?

The average individual cannot be taught safety through fear, for he is not afraid of fear; he has no reason to fear, for he thinks he knows how to avoid accidents. Your approach must then be by logic. Someone will say a contest will increase interest in safety—that the giving of watches, medals, and other similar prizes are the best inducements for safety. What quality of thought do you touch by a contest?—the spirit of competition. Is that safety—a continuing enduring type of safety which will make a man naturally safe for the sake of safety, or is it a "shot in the arm," which will need repeating as the human thought gradually slips back into its natural careless condition?

You cannot class all contests as a "shot in the arm," because the right type of a contest will excite pride in a safety record; although starting from what might be considered a negative beginning, gradually it

may produce a very positive result. If the mental result obtained by a contest is "Our department has learned how to work safely and keep out lost time accidents," then you have accomplished all you can hope to accomplish in your safety program. On the other hand, if the result is, "We won the Gold Watch," your results will be negative because the watch has replaced in the thought of the individual the idea of safety, and safety which is bought is not permanent.

The most effective method to make the individual safety minded is to surround him with such positive safety atmosphere that he consciously, or unconsciously, will absorb safety thinking and practice.

Do we agree that safety is what individuals want when they understand the joy and happiness it will bring to them? If so, the principles used by successful advertisers are a most potent force in presenting safety.

Posters which may be quickly read and easily understood—posters with a good picture tell their story in a few words. In developing this form of advertising the National Safety Council has done a swell job. If a plant had no safety engineer, and would post the National Safety Council's posters throughout the plant with only a reasonable amount of care, accidents in that plant would automatically decrease, for the simple reason that these posters instill the right mental picture in the thoughts of the worker.

Should negative posters be shown? Not unless you want negative results. Perhaps no article ever written on safety attracted more attention than "And Sudden Death" by W. W. Furnas. Did it decrease accidents? The records for the year of 1936, the year this article was published, show that there was a 6 per cent increase in accidents throughout the nation. This article did not remove the mental picture of accidents, it only attracted attention to accidents and death. Any psychologist will tell you that there are four definite mental steps in making a sale or presenting an idea—attention, interest, desire and action, and you must establish each one of these in the consciousness of the individual from whom you desire the action. "And Sudden Death" did not follow through. The individual was left to decide what action to take, and since most individuals think they are practicing all the safety necessary, there was little action.

Your safety program must be so definitely outlined that the logic of your mental pictures will raise the safety thinking in individuals to a standard which does not admit accidents either as a possibility or as a necessity. Wrong images of thought must be destroyed before you can prevent them from finding expression. When you do a mathematical problem on the blackboard and in error mark down that two and two are five, you show a wrong answer. To show a right answer you have to erase the wrong answer and substitute the right one. In our thinking, we can't arrive at a right conclusion while holding in thought a wrong premise.

Our daily acts are the product of our daily thoughts. Before we take any action we think it, not in one instance, but in every instance. There is no such thing as subconscious action. Accidents then, are a slip in the thought processes of the individual.

Someone will maintain that it takes more than a "Pollyanna" method to teach safety, that it needs "brass knuckles." The "brass knuckles" method is only an arresting agent. It is not curative. In analyzing human thought you will find that there is a mental "build-up" which human thought accepts, sometimes with a mental struggle, but more often without. Certain actions of people when first observed do not register pleasantly. Then as these actions are generally practiced by others they are accepted as custom, and eventually this custom is considered a right, or a lawful privilege.

How much habit thinking does the average individual do? That is, how much thinking is thinking, and how much is just a repetition of the routine of life? Do you eat habitually? That is, do you have about the same things for breakfast? Do you dress habitually, have a regular routine of putting on certain articles of clothing in their order? Probably the only individual thinking you do is to decide whether you should change ties or put on a clean collar. How habitual are you in driving your car? Driving is often referred to as second nature—isn't that about the same as thoughtless habit?

Every one practices certain acquired habits of safety. If you raise your arm or close your eyes when an object is coming toward you, you intuitively are practicing preconceived safety. If you take a sip of hot coffee before taking a large swallow, you are practicing safety. If you are driving your car along the road fifty miles an

hour and wish to get out, you stop your car before getting out. Why? Because your logic tells you it is the safe thing to do.

If you have not already done so, you will find much food for thought in tracing the origin of accidents to habitual thinking and habitual working. Mass production is largely responsible for this, for it requires the individual to do the same thing over and over, until it becomes monotonous or humdrum. What causes the accident is, that something momentarily attracts the worker's mental attention and he loses his rhythm of habitual thought. Then before he regains this habitual rhythm, he has an accident.

Because the habitual thinking of workers plays such an important part in safety and the foreman is on the ground all or most of the time, the most effective safety work can and should be done by him. The alert foreman will keep constant supervision over details of operation and when he sees unsafe practices he will correct them immediately. Thus, the thought of the individual is kept in line, the same as your school teacher kept you from injecting mistakes into your problems in school.

What is the key which unlocks the mind of the average individual to admit safety qualities of thought? Perhaps no quality of thought in any person is so vulnerable as pride. It is self pride which makes one accumulate and attain a position in life. Self pride is the impelling force which makes one wish to be on a par with his associates; that forces one to know how to do, and if possible excel.

You have a right to ask that I furnish some proof that the psychology I am suggesting can be applied in a practical way.

Two years ago we decided that our safety record was not as good as it should be. We set up a physical safety organization with heads of departments as divisional chairmen. Under these divisional chairmen were department foremen as chairmen of departmental groups of employees. These safety groups hold monthly meetings, promoting safety in their respective departments. When we started this plan the minutes of these departmental groups were most interesting. Month after month they suggested changes in machinery, special guards to cover up hazards, change of procedure, and many other changes in the physical setup of the plant. Not in any instance did these groups

recognize that accidents were caused by the human thinking of individuals. In other words our groups were always placing the cause of accidents upon the machines, or the action of others, never on themselves.

Our problem then was to turn the thought of individuals from machines and processes to themselves, and help them find the cause of accidents in their own mentality.

To do this we began to give publicity to instances where, by proper safety thought, accidents were prevented. Bulletins were issued describing in detail how accident prevention was accomplished. The subjects covered by these bulletins were also used as the basis of discussion in department safety meetings. Thus the idea of thinking ahead of the accident began to grow. When an accident did occur we issued a bulletin analyzing the accident and pointing out the mental quality of thought which made the accident possible. Gradually the thought of our workers began to find ways to prevent accidents and the idea of having an accident began to disappear.

To stimulate and encourage the workers to improve their safety thinking we designed a bulletin board having on it the name of the department and a division of the board by months upon which "Gold" and "Red Stars" were pasted indicating the safety record for the month. If at the end of the month a "no lost time" record was achieved, we sent to the foreman of that group a "Gold Star" to be placed on his bulletin board. The foreman capitalized on his department's accomplishment by calling all his group of workers together and went through the ceremony of pasting this "Gold Star" under the proper month. This proved to be an outstanding method of creating individual and departmental pride in preventing accidents. It is looked forward to as a recognition of accomplishment and has aided greatly in changing the thought of the workers from machine hazards to what they could do to prevent accidents. Not that the "Gold Star" had any value. It is only a little piece of paper which we buy for 75 cents a hundred, but the presence of the "Gold Star" on their bulletin board is a symbol of accomplishment; and in a very

striking manner tells every employee in every other department of their ability to work safely.

If a department was unfortunate enough to have a lost time accident in a given month we sent that department a "Red Star" which the foreman placed on the department bulletin board. He too called his department together to see the "Red Star" pasted on the bulletin board. The "Red Star" instead of the "Gold Star" touches the pride of the individuals in that department and gradually each resolves to do his bit to put "Gold Stars" on his board. At the same time the foreman informs his workers of the "Gold Star" records of other departments. This works wonders in helping workers to decide that if workers of other departments can get "Gold Stars" they certainly can do as well.

This system has brought into play two vital qualities of thought; pride in individual and departmental accomplishment, and the desire to excel in safety thinking. That this system is obtaining very definite results is indicated by the fact that from June 30, 1936, to June 30, 1937, our Hagerstown Plant had an accumulation of 1,600,000 man-hours without a lost time accident. Such a record was never accomplished before. In our Tipton plant there has been only one lost time accident of three days in two years.

To keep the foreman safety chairman fully informed and properly educated on safety ideas and procedure we peruse the information sent us each month by the National Safety Council, and other sources of information, to obtain illustrations of safety principles. Bulletins describing in detail how these principles may be applied are sent to the foreman. To help maintain a "Gold Star" record for his department the foreman finds it helpful to pass the outline of the principles on to his workers. This establishes principles of safety in the minds of both the foreman, and his workers, and helps raise the standard of safety thinking which is all that is necessary to prevent accidents. When individual workers are properly informed on safety principles and are encouraged to develop pride in their department safety record, accidents just do not happen.

ADJOURNMENT

Chemical Section

Officers 1936-37

General Chairman—H. L. MINER, E. I. du Pont de Nemours & Co., Wilmington, Del.
Vice-Chairman in Charge of Program—RALPH L. ROGERS, JR., Tennessee Eastman Corp., Kingsport, Tenn.
Vice-Chairman in Charge of Engineering—J. J. B. FULENWIJDER, Hercules Powder Co., Parlin, N. J.
Secretary—RALPH O. KEEFER, Aluminum Company of America, Pittsburgh, Pa.
News Letter Editor—F. W. DENNIS, Hooker Electrochemical Co., Niagara Falls, N. Y.
Membership and Publicity Committee Chairman—C. E. SEVRENS, Merrimac Chemical Co., Inc., Boston, Mass.
Occupational Disease Committee Chairman—DR. LEONARD GREENBURG, New York State Department of Labor, New York, N. Y.
Paster Committee Chairman—E. L. ROOT, Celluloid Corporation, Newark, N. J.
Statistics Committee Chairman—R. C. STRATTON, The Travelers Insurance Co., Hartford, Conn.
Members at Large—
 A. L. ARMSTRONG, Eastman Kodak Co., Rochester, N. Y.
 E. F. KING, Lever Brothers Co., Cambridge, Mass.
 S. D. KIRKPATRICK, Chemical & Metallurgical Engineering, New York, N. Y.
 JOHN ROACH, Deputy Commissioner of Labor, Trenton, N. J.
 JOHN S. SHAW, Hercules Powder Co., Wilmington, Del.
 PLUMMER WHEELER, American Cyanamid Co., Linden, N. J.
 S. E. WHITING, Liberty Mutual Insurance Co., Boston, Mass.
 PETER M. WILSON, Mathieson Alkali Works (Inc.), Niagara Falls, N. Y.

Officers Elected for 1937-38

General Chairman—H. L. MINER, E. I. du Pont de Nemours & Co., Wilmington, Del.
Vice-Chairman in Charge of Program—RALPH L. ROGERS, JR., Tennessee Eastman Corp., Kingsport, Tenn.
Vice-Chairman in Charge of Engineering—RALPH O. KEEFER, Aluminum Co. of America, Pittsburgh, Pa.
Secretary—R. S. MACKIE, General Electric Co., Nela Park, Cleveland, Ohio.
News Letter Editor—F. W. DENNIS, Hooker Electrochemical Co., Niagara Falls, N. Y.
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Membership and Publicity Committee Chairman—C. E. SEVRENS, Merrimac Chemical Co., Inc., Boston, Mass.
Statistics Committee Chairman—R. C. STRATTON, The Travelers Insurance Co., Hartford, Conn.
Visual Education Committee Chairman—E. L. ROOT, Celluloid Corporation, Newark, N. J.

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 PLUMMER WHELEK, American Cyanamid Co., Linden, N. J.
 S. E. WHITING, Liberty Mutual Insurance Co., Boston, Mass.

TUESDAY LUNCHEON SESSION

October 12, 1937

Sessions of the Chemical Section opened with a luncheon meeting with H. L. Miner, E. I. du Pont de Nemours & Co., Wilmington, Del., general chairman of the section, presiding.

William P. Yant, director of research and development, Mine Safety Appliances Co., Pittsburgh, Pa., addressed the delegates on "Latest Protective Devices and Safety Equipment for Chemical Workers."

TUESDAY AFTERNOON SESSION

October 12, 1937

Safety in Chemical Laboratories

By A. B. RITTER

Chemist, Hercules Powder Company, Wilmington, Del.

It is generally accepted that all of the hazards which arise in the several stages of chemical manufacture are present in the research laboratory on a small scale at least. It is also accepted that there exist the additional hazards of experimental chemical work. How can both types be designated in order to help the chemist protect himself and his equipment?

We suggest that this be done by dividing the hazards into two groups, known and unknown. In the known group we should include the physical hazards, not only as they pertain to machinery, equipment, apparatus, and temperature, and illumination, etc., but also as they relate to the human body. This known group includes exposure to harm from physical forces; such as, heat,

light, and electricity, and that physical strain which is associated with the human body.

For the dangers in the unknown group which the chemist must face, it is suggested that they be given the names under which they will probably be classified after their initial display. These terms may be defined as follows: *Explosion hazard* is exposure to danger from a violent expansion of gases. *Fire hazard* is exposure to danger from burning or combustion. *Toxicity hazard* is exposure to danger from poisons. *Personal equation hazard* is exposure to danger from the tendency of an individual to err. There may be a few who seldom err and there are those who are prone to err more or less frequently. Therefore, the

personal equation hazard is classified not as strictly unknown but as generally unknown.

We will now give you definite examples of unknown hazards in the industrial research chemical laboratory.

At the completion of a satisfactory miniature test, two determinations by the nitrometer method were made on a new explosive oil without check results being obtained. The oil reacted rapidly but since other materials were known to behave similarly no particular significance was attached to this observation. An attempt was made a day later to establish check results without a further miniature test. The story is brief but impressive. The oil was being washed with concentrated sulfuric acid into the reaction bulb when it prematurely decomposed, bursting the bulb. This phenomenon was classified as an explosion and the oil as submitted was considered an explosion hazard in nitrometer work because of the exposure to danger.

Let us take another instance of an unknown explosion hazard. A specially nitrated cellulose had been made with great care in the laboratory. Removal of the mixed nitrating acid was, of course, necessary. It had been customary in preceding work to filter off the acid by suction. Accordingly, the same small suction flask was cleaned with acetone, dried to remove visible liquid acetone, and connected to a water aspirator. Immediately that filtration started, an explosion occurred which shattered the flask. The nitrated cellulose was scattered but did not take part in the explosion. We, as witness, can verify the fact that two workers left the room hurriedly, one seriously hurt. Here again an unknown hazard had made its appearance. The explosion probably resulted from acetone vapor coming into contact with mixed nitrating acid.

Now let us consider an unknown fire hazard. It was desired to determine the solubility of chlorine in methanol, for possible use in chlorination experiments on a certain base material. The combination of chlorine and methanol was thought to be dangerous. A commendable literature search was made without verification of that thought. Thereupon, commercially pure methanol was measured into a glass gas washing bottle and a moderate stream of chlorine was bubbled through at cold water

temperature. This was carried out without mishap in a ventilating hood.

In the next run, the methanol used was that obtained by distillation of commercially pure methanol which had been recovered from tests on the same base material. This redistilled methanol was used as described in the first run. After five minutes bubbling of chlorine, the glass stopper popped out and a blue flash occurred, simultaneously with a splash of burning liquid.

Take another unknown fire hazard. In this case, there was fuming in which the material charred slowly and was consumed without flame. A certain organic compound was nitrated for the first time. During subsequent purification, signs of instability were observed which disappeared when the product was drowned. The nitrated product was removed from the water and, for the purpose of stabilization, was dissolved in a suitable solvent and agitated with weak soda ash solution. So much heat was produced that the mixture was hurriedly thrown out. As it hit the ground, it fumed.

Now let us consider an unknown toxicity hazard. Solutions of an experimental synthetic resin in octyl acetate were being made at slightly elevated temperature, about 115° F. Care was taken to avoid actual contact with the components. After a week of making solutions, dermatitis appeared on the hands, face, and on part of the body of the chemist's assistant. It was known before the work started that ester solvents could produce dermatitis on hypersensitive persons. However, although octyl acetate is an ester, it has a high boiling point and was not thought to have been the direct cause. The particular cause has not as yet been definitely determined.

Another unknown toxicity hazard was faced in several experiments which were carried out simultaneously and which involved the use of formaldehyde and certain other chemicals in water solution. One afternoon during the experiments, the chemist's assistant noticed pain in his side. The next day second degree burns were found on his abdomen and thigh. Conjecture centered on the formaldehyde, although the burns appeared to be too vicious for that, and also on the possibility that some hydrochloric acid was mixed unintentionally with thiodiglycol, one of the other materials used, resulting in the formation of mustard gas.

The latter could have occurred if thioglycol had been spilled on his clothes and later hydrochloric acid was spilled on them, or if the two materials had been spilled on the bench top.

As to unknown personal equation hazards, it would not be at all difficult to give numerous examples. One occurred during the distillation of 2B alcohol. The setup consisted of a flask in a water bath heated to boiling by a gas flame. The alcohol bumped and boiled nonuniformly. To correct the uneven boiling and bumping, the chemist removed the thermometer and immediately dropped into the superheated flask a piece of cold porous plate. A geyser of hot alcohol shot out, reached the gas flame and was ignited.

In another, two beakers were placed side by side on a laboratory bench. One contained a hot, molten resin on the surface of which a thin skin had formed and the other the same resin in a cold, solid state. The chemist was pressing the cold resin with his fingers to estimate the tackiness when his telephone rang. After the interruption, he picked up the hot, instead of cold, beaker and pressed the surface. Hot resin gushed out and burnt his hand.

Each of the examples was chosen to illustrate only one unknown hazard. By no means does each new dangerous event involve just one hazard. Examples involving combinations of unknown hazards were omitted because they would not add especial value.

How may the chemist anticipate or avoid the unknown dangers? In searching for practical solutions, we submit a simple question—Has imagination any use in chemistry? As you know, the answer is, yes. A second question—Which is more effective, controlled or uncontrolled imagination? We know the answer is controlled imagination.

Chemists apply effectively their controlled imaginations to work in the unknown. It may take weeks, months, or even years, of imagination, study, and work to arrive at an effective use of methods, materials, and apparatus. But a point we wish to stress is the further application of controlled imagination to avoid injury from unknown hazards. The explanation of unknown hazards will define the control for the chemist's imagination. The chemist should let his

imagination enter these channels and provide adequate protection in turn for each unknown hazard.

When a chemist directs his imagination into these fields, he should think in the orderly fashion he follows on unknown chemical phases of his work. This orderly thinking should lead him to provide for an important aid which can be used frequently. This aid is the use of adequately guarded miniature tests immediately preceding the work in which an unknown hazard may be involved.

It may be necessary, at times, for someone in higher authority to point out clearly insufficiencies in imagination, study, and work on unknown chemical problems. Likewise, insufficiencies in imagination on unknown hazards and in provision thereof of adequate protection may have to be called to the attention of the research chemist.

What protection is adequate for the unknown hazards? Adequate protection can be obtained provided the proper sources of information are canvassed. The Safe Practices Pamphlet entitled "Chemical Laboratories" published by the National Safety Council is particularly valuable. Assistance can also be obtained from the Council's Safe Practices and Health Practices Pamphlets, from U. S. Government publications, from the regulations of the National Fire Protection Association, from the codes and regulations of the several States, from the safety codes and rules of the American Standards Association, and from the books and periodicals of the International Labour Office of Switzerland. Our list does not include all of the many excellent reference sources available.

The manufacturers and distributors of safety equipment and materials can render valuable service by designing their products in conformity with the latest safety information, by furnishing specific directions for the operation and handling thereof, and by sharing their experiences with the industrial chemical laboratories.

How will the chemist provide for the personal equation hazard? He will apply his controlled imagination to the possibilities in this field and will be satisfied to go ahead only when convinced his planned procedure warrants.

Chemical Section Safety Contest

The high lights of the 1937 Chemical Section Safety Contest were reviewed by Reuel C. Stratton, Supervising Chemical Engineer, The Travelers Insurance Co., Hartford, Conn.

Of the 75 units registered in the contest, 20 finished without a single disabling injury. All competing units averaged a frequency rate of 6.985, or 32 per cent less than the average frequency rate for the entire chemical industry in 1936. Employees of all participating plants worked 35,073,740 man-hours.

Of the various divisions in the contest, the 20 largest units composing Group A of Division I had the lowest frequency rates, averaging 6.048. Twenty plaques and one certificate were awarded in the contest. The trophies were presented by Walter G. King, Safety Director, American Optical Co., New York City, and Past President, National Safety Council. The recipients of plaques were:

Division I, Group A—Two tied for first place—Canadian Industries, Ltd., Dominion Ammunition Div., Brownsburg, Quebec; Canadian Industries, Ltd., Belcoil Works, McMasterville, Quebec; Charles Lenning & Co., Inc., Philadelphia, Pa.

Division I, Group B—Eight tied for first place—Canadian Industries, Ltd., General Chemical Div., Hamilton, Ontario; Canadian Industries, Ltd., Explosives Div., Nobel, Ontario; American Cyanamid & Chemical Corp., Explosives Div., New Castle, Pa.; Ansul Chemical Co., Marinette, Wis.; Canadian Industries, Ltd., Plastics Div., Brownsburg, Quebec; Chilhowee Co., Newport, Tenn.; Canadian Industries, Ltd., General Chemical Div., Copper Cliff, Ontario; American Cyanamid & Chemical Corp., Chattanooga, Tenn.

Division II—Four tied for first place—Lambert Pharmacal Co., St. Louis, Mo.; Lambert Pharmacal Co., Jersey City, N. J.; Canadian Industries, Ltd., Paint & Varnish Div., Montreal, Quebec; Canadian Industries, Ltd., Fertilizer Div., New Westminster, B. C.

Division III—Six tied for first place—National Carbon Co., Inc., Niagara Works, Niagara Falls, N. Y.; Whitall Tatum Co., Upper Plant, Millville, N. J.; Canadian Industries, Ltd., Salt Div., Windsor, Ont.; The Carey Salt Co., Hutchinson, Kan.; Canadian Industries, Ltd., General Chemical Div., Cornwall, Ont.; The Mountain Copper Co., Ltd., Martinez Plant, Martinez, Calif.

WEDNESDAY AFTERNOON SESSION

October 13, 1937

Safety in Chemical Pilot Plants

By P. V. TILDEN

E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.

At first glance, it might seem that safety in the chemical laboratory, in the chemical pilot plant and in the chemical production plant would present problems of marked similarity. While this is true to a certain extent, the wide difference between operating personnel, processes and equipment in each of the three units makes a general common basis for safety work impractical.

The pilot plant has a much more varied personnel than the laboratory, where the per-

sonnel is of a uniformly high type and well-educated, and than the production plant where the personnel is selected for ability to produce and operate the plant. The pilot plant is operated by a personnel ranging from highly educated, carefully trained employees to laborers, most of the time working side by side.

The pilot plant also differs from the laboratory and from the production plant in the type of materials handled, the buildings,

the guarding, the safety committees and particularly in regard to the new methods and new materials. These differences require that all of these items be carefully considered before any safety program can be used effectively.

Personnel

The personnel of pilot plants must be given serious consideration. The control of the pilot plant is usually in the hands of men who are technically trained and who have had considerable experience. Often, there is a tendency on the part of this type of supervisor to become so engrossed in the products or processes being handled that safety unconsciously becomes a secondary consideration. Working with these men are laborers who are not sufficiently educated to recognize hazardous conditions and to detect unsafe practices and eliminate them.

The tendency in general is to produce a satisfactory product at any cost, to establish a manufacturing procedure, and to take care of safety when the process has reached a manufacturing point. The management of pilot plants, as a result, places the establishment of the process ahead of the safe manufacturing of it.

First of all, safety in methods and practices should be impressed on the control personnel and then the workmen and laborers should be educated along safety lines. This will be found to be more difficult in pilot plants because there is not always the decided line and staff organization that exists in an operating plant; that is, the general flow or dissemination of safety from the manager to the supervisor, down through the foremen to the older employees, and finally, to the new man. In pilot plants the line of demarcation is more abrupt, usually consisting of a direct tie between the supervisor and the workman; and considerable effort must be expended to teach safety work properly in such an environment.

New Methods

The pilot plant is the true testing ground of a new material or process. If a new material is being perfected, it moves from the laboratory into the pilot plant, and then out to the production plant, so that different processes—each of which has its own characteristics, and therefore, its individual hazards—are being moved through the pilot plant continuously.

The supervision should recognize possible hazards and eliminate and safeguard them

while in the pilot plants and at the same time educate the men to work safely. Often the materials being handled are known to be dangerous—at other times the hazards are not known. The known hazards must be guarded against, and the men must be sufficiently trained to appreciate any unlooked-for occurrences that may indicate danger. Ordinary guarding of machinery, and protective equipment such as gloves, clothing and respiratory devices that are used to protect workers in an operating plant, must be used in pilot plants, but beyond this, the workers must be trained to realize that they may encounter unlooked for hazards, and they must be alert.

Material Handling

The handling of materials throughout a production plant is, in most cases, according to a prearranged plan or scheme formulated by those who have made a careful study of the entire situation. Materials are handled in more or less the same manner in the same equipment and by the same workers day after day. This set procedure does not exist in pilot plants, since different materials from various sources are being handled, introducing the probability that hazards may increase in material handling, which is a constant source of danger.

Personal injuries in pilot plants frequently occur because of improperly or poorly designed equipment for handling materials. Often it is necessary to handle small quantities of dangerous material in pilot plants quite differently from methods followed in operating plants, thereby more acutely exposing workmen to their dangers. Available conveyors or machines in the pilot plant will be used, even though not the proper design for the manufacturing operation. Materials that should be manufactured in a closed system are sometimes handled in open systems. At times it is necessary to handle materials, the exact reactions of which have not been fully determined in the laboratory, and the men are unknowingly exposed to toxic vapors or fumes. The supervision and the men must understand that safety work in the pilot plant is as important as safety in the laboratory or in the production plant.

Buildings

In large plants a certain number of buildings are usually set aside or provided for pilot plant operation. These buildings may not

be suited to the occupancies, resulting in congestion, lack of important exit facilities, inadequate separation of hazardous processes, etc. Pilot plant operations have been known to be set up in old garages or out-of-the-way buildings, without consideration for the prevention of personal injuries.

Buildings of adequate size, proper design and construction should be available for pilot plant operation.

Guarding

In most production plants well guarded machines are purchased, or if a new machine is built or purchased, it is gone over by the mechanical division and every moving part is carefully guarded. In pilot plant practice it is often necessary to place a machine in operation in order not to delay the development process. The problem of guarding machinery is therefore more difficult in pilot plants than in production plants and should be frequently checked, continuously supervised and given attention.

Where harmful dust or fumes are being encountered, adequate exhaust or ventilating systems should be installed. Machines should be of the latest type, and fully guarded. The employees should be adequately protected with suitable clothing—aprons, rubber gloves, hoots, etc.—and provided with other necessary personal safety equipment, such as goggles, respirators and gas masks. Every precaution should be taken to make the operation of a pilot plant as safe as the operation of a production plant should be.

Safety Committees

It has been pointed out that the personnel, the new methods being constantly employed, material handling problems, plant buildings and safeguards, all aggravate the usual causes of possible personal injuries in pilot plants. To eliminate hazards each member of the personnel must be constantly on guard to recognize unsafe practices and unsafe conditions so that they may be corrected. The recognized method of properly training and educating the employee is the establishment of safety committees similar to those used in production plants. The following plan has proved practical in a number of operating pilot plants:

A departmental safety committee was organized by selecting a chairman and assistant chairman for each committee, together with

two members consisting of a salaried member and a payroll member. Each committee acted for a period of one month, at the end of which time the chairman retired, and the assistant chairman automatically took his place. His successor was then appointed for the following month, as well as the two additional members for that month. In this way, each chairman became thoroughly acquainted with his duties by virtue of having acted as assistant chairman, and the changing of three members of the committee each month during the year presented an opportunity to drill most of the personnel of the department in the fundamentals of safety work.

Each department of the pilot plant should have a safety committee organized along these or similar lines. During the time in which each chairman is serving on the committee his duties with regard to safety come first, and his usual departmental duties are considered of secondary importance. During the month at least one of the buildings or operations in the area is thoroughly inspected each day until the whole area has been covered, and a report is prepared covering changes of recommendations for the benefit of the succeeding committees. This committee also considers all safety requirements coming from outside inspection bureaus, State officials, etc.

In organizing in this manner for safety it has been found beneficial to hold periodical meetings of the entire department to impress upon all the seriousness of safety work, and the absolute necessity for individual and collective cooperation. In large pilot plants the chairmen of the various safety committees should meet at least once a month with the plant central safety committee and discuss the various recommendations of their committees. All recommendations should receive consideration, and the items corrected. If any suggestions are found impractical, the reason should be given in full and the recommendation should be returned to the committee originating it.

The value of such a system can be seen from the following recommendations that are typical of those submitted in a pilot plant where such a system was in use.

1. A certain chemical is handled in drums, and since there is a liability of developing a considerable pressure on standing in the hot sunshine, a study should be made as to

the correct procedure for handling these materials.

2. Spark-proof wrenches are requested for opening drums of flammable materials.

3. The operator should wear a mask during the cleaning of the filter press, also consideration should be given to some type of ventilation of this filter press. If any type of hood is adopted, it must be certain that its adoption does not increase the hazard. Perhaps some form of down draft ventilation, which will in no way interfere with the operator, could be devised.

4. Since a flame of any kind in this building represents a hazard, it is recommended that the gas to the laboratory benches be cut off.

5. An attempt has been made to repair the catch on the safety door of the locker room. However, it is not repaired and might give trouble in case of an attempted emergency exit.

6. The committee was unsuccessful in locating an outside safety vent on the storage tank, and the installation of such a vent of a proper flame-proof type is highly desirable. The present method of venting, we are told, is to let the inlet valve or line open when the material is being pumped into the tank through one of the other lines.

7. The committee perhaps overzealously discarded twenty-eight rusty 5-gallon cans which were stored on one of the shelves in this building. Each can was carefully opened before being discarded and three of them were definitely found to contain 12% pyroxylin of the 1927 vintage, in a more or less dry condition, and in one case fermented. Four others were shown to contain 11% pyroxylin in the same condition. The remaining cans were not marked with the name of the owner, and in some of the cases, were not even labeled. Thus they were considered an immediate fire hazard and were sent to the burning grounds. It later appeared that some of these samples may have been of value, and the committee wishes to apologize for having acted in such a high-handed fashion, but they felt at that time such a summary action was necessary. This incident at least shows the necessity for an immediate and thorough housecleaning of the storage vaults.

8. The steam hotplate in the roll room is dangerous. A simple guard of mesh wire,

raised an inch or so above the hot surface, to be put in place when the plate is not being used will constitute a sufficiently safe arrangement.

9. The boards laid between the rails in front of the oven constitute a slightly raised platform of which the edge forms a tripping hazard. It is recommended that ramps be placed around this platform.

10. We question the safety of storing solvent bottles, usually of 3-pint size, on the soapstone ledges behind the laboratory benches in view of the use of the tops of the benches for Bunsen flames and electric heaters. It is frequently necessary to reach over other apparatus which may include a Bunsen flame, in order to remove and replace these clumsy bottles on the ledge.

11. In practically all of the pilot plants' operations and even in some offices objects of various kinds are being stored on cabinets and shelves overhead. This is definitely contrary to good safety practice. The committee recommends that a drive be instituted against this particular hazard, even to the extent of having all such objects removed periodically and thrown out.

12. The committee recommends that in the future, any hazardous tools or other pieces of equipment found during a safety inspection be collected at once and not returned to the owner until they have been put in shape.

13. A general survey should be made of all the walks around buildings occupied by the research department. These should be made, then the walks repaired and replaced where necessary. The walks in front of certain vaults are in very poor shape and represent bad hazards, both in respect to tripping, turned ankles and overstraining with handtrucks. Since we go to great lengths to eliminate even suggestions of such hazards inside our buildings, we should do the same for the real hazards outside.

14. In some of our buildings, pipe used for different materials are painted with respect to the definite code developed for this purpose. In other buildings, no attempt has been made whatever to do this. The committee recommends that this practice be extended to all buildings occupied by the research department, since it not only makes for efficient operation, but is also a definite safety aid in case a line must be quickly traced for a leak.

15. In laboratories and pilot plant operations, a number of nitrogen and other gas tanks were found tied up ineffectively with wire or cord. It was reported that the approved type safety clamps are being loaned from one department to another and are not always available when required. It is recommended that a number of additional clamps be made up at once so that there always will be a sufficient quantity on hand.

It is also suggested that the special roller carriage used for handling gas tanks be investigated. This carriage simplifies the transportation of tanks and also holds them in place after they have reached their destination.

The above recommendations show the kind of hazards that are being uncovered and eliminated by safety committees and indicate the excellent results that can be obtained through the proper training and education of the personnel. Supervision must recognize its responsibility if such a program is to be successful. Responsibility for making the changes in equipment or apparatus, in line with the suggestions of the safety committee, rests with the division head under whom the supervision of the particular operation comes. It should not be the intention of the safety committee to inflict hardships upon the operation, or to interfere in any way with its efficiency, but safety and production can go hand in hand, and every precaution should be taken to see that the safety committee operates efficiently and is given 100 per cent cooperation on the part of the management.

Safety Rules

It is particularly important in the chemical pilot plant that safety rules be carefully prepared and explicitly followed. It is obvious that the necessity for such rules is far greater in the pilot plant than in the laboratory or in the production plant, due to type of personnel, untried methods of manufacturing and usually inadequate guarding. Rules should be conspicuously posted so that all employees can become thoroughly familiar with them. The following are typical of the 35 safety rules which were posted on August 1 on one of our own pilot plants:

1. Remember this area is devoted mainly to pioneer work on chemical process and that we are dealing with new hazards. Safety

and cleanliness must be observed on all operations. Keep all buildings and equipment clean.

2. All employees must wear protective spectacles wherever any chemical work is being done, laboratory or Semi-Works. The regular safety goggle must be worn when handling acids, caustic or other hazardous chemicals. Check with supervisor as to the need for safety goggles on new operations or in case of doubt.

3. Keep space about emergency showers clear of obstructions at all times. Each employee must familiarize himself with the location of showers and how to operate them.

4. Goggles, respirators and rubber gloves must be worn where required. Specific cases will be indicated by your Supervisor or Foreman.

5. No person shall enter a tank or similar equipment without the approval of the House Foreman. In the case of agitated equipment, the tight pulley must be chained or the connecting pin in the belt lace be removed and the belt removed entirely from the equipment. Blank off all lines into equipment before entering.

6. Employees when in doubt on any written or verbal instructions given them regarding materials to be used in operation, should not proceed until doubt is cleared by someone competent to do so. Do not trust to hearsay or the word of someone else that gas, vent or pressure lines or valves are open or closed whatsoever the condition desired where the safety of yourself is concerned. You must check these conditions and make sure to your own satisfaction.

Careful attention to the fundamental principles of safety must be given in the chemical pilot plant if the safety program is to be effective. The new methods, processes, and new materials being handled in buildings which in most cases may not be designed for the operation, requires careful selection and adequate safety training of the personnel from the management to the fast worker, and strict adherence to the safety rules. But most important of all are the active wide-awake live-wire safety committees, with departmental supervisors as chairmen, who should be inspired and backed up by the pilot plant manager himself.

Safety in the Chemical Production Plant

By A.S. ZOERB

Director of Training, Tennessee Eastman Corp., Kingsport, Tenn.

All chemical plant hazards fall into two general classes: First, physical or material hazards, which include the building, process equipment, the machinery, etc. Second, and perhaps the more important class is that of human or employee hazards. The physical hazards are by far the easier to identify and correct, whereas the human element is always unpredictable.

Let us consider what our superintendent should do to minimize the physical hazards of his new plant. If the superintendent is not already familiar with the hazards that developed in the research stages of his process, he should consult freely with the research men who have had this experience. The place for him to begin to eliminate the hazards is on the engineers' drawings.

We have all found from experience that it is far cheaper and always more satisfactory to provide all of the special safety features while the plant is still on paper than to wait until after it is built. Usually the special construction necessary for safe design and operation costs no more than ordinary construction on which no consideration has been given to these features. The built-in safety features almost invariably produce economies that more than pay for themselves.

It would be desirable if the superintendent would develop for himself a sort of a check list of all conceivable items which should be considered while the plant is still on paper. Naturally the items will vary with different plants and different processes. The following are some of the features that should be on such a list:

What about the location of the building? Consideration should be given to whether you are "putting all your eggs in one basket" by concentrating hazardous processes in buildings too close together. In case of a serious fire or explosion in one building, will it involve all those nearby or possibly shut them down?

After locating the building, what type of construction should it be? If there are special fume or gas hazards perhaps portions of the building wall should be left open. If heavy fumes or toxic vapors are present,

there should be ventilation openings in the walls at all floor levels. Also all pits or ditches in the floor should be avoided where heavy vapors are present. Should special vent sash or wall panels be included which would blow out in case of an explosion? Special sewers or disposal means may be necessary if there are dangerous chemicals or gases to be disposed of as waste.

Where there is a possibility of chemical reaction of these wastes with other things that may be encountered in the sewer, there is a serious hazard. Are any special exits needed so that the men can get out in case of an emergency? Thought should be given to the arrangement of rooms so as to minimize the handling of materials, particularly lifting by hand. Is an elevator needed? Is there ample storage capacity for incoming and finished materials? Should certain materials be stored separately because they may present an additional hazard if they come in contact with each other? This list could go on indefinitely.

Let us consider some of the hazards with relation to the process equipment. Is it made of strong enough material as indicated by experience in the pilot plant? In many cases, this will involve the choice of special corrosion resistant materials such as stainless steel, glass, rubber, or other special construction materials which will withstand corrosion and prevent possible future failure of the equipment. Unforeseen failure due to corrosion or any other cause is always extremely dangerous. The best available materials should be used.

If pressure or vacuum vessels are used they should be amply protected with relief devices. In that connection, we might include the installation of all necessary indicating and recording instruments both for operating control and for safety which will show the presence of dangerous conditions. Of course, all open mechanical moving parts should be guarded.

Special thought should be given to the plans for tanks and piping. Where there is a possibility of running tanks over, are there adequate overflow pipes? In case safety pop valves are used, are they dis-

charged into the room where they may create a hazard, or to some safe place outside? Are all regularly used valves in the piping system located where they can be conveniently operated? This item is frequently neglected because much piping on engineers' drawings is shown schematically and pipe-fitters are always prone to use straight runs of pipe. As a result, important valves may be located near the ceiling, behind equipment, or in other inaccessible places. It should be just as easy to run these pipes so that the valves can be conveniently reached from the floor. It may be necessary to distinguish by painting them different colors or by labeling the valves.

If flammable liquids or gases are present, special consideration should be given to the equipment used for handling them. Are the vessels properly vented? If common vents to many tanks or vessels are used, are they separated from each other by flame arresters in the vent pipe to isolate a fire in the one vessel in which it originates? Are all possible sources of ignition of flammable materials eliminated? Those include open flames, sparking electrical equipment such as motors, starters, pushbuttons, circuit breakers, etc. What about the possibility of ignition by static sparks? Is all of the equipment properly grounded? Is it necessary to maintain high humidity to decrease the possibility of static sparks? Where there is a possibility of explosion, are there adequate explosion relief vents? Where is the best place to store dangerous flammable materials? How far from the building should they be kept? Should they be stored underground?

Provision should never be made for transferring flammable liquids with air pressure; they should always be pumped. There is always a hazard with remotely controlled apparatus, because of the possibility of one employee operating it when another employee does not expect it. Where such remotely controlled apparatus is used, the valves, switches or other controls should be capable of being locked.

Now let us turn to consideration of special protective devices in the building. Under these must be included emergency showers for the immediate washing off of chemical burns and extinguishment of fire if the clothing is ignited. Are gas masks needed for operating or emergency purposes? Perhaps special detecting instruments should be

provided for some dangerous materials which will indicate their presence. This is particularly needed for invisible gases that have no odor or taste. Perhaps remote controlled switches and valves are needed for shutting down the process from the outside of the building in case of emergency. These are particularly valuable in case of a serious leak or fire that would make it impossible for men to get into the building. For instance, a solvent pipe from a steam driven solvent pump may be broken. If the solvent spills out and catches fire where will the operator have to go to shut the steam off to stop the pump to keep it from pumping more fuel on the fire?

Are special ventilating ducts needed to eliminate dangerous fumes that may be flammable or toxic?

Perhaps the most important of all items in chemical process buildings is the fire protection system. Is any special type of sprinkler system needed? Are the hazards localized by adequate fire walls and fire doors? Are there sufficient portable extinguishers of the right type readily available? Are hose lines needed? For special hazards, consideration might be given to piping foam or carbon dioxide to the vessels where the fire might occur. Should some of the operations be carried on in an atmosphere of inert gas?

Also, under protective devices should be included warning signs of many kinds. The usual signs prohibiting smoking or open lights should be conspicuous at the entrance to the plant or building. Any special hazardous controls may require special signs.

Many hazards are created by the services supplying the process, including steam, electricity, water refrigeration, vacuum, compressed air, gas and other services necessary to the operation. Special consideration should be given to proper insulation of exposed steam lines to prevent burns and, of course, an unnecessary loss of heat. Do steam traps discharge to a safe place? Where several steam pressure supplies are used, are they identifiable so that high pressure steam is not accidentally connected to a low pressure vessel?

On the electric current supply there is almost invariably, in chemical plants, failure to anticipate future increases in loads that are often added. All of the wiring and equipment should be of ample size to carry future loads. If it is decided to use ex-

plosion proof electrical equipment, the installation should be consistent throughout and should include every conceivable item of electrical equipment that might create a spark. Some items frequently forgotten are telephones, elevators with interlocking door switches, pushbuttons, clocks and electric drinking fountains. To prevent the possibility of electric shock from defective equipment special attention should be given to proper grounding of all motors, conduit, and portable electric devices.

Now as to the water supply. Are the pipe sizes provided for the water large enough? Particularly, cooling water supplies to solvent condensers, where water failure might be disastrous, should be of ample size. In some plants there are several water systems, some of which are not suitable for drinking water. Make sure that only drinking water is available for drinking purposes.

Usually on the consideration of refrigeration some thought should be given to whether a safe refrigerant can be substituted for a dangerous one. Perhaps the cooling medium at the process equipment can be brine or cold water instead of the dangerous refrigerant itself. Where possible, it is desirable to have ammonia condensers located outside buildings, where the release of a large amount of ammonia will not be as dangerous as it would be inside.

Since every process will be different, the superintendent should make his own list of important safety features which may differ widely from the ones given. He should spend much time studying his flow sheets and drawings, particularly drawings of piping. In this study it is always enlightening to arbitrarily point to a spot on a drawing and say, "If this piping should break, what would happen?" or "If this pump stops, what unusual circumstances, with their attendant hazards, will arise?" Also, what if the power fails or the water fails?

In looking at his floor plans and equipment layout, the superintendent should look for spots where an employee might possibly be trapped in case of a fire or serious chemical leak. These emergencies do occur and it is far better to think of them and their solution before they actually happen.

You may say that all of this is the engineer's job, or the safety department's job, or the management's job, but is it? The superintendent knows his hazards and is responsible for the safety of his men, so it is

certainly his first concern to see that safe features are built into his plant. Of course, many of his desires along this line will result in compromise, but he should always keep foremost in his mind the safety features he knows he will need. It is his job to sell them to the management and to the engineers.

It is quite possible that he will not think of all of the hazards or the best means of overcoming them. For that reason, he should seek additional advice. He should consult freely with his safety department or with his insurance company's safety engineer. All available information on the properties of the chemicals and the limitations of his equipment should be obtained. Usually the supplier is a good source of information on these special problems. Advantage should be taken of the consultation services of the National Safety Council. Their engineers have accumulated a wealth of information on the proper safeguarding to be applied to almost every conceivable situation.

Now, suppose we have this ideal physical plant with all of the safety features built in that can possibly be useful. Will that mean there will be no accidents? We all know the answer to that. The elimination of the physical hazards is really a simple job compared to making our employees completely safety conscious so they themselves are no hazard.

In the foregoing, all responsibility has been considered as resting upon the superintendent. In the matter of employees' safety, it still rests upon him, but necessarily he must usually delegate much of the responsibility to his foremen who have direct daily contacts with the men. That does not lessen the superintendent's responsibility in the least. If the last analysis the safety record of his department is going to be a direct result of his own influence in seeing that his men, as supervised by his foremen, go about their tasks in a safe manner. His superiors and the management will hold him accountable for his record and for any accidents that occur.

With a new process, it is probable that a superintendent will inherit a few key men who worked with the development of the process in the pilot plant stage. These men may become his foremen, or he may get his foremen from some other department. In either case, a superintendent must impress

upon them the importance of their leadership in the proper training of his workers. Most of the operators who will man the new plant may have had no previous industrial experience or at least no chemical experience. Even if they are not perfectly green they have a great deal to learn before they can be considered safe workers.

With a new process the teaching of each employee should begin as soon as he is employed, whether he has been previously employed in other departments or is new from the outside. A good way to start this teaching is for the superintendent to have a serious private talk with each man before he begins work. The superintendent should discuss only the importance of safe working and should not try to explain the process or a lot of other things that the man is going to have to learn gradually. The object of this talk should be to outline definitely the general hazards of the work and to convince the new man that safe work is a part of his policy.

Above all, the superintendent should impress upon the man the importance of asking questions of the foreman on everything that he does not understand. This is worth while not only from a safety standpoint, but from the standpoint of efficient operation as well. A simple mistake due to ignorance may be costly in many ways. Some men, particularly the older ones, might be reluctant to ask questions or may feel they must not ask too many questions because they think it will indicate ignorance on their part. The superintendent should head off this attitude in the beginning.

There should be a definite program of employee education of which safety training is a most important part. It must be carried on continuously with the foreman acting as the key man. Perhaps the first instruction by the foreman should be on the fundamental safety rules; such as reporting all injuries immediately for treatment, wearing goggles where required, rules against smoking, horseplay and any special rules applicable to the particular process. In conducting his training work it is basic that the foreman should observe all rules himself so that he will be an example for the men. A rule that does apply to everyone alike should not be considered a rule. If possible, new men should be assigned to work along with men already experienced who can show them many of the details of

the work and point out what the particular danger points are.

The objective of all educational safety work is to instill in the man a safety consciousness that becomes a permanent part of his character. When properly acquired this attitude results in a state of mind which makes the man inquire, whether consciously or not, if there are any elements of danger in every task he performs whether it be on the job, at home, or elsewhere. It finally becomes a habit that is of inestimable value.

Several systems are being used in this educational work. Perhaps the most important one is that of holding foremen conferences. In these conferences, the foremen are able to swap ideas, tell of experiences which their men have had that involve special hazards, analyze and discuss accidents and near-accidents, receive information from the management as to safety policies, etc.

Another worth while educational feature is the inspection of the plant by the foremen and also by the men themselves. The inspection reports of the safety engineer are usually very informative. The inspector's recommendations should be considered very seriously. The men should learn to look upon the inspector and his work as a service that is for their personal benefit. The use of demonstrations to show by actual cases what certain hazards are is of great value. Demonstrations are particularly convincing to men who have little technical background. If the men have a chance to see miniature explosions, chemical reactions and fires, using the materials with which they are working in their plant they will be much more convinced as to their hazards and properties than they would be by years of talking.

As in all mass education a certain amount of advertising is necessary to keep the subject constantly alive. Most chemical plants do this through circulars and bulletin boards. Another means is through inter-departmental and inter-plant safety contests in which the spirit of rivalry is the basis of interest. All of these programs are worth while, but in using them one should not lose sight of the primary fact that safety is an everyday requirement of ordinary operation and that it is not some new idea that somebody is trying to put across with spasmodic propaganda schemes at various intervals. Basically, the maintenance of

safe working conditions and safe attitude on the part of all employees is a cold business proposition. It is a means of increasing efficiency and reducing costs. By costs we mean not only money saved on insurance

and disability payments to injured workers, but the even more real cost which is the suffering, pain and anxiety that results from injury for which no amount of money can ever compensate.

ADJOURNMENT

Construction Section

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 EDGAR N. GOLDSTINE, Consulting Safety Engineer, San Francisco, Calif.
 JOHN RUSSELL, JR., Public Service Electric & Gas Co., Newark, N. J.

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Statistics Committee Chairman—E. N. GOLDSTINE, 352 Funston Ave., San Francisco, Calif.

Visual Education Committee Chairman—S. M. LAUDERDALE, Civilian Conservation Corps, Washington, D. C.

TUESDAY AFTERNOON SESSION

October 12, 1937

The first session was called to order by Edgar N. Goldstine, consulting engineer, San Francisco, who acted as chairman in the absence of W. A. Snow.

Awards for No Lost Time Accident Record

By R. J. REIGELUTH

Vice President, C. W. Blakeslee & Sons, New Haven, Conn.

Our company has always maintained the policy of trying to make its employees into one large family. We have about forty men who have been in our organization over twenty-five years, and a large number who have been with us over fifteen years, some of these men growing up from water boys to superintendents.

As all contractors today are seeking means to check the increasing costs of material and labor, we were concerned about a further increase in the cost of our compensation insurance. While the insurance costs are only a part of the cost of a high accident record, they are an indication of how those costs are running. Most of us construction men do not record all of the costs of an accident in our cost books and do not know the cost involved in time lost by the associated workers of the injured man, the cost

involved in replacing the injured man with another workman, the cost involved in replacing a broken machine or damaged piece of work; still we all know these costs exist and when our insurance rates increase, we get an idea of how those other costs are mounting up.

We made a thorough study of what was involved in our accident records and had conferences with two insurance companies who carry our compensation insurance. There were several jobs in our record which had operated without a lost time accident, including various typical kinds of construction work from operating a crushed stone quarry to reconstructing a bridge on which a pier had failed.

We determined what the saving in insurance costs would have been on the jobs which had a record of no lost time accident

if we had been carrying the Retrospective plan of insurance on those jobs. This study showed that a job operating for a period of one year with no lost time accidents results in a saving of between \$2.50 and \$5 per \$100 of payroll, the saving being determined by the type of work. Six men working with one foreman 40 hours per week for 40 weeks amount approximately to 10,000 hours. If these men averaged 50¢ per hour the annual payroll for this crew would be \$5,000. If this crew operated through the year with no lost time accident, the saving at \$2.50 per \$100 of payroll would result in a saving of \$125 in the insurance for that period of time. It is obvious that with a foreman having a larger crew of men, the saving would be considerably more, and also that the saving would be considerably more on a hazardous piece of work where the compensation rate was high. We decided to share that saving with our men.

We set up for this first year the following plan of awards for a No Lost Time Accident Record:

We offer cash prizes of \$50 and \$25 to each foreman attaining the requirements for the award. The \$50 prize is awarded to any foreman who carries his gang through the calendar year with no lost time accident, and the \$25 prize is awarded to any foreman who carries his gang through the calendar year with no more than one lost time accident resulting in no more than one week of lost time. We established the second prize of \$25 to meet the possible situation of a foreman almost making the grade of a no accident record only to have it shot the last week by one accident. We wanted the men to feel that their honest efforts at safety had recognition even though they did not have a perfect score.

To qualify for these awards a foreman must be a man regularly employed on our payroll at least 40 weeks in one year. We place no requirement for a minimum amount of time that a foreman must work as a foreman in any one year. We figure each foreman's record on the same basis that the baseball leagues figure a player's batting average. We want results and if a man who gets to "bat" only once makes a "hit," he has a perfect score. If a foreman has a job for only one month or less and has a no accident record he has done the best that he could for the time we called upon him for performance.

I want to make that point plain. All construction men are faced with a problem of keeping their key men working all the time, and from time to time demote key men from positions as foremen to jobs in a gang when there is not work for the men as foremen. We have carried on work sometimes in periods of depression when almost every man on the job was of foremanship material. So that in an effort to avoid imposing any hardships on our men we classify those men as foremen and available for the awards who have been in our employ for a period of 40 weeks in a calendar year and used by us as foremen any time during that year.

We classify as a lost time accident any accident where the injured man is unable to return to work on the shift following the shift in which he was injured. An injured man may receive first aid treatment on the job or at a physician's office and may be off the job the larger part of the day in which the injury occurs, but if he is able to return to work on the next shift, we do not classify that accident as a lost time accident.

We put this plan into operation at one of the meetings of our superintendents and foremen. Our plan for meetings of this nature is to have a private dining room in the best hotel in our city to which we call the superintendents and first-class foremen from their jobs, wherever they may be located. In cases of jobs remote from our city, it is necessary for these key men to leave a job in the middle of the day to get to the meeting; but we consider these meetings of sufficient importance to warrant the effort and cost about once a month.

It has always been difficult to induce the foreman on a job to consider safety from a humanitarian point of view, and it is also difficult to get him to realize fully the costs involved in accidents to the company. But it is comparatively easy with a foreman, as with anybody else in the world, to point out the value of safety when it means \$50 in his own pocket. The foremen are showing a keener interest in safety than they ever have before, and have come to look upon an accident as a direct loss to themselves.

Throughout the competition for these awards we have not abated our efforts to assist our foremen and superintendents to secure as safe conditions as possible on our work. We have had meetings, not only of the foremen and superintendents, but also

of the men themselves on some of the jobs, and have pointed out to them in mandatory language the necessity for safety. I use the term "mandatory" because that is exactly the position of our firm with our men on safety today. We have claimed the right at all times to demand proper performance and low costs of our men, and in recent years have taken the position that we also have a right to demand and require safe conduct inasmuch as this is one of our great costs.

We constantly remind our foremen that they must conduct themselves, and plan their work in such a safe way as to secure the confidence of the men who are working with them. A notable case of this kind occurred in our organization a few years ago when three men refused to work with a foreman because they said he did not plan his work safely. We did not take their objections as seriously as we should, thinking that there might have been personal feeling on their part; but within a couple of weeks after their refusal to work for him he had a failure of some of his rigging, which cost us a man's life.

Another factor which we stress with our foremen is the contented human element. So much of our work depends upon the human factor that it becomes highly important that each human factor in our organization has his mind free from worries

over family affairs or his own physical condition. Each foreman should know his men more intimately than the superintendent can know them; they should be constantly on the watch for any indication that any workman is not up to 100 per cent efficiency. A physically fit man is always much safer on the job. The condition of the men immediately after pay day should be watched particularly closely, and no man who shows any effects of intemperance should be allowed to work.

In the last analysis the responsibility for all of this safety program rests with the employer himself. Every executive should have some way of obtaining a bird's-eye view of the accident experience of his organization. In our organization we use what we call tally sheets for each job. As the accident reports come from the jobs into the main office they are recorded on job tally sheets, so that our executives have a cumulative statement of the accident record on each job. A glance at a tally sheet shows instantly how effective the safety work is on each job and enables each executive to criticize his superintendents intelligently and effectually. These tally sheets are used very effectively at superintendents' and foremen's meetings as a directing influence and a guide in the conduct of those meetings.

Keeping a Record of Accident Costs

By EDGAR N. GOLDSTINE

Consulting Safety Engineer, San Francisco

Accident costs may cover a wide field or may be restricted to a few elementary facts. The nature and extent of these costs, and the uses to which they are to be put will determine how they should be kept. The insurance manager may want no more information than the figures for medical expense and compensation awards for the policy year, so that he can compare them with the insurance premiums to determine the loss ratio and its probable effect on future insurance rates. The annual report to the National Safety Council on the accident experience requires data on man hours of exposure, the number of lost time injuries, and the days of time lost from work. Management should be concerned about the

hidden costs of accidents, as well as the insurance expenditures. The safety engineer may want to go into the greatest detail to obtain a comprehensive analysis.

Certain primary records are accessible for all reported accidents. The First Report of Injury provides for these facts:

TIME and PLACE of accident, including day of week and hour of day
WHEN FIRST REPORTED
Date of BEGINNING OF DISABILITY, and estimate of EXTENT OF DISABILITY
Name of FOREMAN
NAME, AGE, OCCUPATION OF INJURED

Whether it was his regular work, length of time employed, wages earned

CAUSE of Injury, NATURE of Injury, MANNER OF OCCURRENCE

Name of Physician, etc.

Most First Report of Injury records lack vital information necessary to determine basic causes of accidents, and omit desirable data on just what occurred. The probable length of disability, information obtainable from the physician treating the case, is seldom recorded. The first step in keeping a record of accident costs is to inaugurate the measures required to have these forms filled out in accordance with an acceptable standard of accuracy and completeness.

The Surgeon's First Report gives data concerning the patient, the accident, the injury, the treatment, and the estimated extent of disability and treatment.

The Surgeon's Final Report lists the number of treatments, detailed expense of treatment, nature of treatment, date of ability to return to work, any stoppage or refusal of treatment, and date of discharge.

In addition to these three primary records, it is desirable to use a Supplementary Accident Investigation Report which may take a number of forms. One of the simplest asks five vital questions:

Exactly what happened?

Who was directly responsible?

What unsafe condition or practice caused this accident?

What should have been done to prevent it?

What are you going to do to prevent a repetition?

This may be supplemented by classifying the accident according to a basic cause analysis, which is outlined in various forms in Heinrich's book, "Industrial Accident Prevention." These supplementary forms are much more analytical and critically frank, as a rule, than the First Report of Injury record, and may place responsibility in a manner that might not be good policy on a state record. The proper and intelligent use of a Supplementary Investigation Report is highly commendable, and is an almost indispensable element of an integrated, effective safety program. Without it, accident records will not be as informative as they need to be.

The First Report of Injury, and the Sur-

geon's First and Final Reports, with the data on the amount of compensation paid, and possibly complemented by the Supplementary Investigation Report will supply the basic information required to maintain a record of accident costs. Much remains to be done in the extraction of the vital facts, and their proper assembly in a manner that will provide helpful presentation of them.

While it is possible to work directly from the original records, it is usually much more convenient to place the pertinent data in a more accessible form. Safe Practice Pamphlet No. 21, "Standard Industrial Injury Reporting System," published by the National Safety Council, suggests a number of ways in which this can be done. I prefer to use a form 22 inches by 11 inches in size, ruled off into 25 lines and 22 columns. Each line lists the essential data for a single accident. Estimates of days of time lost, medical expense, and compensation awards are noted in pencil until the final figures are available, when they are then entered in ink.

Tabulation sheets may be used for listing and summarizing the data in various ways. Where the number of cases runs up into the thousands, the use of cards and mechanical tabulation may be justified. A limited number of industrial organizations, state industrial accident commissions, and insurance companies make their analyses through punched cards passing through electrical equipment.

Standard nomenclature, modified to fit special needs, is desirable. The United States Bureau of Labor Statistics Bulletin No. 276, "Standardization of Industrial Accident Statistics," will be helpful as a guide.

The use of graphical charts, supplemented by statistical data presents the facts so that they will practically tell their own story. Various refinements in presentation may be made so that both severity and frequency will be indicated in the same chart, with blocks of various shadings or colors to designate individual cases or groups of cases.

Among the accident tabulations that might be helpful, the following are suggested:

By Nature of Employment
By Age Group
By Years of Experience
By Length of Employment
By Calendar Years
By Months of the Year
By Days of the Week

By Hours of the Day
By Body Part Injured
By Nature of Injury
By General Cause
By major sub-classifications under General Cause
By Primary Basic Causes
By Secondary Contributing Causes

By Foremen in Charge
By Manner of Performance
By Agency (Machine, Material, etc.)
By Part of Agency
By Method of Contact

The figures may be summarized using days of time lost, medical expense, compensation awards, or other associated data.

WEDNESDAY AFTERNOON SESSION

October 13, 1937

Methods for Protection Against Silicosis, and When They Are Justified¹

By DANIEL HARRINGTON

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While the hysteria with regard to silicosis and other occupational diseases has largely subsided and this subject is being more carefully considered and soberly judged, it would be poor policy for any employer to maintain that the storm has ended and that he can relax and revert to conditions as they were some years ago. The fact is that the plan of paying occupational-disease compensation is now in its infancy and can be expected to grow rapidly.

At present while all the States of the Union, including the District of Columbia and excepting only Arkansas and Mississippi, have compensation acts, only the following make provision for occupational diseases to some extent: California, Delaware, Connecticut, District of Columbia, Illinois, Indiana, Kentucky, Massachusetts, Michigan, Minnesota, Missouri, Nebraska, New Jersey, New York, North Carolina, North Dakota, Ohio, Pennsylvania, Rhode Island, Washington, West Virginia, and Wisconsin.

Silicosis is compensable in one way or another in California, Connecticut, District of Columbia, Illinois, Kentucky, Massachusetts, Missouri, New York, North Carolina, North Dakota, Ohio, Pennsylvania, West Virginia, and Wisconsin, and possibly in other States. It will be surprising if comparatively comprehensive occupational-disease legislation is

not on the statute books of nearly every state in the Union within the next five years.

With this situation confronting him, the farsighted industrialist who has the interest of his organization at heart will immediately start to "put his house in order" by studying possible occupational disease hazards to his employees and promptly applying known remedial measures or attempting to devise such measures if none exist. Unquestionably, one of the most important of the surveys to be made relates to dust occurrence.

While the state dust laws and regulations apply primarily to silica dust and resultant silicosis insofar as the health hazard is concerned, those most familiar with dust occurrence and its possible hazards recognize not only that the breathing of large quantities of dust of free silica (SiO₂) is probably the greatest hazard to health likely to be found where dust is involved, but that not even silica dust is harmful to health unless it occurs in very finely divided form and is breathed in relatively large quantities more or less continuously for a considerable length of time. Moreover, many thoughtful experts on dust harmfulness are now becoming convinced it is to be expected that health will be harmed when human beings are obliged to breathe high concentrations of any kind of dust more or less continuously. Professor Philip Drinker, of Harvard, as chairman of the Preventive Engineering Committee of the Air Hygiene Foundation, Pitts-

burgh, has expressed the considered opinion of a body of outstanding dust experts as follows:

"There is no satisfactory medical answer at present to this question, but the engineer is making a bad mistake if he lets men breathe heavy dust concentrations of any material. If no other reason for dust control can be found, then one should read transcripts of some of the recent suits at common law in which fantastic damages for alleged silicosis were granted to men who breathed dust containing little or no silica. The courts and compensation boards are not impressed with subtle distinctions between dusts with 10 per cent and 40 per cent quartz, especially when medical experts are reluctant to make definite statements as to the comparative significance of such differences.

"It would be well to realize that men working in dusty trades suffer far more from respiratory troubles of all kinds than do men who work in clean air. The evidence that excessive dustiness of any kind is harmful is beyond argument."

It should also be remembered that the inhaling of dust is by no means its only hazard in industrial work that may require compensation payment; and even here the harmful effect of breathing dust is not necessarily confined to the lungs, as some kinds of dust are known to have detrimental health effect on the nose, throat, and bronchial passages as well as (indirectly) on the heart, stomach, and possibly other internal organs. Externally, dust may cause injury to the eyes, ears, and skin; and some dusts, in contact with the perspiration, are absorbed with definite harm to the health of the victim.

Dust Cuts Visibility

Moreover, heavy concentrations of dust in the air reduce visibility materially. Obviously, in industrial occupations in which but limited amounts of natural light are available or in which artificial light is used entirely, any decrease in visibility due to air-dust concentrations (and the decrease in visibility may, under some circumstances, amount to 75 per cent or more) is likely to result in materially reducing efficiency and also in the more frequent occurrence of accidents accompanied by an increase in compensation commitments. Some dusts (coal, zinc, aluminum, and scores of others, mineral and nonmineral) are explosive and many

are subject to spontaneous combustion with consequent hazards to health, safety, and property. Many dusts have detrimental effects of various kinds on property as distinguished from persons. Machinery, growing vegetation, animals, dwelling houses, and other types of property are damaged by dusts, and compensation of some kind often is obtained from industrial concerns through damage suits or otherwise.

From the viewpoint of respiratory harmfulness, it is generally stated (though actually knowledge on this point is by no means certain) that the particle sizes of dust (such as that of free silica) that affect health adversely upon entering the lungs are those that are less than 10 microns in size, different persons having different ideas as to what the maximum may be—10 microns or 8 or 6, and some say that the harm really is done by particles less than 2 microns in size. As against this, it is stated that fibers of asbestos dust as long as 200 microns have been found in the lungs of men, and that undoubtedly these long asbestos fibers exerted at least some detrimental effect.

Since a micron is only about one twenty-five-thousandth of an inch, or much smaller than the naked eye can see, it is usually assumed that the larger dust particles that can be seen floating in air, and which settle out relatively fast are not harmful to health. Certainly, this is not so, as the larger particles that float in the air (some of them 100 or more microns in size), if present in considerable quantities clog the air passages to the lungs, some of which have agencies that under ordinary conditions intercept dust particles before they can reach the lungs and this clogging then allows the smaller and probably most dangerous dust to enter the lungs unimpeded.

A common-sense opinion as to what constitutes an atmosphere so dusty that dust-prevention action should be taken is that any atmosphere in which dust can be seen by the naked eye is too dusty, not only for health but also, at least in many cases, for safety and efficiency. If the visible dust is eliminated, much of the invisible or probably most dangerous dust will unquestionably have also been removed and very likely the health as well as other hazards much minimized or even removed.

After the visible dust has been removed, it may be necessary, under some conditions or with some types of dust, to make more in-

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tricate investigations as to the occurrence of invisible dust, using the impinger, konimeter, or other instruments; but unless litigation is in effect or threatened, those intricate studies are relatively unimportant if the visible dust is eliminated from the air of working places.

Prevention Is Best

Manifestly, if dust is not produced, it can't get into the air or become harmful otherwise; and some relief from dust troubles in industry can be achieved by using construction, practices, processes, or equipment that tend to eliminate dust formation.

In designing and equipping the places in which employees must work, the forward-looking industrialist will be wise to prevent the making of dust or to control it if it must be made, by using machinery, methods, processes and construction with dust-eliminating characteristics rather than those that produce or spread dust, even though some additional expense in construction or operation may attach to the dust-prevention features. The emphasis now being placed on dust in its various phases and the expense which dust may cause make it almost imperative that in the future much more thought be given to dust prevention and handling than has been given in the past.

For instance, processes or practices that produce excessive dust should be discarded for others that produce less dust, or they should be isolated somehow, such as by housing them tightly in a separate part of the plant or using them at times when the least number of persons would be exposed to them or when there is ample time to remove the dust from the atmosphere of the working places. Such installations or practices must be operated efficiently at all times, however. Common sense should be used in handling a dust control device or method; certainly it is foolish to use an elaborate exhaust system to take the dust out of part of an establishment and then exhaust the dust-laden air at such point or in such manner that it will be taken into the same or some other part of the establishment or into an adjacent one through doors and windows.

If dust must be formed, several effective methods are available to prevent the dissemination of dust into the air or into places where it may cause trouble. Among these are wet methods, such as wet drilling in-

stead of dry drilling, wet crushing instead of dry crushing, wetting or washing down floors, walls, and rock faces. In general the use of water in industrial processes and otherwise is one of the most effective available aids in the prevention of air dustiness, even though in some cases wet drilling does give off some dust. Notwithstanding a growing tendency in some quarters to decry the effectiveness of wet methods, up to now the use of water is probably our best defense against dust dissemination, especially in mining and tunneling.

Dust-exhaust devices, such as hoods, traps for drilling, etc., have a definite place in dust control, particularly in surface plants and operations. Under some conditions exhaust systems, when well installed and kept in repair and operation, not only remove dust but also more than pay for themselves in dollars and cents value of recovered dust. It costs approximately \$7,000 to install such a device in a surface plant processing one of the metals, and the value of the dust recovered daily averaged about \$25. In addition, the device kept the air of the plant as well as the surrounding walls and other surfaces practically free of dust.

On the other hand, the use of dust traps in dry drilling, while definitely applicable to certain types of surface or near-surface rock-excavation work, has not been found applicable to general rock-drilling practice in underground work. There are several reasons for this, some of which may be overcome in time.

Some types of rock cannot be drilled dry with any degree of effectiveness, and as yet the available types of rock-drilling traps are not workable with wet drilling; if dry drilling can be done, the traps ordinarily will do a good job of removing the dust from drilling, but this will leave the rock surfaces (top, sides, and floor in many cases) dry, and subsequent operations (blasting, mucking, timbering, hauling, etc.) will throw into the air dust certain to be created in large quantities by the other processes. The dust thus thrown into the air will settle on dry surfaces, ready to be thrown into suspension subsequently by any or all activities. Dust traps are somewhat cumbersome, especially when used in the more or less confined places in mining and tunneling.

However, dust traps with dry drilling have definite applicability for use in surface or near-surface operations where dry drilling

can be done, and have numerous advantages over wet drilling, especially in very cold weather.

Good Ventilation Needed

Ventilation is probably the most effective dust-control practice available for many industries, though it ranks second to wet methods in others. Where ventilation can be applied effectively, dust can be removed from the air or its concentration can be kept so diluted as to render it practically harmless to workers; ventilation can minimize dust hazards of almost all kinds, including spontaneous combustion, though it may enhance hazards of dust explosibility in some instances. In some cases ventilation should be induced by exhaust methods, but in others forced or blowing systems are the more effective, this being particularly true in underground work in places having high-temperature air due to rock or dripping water or other condition, such as rapid oxidation of surrounding rock or timber.

To obtain really effective ventilation in such work as tunneling and metal mining is difficult usually because ordinarily but one opening is driven instead of having workings in pairs as in coal mining, where fresh air flows in one opening and return or contaminated air in the other. Conditions brought about by dust may force the use of parallel openings in many tunneling and metal-mining operations of the future, and, notwithstanding the violent objections this suggestion will raise, there are good reasons for believing that in many cases there would be definite dollars and cents savings if the parallel-opening system, with its numerous ventilation, health, drainage, and other advantages, were used instead of the present one-opening system, with numerous disadvantages and hazards and with about its only real advantage the fact that its use is and has been customary.

Dry drilling is unquestionably the dustiest work in mining, tunneling and quarrying, and it continues to be used far too much in the United States; certainly, if dry drilling is allowed at all, it should be done only with auger twist drills or with the simultaneous use of up-to-date dust traps.

Wet drilling as practiced in the United States, with water forced or drawn through the drill steel by means of compressed air, is now under fire as producing relatively

large quantities of dust even though the material floating in the air usually is wet; some of this criticism is undeserved but, some of it is legitimate. The trouble is due largely to the fact that the holes are collared or started dry and, in some cases at least, are drilled dry for several inches after starting, and the dust created by this dry starting impregnates the usually stagnant air of the ordinary underground-tunnel or metal-mine working place for much if not most of the working shift.

In some cases the driller drastically limits the amount of water sent through the drill steel and, while nominally drilling wet, the actual practice is closely analogous to dry drilling with compressed air, which flows through the drill steel and forces out of the drill hole and into the air of the working place undue quantities of water-entrained dust or particles. In some cases when the drill is out of repair, the driller allows far too much compressed air to flow through the drill steel.

When present types of wet drills are used properly, the dust from drilling can be kept within reasonable limits, and this is actually being done by numerous alert and conscientious mining and tunneling companies. Some companies in the United States and Canada are experimenting with rock drills that do not allow compressed air to go through the drill steel but require the water to be forced through the steel by its own pressure; such drills are said to produce less dust than the usual types in which water is sent through the steel by compressed air, but the practicability of the newer type of drill is questionable and it has been used relatively little in the United States or Canada.

Must Use Judgment

However, air dustiness can be kept well within safe limits if modern types of wet drills are operated with care and judgment in collaring wet with plenty of clean dirt-free water; if the drills are kept in good repair; if the proportion of water and compressed air flowing through the drill steel are adequately regulated; if the exhaust from the drill is prevented from impinging on nearby dusty surfaces of muck piles, floors, walls, or timbers thereby throwing dust into the air; and, if, insofar as feasible, the drilling of upper holes is reduced to a minimum, as upper holes, whether

drilled dry or wet, are relatively heavy producers of dust in the air of working places.

Next to dry drilling, blasting causes more finely divided dust to be thrown into working places than anything else; and, in addition to throwing violently into the surrounding air immense quantities of finely divided dust, blasting with the heavy charges of explosive required in many mining and tunneling operations also impregnates the surrounding air as well as the rock piles with considerable quantities of poisonous gases, such as carbon monoxide, oxides of nitrogen and, in some kinds of rock, hydrogen sulphate and other dangerous sulphurous fumes, practically all of which occur in such quantities and percentages under some circumstances as to asphyxiate persons who may breathe them or to cause serious illness, often of a more or less permanent character. Many persons who have studied the incidence of dust disease are of the opinion that the breathing of even small quantities or percentages of extraneous or harmful gases, such as carbon monoxide, oxides of nitrogen, hydrogen sulphide, etc., inflames or otherwise adversely affects the respiratory organs, especially the lungs, and makes them much more easily and readily susceptible to harm from the breathing of dust particles.

Past blasting practice most certainly must be modified and reformed if the employer is to avoid heavy penalties in compensation and other charges due to the inclusion of legislation on occupational diseases (one being dust disease) in the laws of the various States. If at all feasible, blasting should be done at the end of the working shift or on an off shift, and the dust- and gas-laden air should be removed or thoroughly diluted before the men return to work.

Ventilation is, of course, an essential agency in cleansing the air where blasting has been done, but in addition to ventilating the place it should be thoroughly wetted (walls, floors, roof or top, timbers, etc.) before blasting is done, and a water blast should be kept in effect during and after the blasting; the region should be thoroughly wetted upon return to the face region after blasting, and the muck pile should be kept well wetted at all times while loading it out, as the water not only tends to allay the dust but also either absorbs or otherwise aids in the dilution or elimination of harmful or poisonous gases from blasting, which usually cling to the blasted material.

In general the larger the quantity of explosive used, the more finely divided the blasted material, the more heavily the air is impregnated with dust and smoke, and the greater the quantity of poisonous gases left at the places; hence, methods should be used which will tend to reduce the quantity of explosives used and of gases and dust produced. In this it will be found that the use of stemming or of some types of blasting plugs now available will more definitely confine the explosive; hence, increase its efficiency and reduce the quantity of explosive used and also reduce the amount of poisonous gas produced and possibly reduce the violence of the blast and its tendency to produce dust and disseminate it into the surrounding air.

And it would be well for users of explosives to investigate types of explosives that are known to give off minimum quantities of harmful gases on detonation and to use them; also the elimination of the use of fuse and the substitution of electric blasting would aid in reducing the amount of poisonous gases from blasting. Explosives that have been held in storage too long or that have been stored under unfavorable conditions as to moisture and temperature, are likely to give off maximum quantities of harmful gases if they detonate at all; hence, utmost care should be taken in the storage of explosives and to see that they are not held in storage too long before being used.

Respirators Available

Dust respirators of various types are now available for use in excessively dusty atmospheres, and while they are cumbersome and have numerous features that make them undesirable for constant wear throughout a working shift (though they can be worn readily for several minutes at a time), they do give adequate protection to wearers against dust but give essentially no protection against either poisonous or asphyxiating gases. Dust respirators should be regarded as being temporarily useful for emergencies only, whereas protection for workers against dust should be more substantial.

What might be designated "good house-keeping" has a definite place in dust prevention. Dusty materials should be stored in dust-tight containers or bins; dusty processes, including the handling of dusty material, should be carried on, as far as

feasible, in dust-tight compartments or structures, the tightness of which should be maintained; ledges or surfaces on which dust may lodge and accumulate, to be thrown into the air by some shock or movement, should be changed to prevent opportunity for such accumulation, or, if this cannot be done, such surfaces should be cleaned periodically by vacuum process, by washing down, or by sweeping (the latter being a relatively poor method, and should be employed only when a few of other workers as possible are present); floors should be kept as free of dust as possible preferably by washing them with water; and, certainly, air for the working places should not come from dusty sources.

Physical examinations should play an important part in the drive to minimize health harm from dust in industry, but so much controversy has been aroused because of them that their effectiveness has been largely nullified. Unquestionably, every person employed in an industry where considerable dust may be found in the air should be rigidly examined by a competent doctor previous to employment, and if the examination reveals the presence of respiratory trouble, the person should not be employed; this is especially true if tuberculosis is indicated. At six- or twelve-month intervals every person in dusty industry should submit to a rigid physical examination; and if disease is shown to be developing, the victim should be transferred to nondusty employment if such is available. Handling physical examinations

in a manner fair to the worker as well as to the employer should be worked out, and it must be admitted that to date this has not been done at all adequately.

Prevention of dust disease is chiefly an employer responsibility he should shoulder willingly, not only to safeguard the health of persons in his employ but also to relieve his firm of the heavy financial burden likely to be thrust upon it by compensation or legal authorities, should employees become afflicted with dust disease; and when one takes into account how little is known as to the cause of the disease and how to relieve it if it is incurred, it would seem to be the acme of common sense to do anything practicable to reduce the dust content of the air of places where employees must work. This does not mean that the employee should not help himself, as it is manifestly as much to the interest of the employee to avoid dust or any other occupational disease as to avoid having accidents. However, information as to occupational disease (including dust disease) is not readily available to the worker in understandable form, and the employer should carry on an educational campaign to inform his safety and operating officials about occupational disease matters and to have them transmit the information to the workers so the latter can cooperate wholeheartedly in trying to eradicate these dread diseases from industry or at least control them to a far greater extent than has been done.

Safe Practices in Use of Heavy Construction Equipment

By E. A. BLANPIED

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My personal experience has been confined mainly to work of river improvement and bridge building. Our records are divided into these two classes.

River work consists of driving pile dikes and rip-rapping river banks, generally for the U. S. Government.

Bridge classification covers railroad and highway bridges of the heavier type including their foundations, both "pneumatic" and "open dredged."

River work, being mainly done by floating plant and with a large percentage of un-

skilled labor, differs greatly from the more complicated bridge work which uses mostly skilled and semi-skilled labor under greater hazards.

The bridge classification is sub-divided into erection and foundation as each has its own special hazards and treatment.

River work has been the subject of extensive research along accident prevention lines by the U. S. Corps of Engineers and most of the fatalities are due to drowning. Special safety requirements to lessen this hazard have been compulsory by being

placed in the contract specifications or by orders of the engineer officers in charge of the work.

These items include:

1. Safety skiff and its equipment to accompany each piece of floating plant.
2. Life lines to be festooned along ends and sides of barges and stretched along tops of dikes.
3. Gang plank to be wide and guardrailed.
4. Life preservers to be worn by deckhands and boatmen during working hours.
5. Extensive first aid kits to be kept with each gang.

Some of these requirements are commendable and others may be of doubtful value, but all are well-intentioned and serve to keep the men safety-minded at all times.

The labor used on river improvement work has been a continual source of trouble. Of late most of the men have been procured through the local re-employment offices and the relief rolls.

A careful physical examination by a local physician acquainted with most of the local labor has been a good preventive of accidents; and an organization of safety-minded foremen and overseers has held down the number of injuries.

Safe-guarding of hoists, pile drivers and other mechanical equipment has also cut down the number of serious injuries and the severity rate, but the prevention of injuries to, and by, the careless unskilled laborer is the same difficult struggle in construction as in every other type of work using human labor.

Bridge foundation work has two main sources of accidents: namely, the carpenter force, building forms and setting reinforcing; and the workers, known as sandhogs, who sink the compressed air caissons.

The form-builder is exposed to many minor dangers and a few major ones. Nail injuries, falling objects, slipping and striking against objects, and hand tool injuries are the most prevalent, and serious falls are not unusual in spite of scaffolds and safety belts.

The accidents are kept down as far as possible by using good ladders, railed scaffolds and lineman's safety belts for work on outside of forms and the waste is cleaned up to prevent nail injuries.

The compressed air worker is a special problem to the safety engineer. The sand-

hog is given an especially rigorous medical examination and an age limit of 50 years is required, a decompressing lock maintained on each job, and regulations enforced as to time of decompressing when coming out of the caisson. Few accidents occur in the actual work of sinking. Most of the trouble comes from the release of pressure in the lock, when the men go off shift, and the greater the pressure drop between caisson and the outside air, the more cases of bends and paralysis will occur.

Steel bridge erection is the other classification and under that head we have the iron worker who erects and bolts together the superstructure; the iron workers who place the rivets and the painters who sand blast and paint the structure.

The men who follow this type of work are probably the best paid and most efficient workmen on the construction field.

The hazards encountered are appalling to the safety-minded observer. Both the iron worker and the painter must be a combination of tight-rope walker, trapeze acrobat, human fly and juggler to be able to fill all of the requirements of the job, and must have good eyesight, steady nerves and strong limbs.

There seems to be a division of opinion as to safe practice for erection work. One company pins its faith to safety helmets, safety belts, goggles and safety shoes with non-slip soles and such mechanical aids as railed scaffolds, both swinging and fixed, safety nets to catch the unwary, and so on. This system seems to be based on the idea that mechanical safeguards will decrease the hazards attendant on this class of work.

On the other hand, we have erecting companies who consider these items of equipment as increasing the hazard; with possible exception of the hard hats or helmets and the non-slip shoes.

They explain their attitude by saying that the men are, in fact, acrobats, and any safety items like belt lines, guarded scaffolds and nets give the men a false sense of security and lead to carelessness on the part of the individual and almost certain disaster when on duty in places which cannot be guarded.

They claim (with good safety records to back them) that they want their men to be continually conscious that a misstep means death or serious injury so that they will never relax their vigilance for a moment.

One painter boss uses 8-inch boards for suspended scaffolds with no guards, as, he says, a wider scaffold would allow the painter too free a movement while the narrow plank keeps his feet still and his body in balance.

His sandblasters swing by one hand and one leg from diagonals, handling the hose with the other hand, and slide down the diagonal as the blast steams its way without any safeguard but a sandblaster's helmet to protect his eyes and head.

This paint gang has a six-year record without a fatality and only a few lost time injuries of minor nature.

One steel erection gang, using this method, if I may call it so, has erected three or four major steel bridges and dismantled another large bridge with but one fatality, and it was one which safety equipment would not have prevented.

Construction work, either light or heavy,

embraces practically all the other divisions of industry. The scope of its safety practice extends from the chemistry of water treatment for drinking or filling boilers to the physics of guarding off the actinic rays from the electric arc welder; from the grovelling toil of the sandhog a hundred feet below, to the aerial gyrations of the raising gang on steel erection 200 feet above, the water level.

What are its safety practices? You know—and I know—just the same one place as another. Trite, shopworn platitudes, old stuff, but true as the Ten Commandments or the Golden Rule. Safety is attained only through training of the individual worker in safe habits by a foreman who believes in and practices safety, and who is directed by a superintendent who *wants* safety on his job and who is backed by a company which *demand*s SAFETY. When you have that combination you will get safe practices and real safety in construction.

Safety Training for the Construction Foreman

By M. L. CURTIS

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Ninety-five per cent of the actions of men are results of habits. When you get up from bed each morning, you pick up the same shoe first. You always put on the same garment first, and you put it on in exactly the same manner. Your habits are fixed. You have the habit of going to work by the same route.

Accidents are symptoms of a mental deficiency! No man deliberately hurts himself.

Since habits are fixed in the early experiences of job learning, and, since 95 per cent of our acts are a result of this early habit formation, it necessitates our looking into the minds of the men whom we are to train in safety. This I choose to call safety training in the coordination of the mind and muscle, or muscular coordination.

But, first, why train construction foremen in safety? (Chart I)

The location of the cause of most accidents (aside from "natural" causes over which man has no control) being thus established, and just and sufficient reasons for

eliminating accidents stated, let us look further into the mind for a solution to the

CHART I OBJECTIVES

Safety Training for Construction Foremen

1. To Eliminate Money Waste in the Form of
 - Insurance Premiums
 - Loss of Time
 - Loss of Job Progress
 - Reduced Volume of Work Output
2. To Raise Efficiency by
 - Improved Living Conditions
 - Steadier Employment
 - Better Wages
 - Lower Prices for Necessities of Life
3. To Reduce Human Suffering in the Form of
 - Bodily Harm
 - Mental Anxiety

problem of safety training for construction foremen.

If we would change a man, we must first change his mind. Attitudes, morale, actions, and the like originate first in his mind. This being true then, our training program is one of correct habit formation. The greatest cause of accidents is ignorance, and ignorance is a condition of the mind. We must, therefore, in order to make an experienced man a safe worker change those habits which are apt to cause accidents and form new safe habits. (Chart II)

CHART II CORRECT HABIT FORMATION The Greatest Cause of Accidents Is Ignorance

Ignorance Is a Condition of the Mind

DOING
APPRECIATION
INFORMATION
NOTHING

Education Is the Training of the Mind

How are men trained in industry? A man on a new job begins with nothing. The instructor gives some information regarding operations of the job, and then expects the man to step up to the doing level, where he repeats those operations day after day and year after year. Instead of forty years of experience, too often the man has had one year's experience forty times. The trainer has eliminated the third and most important step in the correct habit formation, that of *appreciation level*.

In altogether too many cases the man is told *what to do without being given any information regarding how to do it*. This is a fault of industry. Safety training is the appreciation step in habit formation.

By appreciation we mean an appreciation of all phases of the responsibilities of the construction foreman; appreciation of work well done; appreciation of correct work habits; appreciation of men and their innermost thoughts which affect their actions on their job; appreciation of safety of men in all of its complications; appreciation of job pride; appreciation of other foremen's jobs; and above all the ability of a man to appreciate what his employer is doing for him.

It is this step, the *appreciation level*, which includes the different types of minds.

Safety training of construction foremen, therefore, deals with mind types and the ability of the foremen to deal with these types of minds. (Chart III)

CHART III TYPES OF MINDS The Bewildered Mind The Insubordinate Mind The Unwilling Mind The Uncontrolled Mind The Misinformed Mind The Uninformed Mind

The physical body is made to react to sensation before we are conscious of those sensations. This is known as reflex action. Some of the factors of reflex action are rhythm, reaction time, and the rate of reflex movement. In other words, we run and then get scared; rather than get scared and then run. We remove our finger from a hot stove before we actually feel the burn.

Men with slow reflex action have no place in industry. Reflex action is all right under ordinary circumstances, but it cannot be depended upon in case of an emergency. Let the mind be master of habits and not let habits master the mind.

I. The Bewildered Mind

Too often the trainer "takes for granted" that the men know the *why and how* of the job. Some men catch on more easily, while others must be shown and taught. A few minutes of instruction to this mind type may save a life.

II. The Insubordinate Mind

This may be a nation heritage. This type demands more direction possibly than any other type. One cannot develop safety in men by merely putting up safety signs, or by telling them to wear goggles or safety shoes. Many men have their minds made up as to how they will react to a stimulus, and they *just react* without thinking. All this must be recognized by the trainer in order that he will know how to correct these defects.

III. The Unwilling Mind

This type of mind is one which thinks that the way he was shown to do the work in the beginning is the correct and only way to do it. He is satisfied with the habits which he has formed. In other

words, he believes in "status quo." To change him would be to change his world, his ideals, his all.

IV. The Uncontrolled Mind

This type might well be called the wandering mind. Any uncommon noise or movement is distracting to the person. He is thinking about the movie he saw last night, the cross wife he left at the breakfast table this morning, or a bill that is overdue. He becomes a victim of the results of a worry which is generally needless. His mind is seldom on his work; he cannot concentrate.

V. The Misinformed Mind

One who has been accustomed to doing work by the use of old established habits, which habits are wrong because of misinformation, will possibly be the hardest type of person to correct. It is harder to change habits formed in this way than to develop habits in the beginning.

VI. The Uninformed Mind

The person who does not have the information necessary for the job will do the work the way he thinks it should be done, whether it be right or wrong. He learns by the pick-up method, gathering information as he goes. It is my opinion that a larger per cent of laborers in industry have accumulated their information by this manner than by any other. Quite often they develop into the misinformed type because of lack of guidance and direction.

The solution of the problem of training these several types of minds may be found only after the individual type is recognized. The person with a bewildered mind needs information. He needs to know the why of the job as well as the how. In the construction of an oil derrick, the construction foreman needs to know that by adding more "lines to a string" for pulling tubing, he decreases the stress on the derrick. The foreman can erect a derrick without this information, but having this information may eliminate his erecting a second derrick in the same place. This kind of information is necessary for correct habit formation.

The man with the insubordinate mind needs special attention to overcome insubordination. He must be shown the why of the job and must be made to believe in the right way of doing the job. His ideas must be disapproved with reasons to justify the disapproval.

The man with the unwilling mind may become *willful* or be *dismissed*. He lacks loyalty; he lacks interest. These two things, loyalty and interest, must be inculcated in his mind.

The uncontrolled mind may be controlled by the elimination of worry. Give him special kinds of work which will demand continued concentration. If possible, let him work alone so that no one else will bother him. He can develop the habit of concentration provided his habit of not concentrating is properly eliminated.

The misinformed mind must have all misinformation removed, and correct information and habits replacing it.

The person with the uninformed mind must have instruction, individual help if possible.

Again we find that safety training is based upon correct habit formation. Good habits, ability, and information are not complete unless the worker is able to do his task in a safe way so that he might protect himself and others.

To readjust and adapt construction foremen in safety consciousness requires constantly the effort of safety directors in a safety training program. The essentials of such a safety training program are: (Chart IV)

CHART IV ESSENTIALS OF A TRAINING PROGRAM

The foreman must realize an immediate need for the training (or the need must be instilled in the minds of the foremen).

The training must be so planned as to meet this immediate need, to be effective.

The training must be on the level (educationally) with the trainee.

When industry as a whole is willing to admit that there are training methods about which it knows little or nothing, and when industry is willing to begin its training program at the bottom and work up, then and only then will it be ready for such a safety training program as will accomplish the desired results.

When this is accomplished, the mental cause of accidents, which in my way of

thinking is the greatest cause of all accidents over which man has control, will be eliminated, and the greatest of all results of

accidents, human misery, will end. Safety training is an insurance policy for the worker, the cheapest that money can buy.

THURSDAY AFTERNOON SESSION

October 14, 1937

Interesting Phases of Construction Safety Code Work

By CYRIL AINSWORTH

Associated Secretary, American Standards Association, New York City

The Construction Safety Code project is now a going concern. Four important sections on Demolition, Excavation, Blasting and Compressed Air Work have passed through the preliminary stages and are now being prepared for final consideration by the committee.

The chief function of any safety code is to serve as a means of furnishing the industry specific suggestions for removing accident hazards and carrying on particular jobs without exposing workmen to the possibility of injury. The Associated General Contractors of America have already produced a Manual of Accident Prevention in Construction. This excellent piece of work has been approved by the American Standards Association as American Recommended Practice. This action was taken during the NRA days when the American Standards Association was being called upon by many industries to provide safety codes to which they could refer in their NRA codes. American Standard Safety Codes were also referred to in PWA contracts although this was later changed as far as the Construction Code is concerned, to a direct reference to the Manual of the Contractors Association.

The safety code now under development is therefore actually a revision of the present American Recommended Practice and will furnish the industry concrete suggestions for carrying on construction work with as few accidents as possible.

The Construction Safety Code will also serve as the basis for the recommendations made by insurance groups to their assured. For many years insurance companies, both stock and mutual, have been committed to the use of American Standard Safety Codes in their accident prevention work and efforts have been made to bring the compensation rating schedule into harmony with the American Standard Safety Codes which have been developed. This work had proceeded to the point where the schedule was about 90 per cent in harmony with the various national code requirements.

In those sections of the country where the schedule no longer applies, national safety codes will be used by insurance groups as the basis of their recommendations for the prevention of accidents in all industries, and it seems safe to assume that this same procedure will apply to the Construction Safety Code. The opportunity afforded the construction industry to confer with insurance groups through the sectional committee which is developing the Construction Safety Code is therefore a very important one.

Another important use of the Construction Safety Code will be its stabilizing effect on the various rules and regulations which have been and which may be instituted by regulatory authorities having jurisdiction over the accident prevention work of the industry. I have mentioned this point last because I do not want you to feel that those who have advocated the development of the code believe this is the most impor-

tant use for the code. Unfortunately there are those who believe that American Standard Safety Codes are intended primarily for use in making recommendations to regulatory bodies for the development of new safety regulations. As tremendously important as it is for any industry to take steps to remove the inequalities that may exist in the rules and regulations enforced against it, it is of far greater importance that industry lend every possible effort to so conduct its establishments and operations that accidents to employees will not occur. American Standard Safety Codes are developed primarily for the purpose of assisting industry to accomplish this end.

There is no question that all the American Standard Safety Codes have been extremely valuable in presenting governmental agencies with concrete suggestions for the development of practical, reasonable rules and regulations for the prevention of accidents in the various industries. You would not have to look back many years to find a most confusing picture of the technical requirements being enforced by the various regulatory bodies throughout the country on any particular phase of accident prevention work that you might care to investigate. No two states seemed to agree on the proper way of guarding such a simple piece of mechanism as a gear.

Of course, when the many complications incident to construction work are introduced, the picture becomes even more confusing. Not all of these recommendations of the various governmental agencies could be technically sound. There certainly could not be so many correct methods of removing a single accident hazard. The gathering together of technical information and expert opinion, through the use of the national safety code committees affording complete cooperation between industry and government, has produced a series of safety codes having the support of both industry and government, and has gone a long way toward removing confusion and providing some degree of harmony in the various rules and regulations enforced by governmental agencies throughout the country.

The enforcement and administrative work of governmental agencies is constantly becoming more valuable to industries coming under the jurisdiction of such agencies because of improvement in administrative techniques; recognition of the fact that the

fundamental conception of enforcement is education; improvement in the qualifications of personnel; and more adequate appropriations with which to carry on the work.

All of these conditions are making it possible for regulatory bodies to apply the rules and regulations which they put into effect with a degree of intelligence which permits cleaning up sore spots within the industry. A contractor whose bid on a particular job does not include any expense item for the erection of safeguards and provision for proper working conditions in general, is forced, through this intelligent government education and pressure, to change his methods of operation so that he will engage in fair competition with other contractors.

Every industry contains groups which approach the accident problem in a fair and intelligent manner. These groups are thrown into competition with other elements whose sole interest in accident prevention work is to let the insurance group take care of all such problems. Case after case could probably be brought forward to point out that proper cooperation between regulatory bodies and industry as a whole, through a reasonable and intelligent enforcement of rules and regulations contained in safety codes, has been of tremendous value in eliminating such unfair and improper conditions.

From this point of view your industry has a definite interest in securing the cooperation of those governmental groups which desire the help of the construction industry and all other groups involved in the development of proper and reasonable rules and regulations which they can put into effect. Such cooperation will assist in improving the accident record of the industry as a whole. These governmental groups are now participating, through the American Standards Association, with the construction industry, insurance groups, employees, and technical experts in providing a code which will accomplish these purposes.

During the past year considerable progress has been made on the code. The drafts which have been prepared have been circulated to the committee for comment and criticism. It is possible that there are some representatives of the construction group present who are serving as members of the construction code committee. If so, I urge them to review, at the earliest possible date,

the drafts of the sections of this code which they have already received, discuss them with other persons active in the work of the Construction Section of the National Safety Council and other construction safety groups, and forward any criticisms they may have to the chairman of the sectional committee for his use in revising the drafts. The chairman of this committee has only one objective in mind—namely—turning out the best possible code that can be developed.

Additional drafts of new sections will be forthcoming during the coming winter months and these too should be carefully reviewed in order that your points of view can be incorporated. The time already spent in past years in getting this project started

would be incomparable to the loss of time which would ensue should this code approach completion and reach the final stages of approval, only to find that those groups who should have been participating in its development request that the code not be approved because it does not incorporate their points of view.

The officers of the committee and sponsors for the project would very greatly welcome any suggestions which the Construction Section may have to insure adequate consideration of the code provisions. If such suggestions should be forthcoming in the near future, I urge that you convey them at the earliest possible date to Mr. W. D. Keefer as secretary of the committee, and they will be fully considered.

Methods Used to Present Safety Movement to Employees

By GEORGE P. JESSUP

Construction Superintendent, Gunterville Dam, Alabama

During the early part of this century the great number of men being injured annually on construction work attracted my attention. I remember discussing with my superintendent whether something could be done to reduce the time lost by employees due to accidents and sickness. We came to the conclusion that it would pay to employ a doctor to look after the men, as our veterinary had greatly reduced the non-productive time of our mules.

Today to emphasize to our employees that we are really in earnest in seeing that the job is a safe place to work, we insist that housekeeping conditions be good, all litter removed at once, stock kept in orderly shape, and equipment in repair.

During planning of layout and sequence of work much thought has been given to safe working conditions: all machines well guarded; such equipment as safety harnesses, goggles, respirators and the like readily obtainable by employees; walkways and staging well designed with capacities marked upon them; working area well lighted; and pipe lines and electrical wiring so placed that they do not present hazards. This shows our employees that the management wishes the job to be a safe place to work.

Since the superintendent's many duties will not allow him sufficient time to attend

personally to the necessary details of the safety program, we have a safety engineer to head this department. Great care was taken in selecting this assistant to see that he had construction experience, was well acquainted with accepted safety methods, physically able to carry out the program, and had a personality that would gain the confidence of employees and ability to instruct men without offending them.

That employees and management might work closely together, a safety committee was established, composed of superintendent, safety engineer, and representatives from labor, mechanic, and foreman groups. The craft members serve for three meetings, one-third retiring each meeting and being replaced by other employees. These meetings are held once a week during working hours. A definite order of business is followed, a precaution taken so that they do not become gossip or grievance clubs.

The new members are taken on a tour of the job, previous to the meeting, at which time the safety engineer explains the objective of the safety program, discussing correct and incorrect methods of performing work and placing protection about hazards as they encounter them during the tour. At the committee meeting the patrol makes verbal reports of conditions of the job from the safety viewpoint.

After this report, the meeting is open for a few minutes to discussion and recommendations from other members. At the completion of discussion, the superintendent or safety engineer gives a talk, choosing a topic of safety interest, after which the retiring members are presented with a job safety emblem and letter of appreciation for service on the committee.

Every endeavor is made to interest the members in safety work and impress upon them that they will be expected to help reduce job accidents during their employment. Minutes of these meetings are distributed to present and past members, to all foremen, and are posted on the bulletin boards.

Keep Complete Records

That the causes of accidents may be studied, the safety engineer investigates all accidents, making a report to the superintendent on all lost time injuries. He keeps a record by gangs so that he may discuss the accidents with gang foremen. Foremen are judged by their gang accident records as well as by cost records.

The safety engineer makes a tour of the complete job at least once a day, on the alert to discover hazards overlooked by foremen and men, to observe methods and equipment being used, assisting the foremen to instruct individuals in the proper way to perform assigned tasks, advising foremen of hazards that should be removed or protected.

Training employees to become safety conscious requires a most carefully planned program. This will include personal, group, and mass instruction.

Since the nature of construction work causes continual change of personnel, of whom a large percentage are green hands, it is important that the individual's education start before or not later than his first check-in. We have prepared a short pamphlet, explaining the type of work being performed and equipment used, emphasizing that the individual must keep clear of swinging booms, rock blasting, and so forth in his assigned working area. This bulletin is explained to each new employee by the employment man so that he will be alert to new conditions.

When the new employee reports to work, the foreman carefully instructs him in the

safe way to perform his task, pointing out local hazards, and emphasizing that he will be required to work safely.

Realizing that new men must not be made to feel that they are to work on an extremely hazardous job, the safety engineer makes contact in an informal manner when on his daily inspection of the job, explaining our safety policies and the necessity of working safely.

Group meetings, held during off shift periods, composed of a few men engaged in similar work are conducted by the safety engineer, so that he and the employees may discuss the safety problems of their particular tasks. Care is taken that groups are complimented on good practices as well as criticized for wrong methods.

Camera Is Useful

We have provided a postcard-size camera and projecting machine, so that snapshots of actual job conditions may be taken and shown on the screen, the points of merit or defect being pointed out to the group. In showing these pictures, caution is used to see that no one is ridiculed. These group meetings are of great value in gaining the cooperation of employees and in promoting the safety program.

At intervals of about six months we hold a mass meeting of all the job personnel, at which time the past record and future program are outlined and someone well acquainted with our job gives a safety talk.

To reach those whom we have not contacted personally and to keep safety fresh in everyone's mind, the extensive use of bulletins and signs has been adopted. On bulletin boards erected near checking windows and other places of prominence, National Safety Council posters, home-made cartoons, and job pictures are posted. Bulletin boards in attractive colors upon which snappy slogans are painted help impress the necessity of working safely. Signs warning of danger, designating location of safety equipment, and giving instructions are used about the job.

Upon a large blackboard in front of the time checking window all accidents, except very minor ones, are posted and the causes of them given so that other employees may be warned to prevent repetition of such injuries.

To reduce lost time and accidents caused by ill health, our employees are required to have a thorough physical examination. They must be vaccinated for smallpox, be given typhoid shots, a Wasserman test, and have malaria smears taken. If, upon examination, the employee is found in need of medical attention, he is so advised by the physician.

Periodic reexaminations are made to note progress in eliminating defects.

That our methods are helping the general safety cause is shown by desire of men to serve on the safety committee, the pride with which they wear their safety emblems, and the repeated invitations to have someone address their gatherings on safety.

Practical Engineering as Applied to Safety in Construction

By F. J. CRANDELL

Civil Engineer, Liberty Mutual Insurance Co., Boston, Mass.

There are only two fundamental causes of accidents in the construction industry. The first is structural failure, which invariably produces catastrophes and fatalities. The second is inefficiency in operation.

For years the construction industry has been loath to accept suggestions of the safety men. To a large extent they have been justified. Too long the safety question has not been attacked from an engineering standpoint. The past method of attack has not been one to command the respect of the construction industry. There is a definite need and place in the industry for safety work, but it must come from scientific engineering analysis of operation.

Engineering properly applied will control the two fundamentals of accident causes. An example is the analysis of the collapse of wooden forms under a working load during the pouring of the roof concrete slab of a reservoir. The collapse of these forms caused 17 men to fall 27 feet to the concrete floor slab of the reservoir already poured.

Conferences with the contractor brought out that these columns and forms had not been designed, but had been put up on the assumption that they were of sufficient size. The posts shown had an intermediate support 7 feet from the top and from that point to the concrete support of the post there was a clear, unsupported distance of 20 feet. A calculation of the dead and live load supported by the form gave it a total of 219 pounds per square foot. Further calculation showed that each column must take a load of 2,880 pounds.

An analysis of these columns, 4 inches x 4 inches in cross sectional size, showed that their slenderness ratio was equal to 60. This

value definitely took the column out of the short column class which depends for its strength on crushing in direction of its length, and brought the column into the long column class, which depends on stiffness or resistance to lateral deflection or buckling for its strength and behaves essentially as the Euler column. Calculation of the Euler formula with a factor of safety of three showed the safe working load for these columns under these conditions to be 1,000 pounds. These calculations show that the columns were sustaining a load of 1,680 pounds above their safe working load.

The safety engineer's job in this case was one of structural analysis, and it was necessary that he have a fundamental engineering knowledge of design if he were to overcome this hazard. The prevention of this accident could have been accomplished very simply. An intermediate tie of 1 x 6 boards rigidly connected to all columns would have reduced the slenderness ratio sufficiently so that the load would not have exceeded the safe working load of the column.

This example definitely shows that the safety engineer of today, whether working for the contractor or the contractor's insurance carrier, must have a fundamental basic knowledge of engineering.

The day of the safety inspector who would submit recommendations on safety after reviewing the operations for one day, or one hour, is gone. The rapidity of construction operation is so great that inspection or criticism of an existing operation is of little or no consequence because tomorrow the same conditions will not exist. The engineer of today must make an analysis at the beginning of the operation and set up

the proper regulatory conditions to produce an adequate factor of safety.

How shall the engineer control the second fundamental of inefficiency in operation? He must first familiarize himself with the plans and specifications of the operation. After this analysis the next step is to discuss what methods of operation the superintendent intends to use. The engineer should then be able to pick out the hazards and suggest necessary remedies.

The safety engineer's recommendation submitted before the job is started will allow the superintendent time either to work the recommendation into his operation or to offer his objections to the engineer. In the latter case the engineer must submit alternative recommendations.

Here is an example of engineering analysis as it was used in driving a 16 foot diameter tunnel under the River Rouge at Dearborn, Mich. The steps were:

1. Analyzing plans and specifications.
2. Investigating borings.
3. Checking design of temporary structures to be used in operation.
4. Establishing of code for compressed air work.
5. Setting up regulatory methods for routine working conditions.

The first step informed the engineer of the location, the depth and possible pressures that might be encountered during the sinking of the caisson and driving of the tunnel.

The tabulated borings, as shown on the plans, and also the samples taken from the borings, were investigated. The borings indicated the stratification of the ground through which the tunnel was to be driven and informed the engineer of approximately the type of soil that was to be encountered.

To get a complete picture and profit from the experience encountered by other contractors in this territory, a geologist's report was obtained which indicated the actual constituents of the soil. Analyzing the geologist's report, the engineer felt that there was a possibility of explosive and toxic gases in this vicinity. The contractor had no means of detecting their presence. It was therefore necessary for the engineer to determine some practical means of detection. The geologist's report indicated that

the greatest possibility of an explosion was from methane gas whose explosive range was between 5 per cent and 15 per cent by volume of the surrounding atmosphere. Furthermore, hydrogen sulphite was anticipated, and the toxicity of this gas was determined. An instrument was obtained from the Mine Safety Appliance Company, a "Continuous Combustible Gas Alarm," which satisfied the requirements and was calibrated for 3 per cent methane. A hydrogen sulphite gas indicator was also obtained. These instruments were exhibited and explained to the contractor, and with his cooperation they were worked in with the method to be used in driving the tunnel. The continuous gas alarm was carried along with the heading.

The next step was to determine a practical means of getting rid of the gas after it was encountered. With the assistance of the contractor, a ventilating system was designed which consisted merely of a single pipeline with a valve at its end located at the heading in the tunnel. The pressure in the tunnel was to be used to force the contaminated air out through the pipeline. This line, of course, was run from the tunnel heading all the way to the grade level, and the valve was operated by the shift foreman whenever the combustible gas alarm went off.

All temporary structures that were to be used in the operation were next checked for structural errors.

The New York State Compressed Air Code was used for the regulation of this work.

The engineer had now reached his fifth step. He discussed with the superintendent the locations where the material would be received, the loading and unloading of same, and set up with the assistance of the superintendent regulations for the proper methods of handling all material and equipment. Regulatory methods were determined to cover such items as welding, compressor plan operations, sinking of the caisson, lowering of shield into the hole, shoving of the shield, setting the steel, bolting the steel, etc.

Carrying out these regulatory methods and enforcing them came under the jurisdiction of the superintendent. Without his assistance the whole analysis would have been of no consequence.

All explosive gases were detected and the

tunnel properly ventilated, and no explosion occurred. The method used to control the ordinary functions of the operation was so carried out that again no interruption occurred, allowing the contractor throughout the whole job to produce an extremely efficient and economical operation, finishing the job ahead of schedule, and guaranteeing the original estimated profits for the work.

A safety engineer, to be of assistance to a contractor, must be continuously posting himself on the latest methods of the industry and the engineering profession. An example of this need is indicated by the losses in operation that occur through failure in trench and cofferdam work. The cause of these failures in the majority of cases is lack of knowledge of the stresses and strains in soils and the distribution of pressures.

For years the theory of the pressure of soil on the back of any lateral support, the timbering of cuts included, has been that it increases like hydrostatic pressure, in direct proportion to the depth. Rankine's earth pressure theory was the basis of this assumption. This theory is still being followed by many contractors, although we have direct evidence that this is not wholly true. We have practical data which is the result of direct measurements made by Mr. Miller, of New York, in 1916. The lateral pressure was computed from the deflection of ranges over a bank area measuring 22 feet horizontally and 55 feet vertically.

Below the depth of 60 feet the cut was occupied by the completed structure. The width of the cut was 85 feet and the soil was coarse sand mixed with 20 per cent to 30 per cent clay and some gravel. The difference between the hydrostatic and the observed pressure distribution was far too important to be ignored.

Experimental data concerning the relation between the lateral unit of wall, the location of the center of pressure, and the hydrostatic pressure ratio, were obtained by Dr. Karl Von Terzaghi in connection with large-scale earth pressure tests at the Massachusetts Institute of Technology in 1929, and his observed distribution of pressures approximately confirms those measured by Miller. Terzaghi further states the fundamental assumptions of Rankine's earth pressure theory are incompatible with the known relation between stress and strain in soils, including sand. Therefore, the use of this theory should be discontinued.

For identical soil conditions and equal yield of the lateral support, the total lateral pressure on the support is the same. Yet the distribution of the pressure over this support varies enormously according to the distribution of the yield over the face of the bank. The more this distribution departs from a straight line through the foot of the bank, the more important the departure from the hydrostatic pressure distribution is likely to be.

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 H. E. WHEELER, JR. (Chairman), Henry Heide, Inc., New York, N. Y.
 J. J. LYONS, John F. Jelke Co., Chicago, Ill.
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 RAY H. CULKIN (Chairman), Rockwood & Co., Brooklyn, N. Y.
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 FRED A. WERN (Chairman), Borden-Wieland, Inc., Chicago, Ill.
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 D. R. GRANT, Beechnut Packing Co., Canajoharie, N. Y.
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 W. J. MAZE, Hawaiian Sugar Planters' Assn., Honolulu, Hawaii.

Members at Large—

F. A. HASSE, Corn Products Refining Co., Chicago, Ill.
 W. A. SULLIVAN, Loose-Wiles Biscuit Co., Kansas City, Mo.

TUESDAY AFTERNOON SESSION

October 12, 1937

The first session was called to order by General Chairman C. W. Dempsey, Liquid Carbonic Corp., Chicago, who introduced the speakers and directed the discussion.

Proper Safety Training in Maintenance Departments

By ANDREW J. PERCIVAL

Personnel Officer, Westclox Division, General Time Instruments Corp., Peru, Ill.

To my notion this is one of the most confusing ages since the industrial revolution. So confusing that the leadership of most industrial groups, both of labor and management, have such differences of opinion that it is most difficult to tell where we are and whither we are bound. An ever increasing mass production is necessary, and this, coupled with the technological changes to complete it, will come so fast that most of us will not be prepared for the transition.

Safety, the fore-runner of good personnel practices, can lead the way in our constant changing positions of thinking and doing. We can solve these varied problems if we start with the philosophy that safety and personnel are not exact sciences but are inexact arts. The by-products of energized safety programs have taught us in the past and should continue to teach us in these new and different ways of doing things.

Maintenance groups should carry, as the radiating center of good safety practices, these new burdens, if management but gives them the opportunity.

Standard safety measures known to the industry are known to you, therefore safety resolves itself down, to my way of thinking, at this time to the human relationship and its reaction.

Let us go back into the history of the safety movement for some of this human reaction. The *National Safety News* of March, 1922, carried a then astounding article. A concern of some national importance went two years without a single lost time accident. The writer of the article asked the question, "How was it accomplished?" And the answer, every man from the top down—not from the bottom up—spreads and practices the gospel of safety.

In a 1924 issue of the *News* an article appeared on the study of fatal accidents in maintenance material handling. In substantially these words was the summary of the article—"The outstanding feature of these fatal accidents is the human element." Let me stress again that the psychology of accidents must be given consideration. In this same issue of the *News* the human factor was discussed and out of some fifteen

major mental causes of accidents these were the outstanding: predisposition, inattention, preoccupation and depression. Hasn't the hysterical period we have just passed through given birth to just such accident bugs, and may we not expect more of them in the changing future? We should profit materially from the last eight years experiences in this respect.

These time worn, yet ever important, slogans and expressions of safety campaigns are always with us:

Work with us, not for us.

Accidents don't happen—they are caused. Safety and efficiency should be twins. and dozens of others.

We have had the three Ms—Men, Machinery and Methods. We now have the three Es—Education, Engineering and Enforcement. These, of course, are a part of the sales of safety. But we must have anchorage if we are to succeed—that anchorage is the hub of the safety wheel and that hub is the maintenance group. Safety education is a problem of keeping eternally at it, and the gospel center, the safety address system of a plant, lies with the maintenance group.

The maintenance group should be a definite form of organization, where officers and committees function, where minutes of meetings are carefully recorded, with rec-

ommendations followed through to a conclusion. The form of the organization may be one of many and varied and still accomplish the desired results.

The whole essence that lies behind this maintenance safety organization group success can be put in one question—Is management primarily interested in safety? If the answer is yes, you succeed and have fun doing it. If the answer is no, or if only passive interest is shown, then all of the slogans, organization work and tireless efforts are in vain—you can't succeed.

This brings up a question of management: Should management take a primary interest in safety as it usually does in production, finance, sales, etc.? My feeling is it should for a very selfish reason—indirect profits and the training field for good personnel practices. Increased compensation awards are being demanded before the legislatures of the several states. In a certain state full wage compensation is being demanded and that the state become the insuring carrier. It has been cited that \$22,000,000 was paid for coverage in the last year and only \$7,000,000 of this sum expended in awards.

These ever increasing legislative demands stress the social obligation more and more. Better prevention programs will be the answer. This trend leads us to further obligations, teaching men how to live as well as how to make a living.

Accident Reduction with a Planned Maintenance System

By H. E. HILDEBRAND

Director of Engineering, Continental Baking Co., New York City

My earliest recollection of the food-industry dates back to 1904. I remember a bakery, one of the largest in this country, operating 18 ovens and employing some 200 men.

The bake shop was in the basement, and the horses were stalled on the second floor. The floor was of wood, and as I remember, was not entirely waterproof. The plant was considered modern; the layout had been well engineered.

The ovens had to be in the basement under the sidewalk because Mother Earth was the best and cheapest insulation available at

that time. The stable on the second floor was considered well located from a ventilation standpoint.

In the basement shop flickering gas jets revealed pale faces of bakers who seldom saw the light of day. Miners' lamps in front of their white caps would have been more in keeping and certainly more useful in their subterranean occupation. Accidents, ill health and foreign substance hazards must have been extremely high. People didn't seem to pay so very much attention to those things until something happened to them person-

ally. Then they consoled themselves with the old slogan, "Accidents will happen."

Since that time a lot of improvements have been accepted by industry.

To me it seems that the one outstanding development which has done more to improve maintenance, reduce accidents and bring industry out of the dark ages, and bakeries out of the cellar, has been the perfection of the electric lamp and the establishment of a definite science of illumination.

Illumination, good maintenance and safety go hand in hand.

Proper illumination must be engineered by men who understand this science. The promiscuous hanging of lights from the ceiling is not illumination. Screwing a 50 watt lamp into a 150 watt reflector of a well designed lighting system isn't illumination either. It's lamp switching.

Lamp switching isn't good economy, no matter what other reasons may be behind this practice, because speed, accuracy and the morale of the working man is decreased; equipment is neglected and a general unsanitary condition develops.

With proper illumination 10 to 15 per cent more production can be turned out by a workman, and he suffers less eye strain and is not subjected to nervous fatigue.

In the food industry there is no place for localized lighting. Localized lighting throws shadows and leaves dark places; places where things are thrown to be tripped over; places where the janitor forgets to clean; where foreign substances originate and mould and bacteria grow.

As a general guide to the proper degree on intensity of illumination recommended for various types of food factories, any good handbook can be consulted. For bakeries we use the following system:

Intensity of illumination for:

Storage Rooms—2 to 3 foot candles.

Ingredient Weighing Rooms—8 to 10 foot candles.

Bake Shop—5 to 8 foot candles.

Offices—10 foot candles.

Shipping Rooms—4 to 6 foot candles.

To obtain a high reflection factor the walls are either painted white with oil paint or else light colored tile is used. (Aluminum is never used on walls, because after a while the walls begin to have a leady, depressing appearance. Cold water paints are not rec-

ommended, because they have a tendency to peel off and drop into food products; especially after several coats have been applied.)

To reduce the possibility of foreign substance from shattered light globes, the lighting fixtures are of the dome type with a heavy glass globe screwed into the fixture over the bulb (similar to the vapor-proof fixture). The reflectors are cleaned at definite intervals to insure maximum efficiency.

I have gone into some detail on the subject of lighting because a plant maintenance system depends almost entirely upon proper illumination.

Some years ago every factory had a "handy man"—a fixer—a man who waited for things to break down. A number of factories still have such an individual and still operate on a fixing system.

Scientific methods of production have been introduced in most industries, but scientific maintenance has not kept pace with the development of manufacturing methods. How often have we seen well designed buildings and machines under the care of a "handy man."

In the same spirit with which an engineer lays out his plans on a drafting board should the manufacturer plan and design the maintenance system in his factory.

The same manufacturer who tried to save money by economizing on illumination also thinks that he is saving money by not maintaining his buildings and equipment, although the experiences of most successful companies prove conclusively that organized maintenance is a most profitable investment.

With a planned maintenance system in operation the benefits which are almost immediately apparent to the manufacturer are the increase in and continuity of production. Later he becomes conscious of a decrease in accidents and also becomes aware that his machines last longer and his buildings require fewer major repairs. Things are in better order. His investment in the maintenance organization, be it one man or more, is beginning to pay for itself.

Let us now consider a maintenance system which has been in operation for a number of years and has proved itself successful. It is in operation in small plants with one maintenance man and in larger plants employing twenty men or more. This system is based on the following principles:

1. The lighting system shall be maintained at its designed intensity.
2. The entire building and each operating machine shall be inspected daily.
3. The building and equipment shall always be kept in the same condition as when new.
4. No machine, machine parts, tools or other materials or equipment not used currently for manufacture shall be kept or stored in the manufacturing area. Such tools and equipment which are used for manufacturing shall have a definite storage place.
5. The entire plant shall be cleaned on a prearranged janitors' or porters' schedule with a definite time allotment for each area or machine.
6. A maintenance engineer's chief duties will consist of *maintaining* a plant and not of building new equipment and carrying on other major construction or installation work.

The operation of this system is as follows:

The chief maintenance engineer makes an inspection trip once each day and takes with him what may be called "The Engineer's Daily Log Sheet." On this sheet are printed the names of the various machines in the plant as well as various building parts, such as floors, windows, walls, lights, plumbing. A space is left after each printed item for him to designate whether the equipment requires repairs. Minor repairs or adjustments are made by the engineer on his trip. Upon the completion of his trip such major repairs as are necessary are made either by him or by those working under his supervision.

The "log sheet" is posted in the plant superintendent's or foreman's office, so that if any trouble develops while the engineer is not on duty, a note is made by the superintendent or foreman in a space provided on the sheet. This eliminates the possibility of the superintendent forgetting to tell the engineer about difficulties he has had. The sheet also indicates to the superintendent that all machines have been inspected that day. The superintendent signs the log sheet, and it is brought to the manager by the engineer just before he makes his inspection the following day. If anything unusual arises, it is discussed between the manager and engineer at that time.

This system of maintenance stresses orderliness, and orderliness breeds safety. The results obtained by this system may best be demonstrated by a typical example:

A food plant in which the maintenance system was recently reorganized was operating with six engineers or mechanics and 12 janitors or porters. The engineers' jobs may best be briefly explained by stating that they repaired things when they broke down and fired the boilers. The porters cleaned the plant when they weren't unloading material and doing other odd jobs. The plant had been a show place when it was built but a lack of understanding of the meaning of maintenance had created a general disorderliness.

Wood floor boards were coming loose, and splintered and concrete floors had developed holes and ruts. The paint on walls and ceiling had become dingy and was peeling in places, dropping on food products—creating foreign substance hazards. Low wattage globes had replaced the proper size lamps, and several extension lights were used permanently for local illumination.

Evidences of temporary repairs were prevalent throughout the plant. Cleanliness had been neglected in corners, underneath equipment and above the eye level of the janitors. Roaches were in evidence. The production organization had adapted itself to its surroundings and dressed and acted accordingly.

A planned maintenance and portage system was installed with the result that within two months the maintenance force was reduced from six men to four and the janitor portage crew from 12 men to eight.

Today this plant is bright, clean and well maintained throughout, and the entire organization has reacted to its more pleasant surroundings.

The first step in the reorganization was the installation of proper size electric lamps in shatter-proof globes.

The floors have been repaired, and the wood floors are now being maintained with an oil treatment and buffing system instead of the old water scrubbing method which had a tendency to deteriorate and splinter wood floors quickly and never kept them altogether clean and sanitary.

Uniformed porters and janitors work on a time schedule posted in each working area and now clean the entire plant regularly.

Accident hazards, which now stand out more clearly, are more readily eliminated.

Vermin have been exterminated, and all small outside openings through which they might enter the plant have been closed up.

A paint washing and painting schedule has brightened the walls and ceilings.

Haphazard "fixing" has been replaced with a definite maintenance policy.

Breakdowns are not allowed to happen.

Foreign substance claims have been materially reduced.

What Accident Prevention Means to the Flour Milling Industry

By C. B. WARKENTIN

President, The Midland Flour Milling Co., Kansas City, Mo.

Accident prevention in the flour milling industry means saving the lives and limbs of men who are not only our employees but also our friends, often of a lifetime.

This is true in other industries, but peculiarly so in flour milling. Because machinery does much of the work, the proportionate number of employees is small, and we can—if we will—know them all. In the second place, this oldest of all industries has from earliest days been carried on in certain communities and in certain families, from generation to generation. So it is traditional in our industry for the miller and his men to be old friends and often relatives.

Next, accident prevention means conservation of property and profits. Safe operation is always more economical than unsafe operation. If you clean up a plant from the safety angle you also improve it from the production standpoint. The insurance carrier pays the direct cost of accidents to employees and members of the public, but does not pay the heavy loss to the owners on account of confusion and disorganization that always follow an accident.

An intangible thing that accident prevention means to the flour milling industry, or any industry, is the opportunity to improve morale by a cooperative enterprise. Safety is for the mutual good of all concerned—the flour miller and his stockholders, the employees and their families. It is an undertaking in which they can wholeheartedly join hands, without misunderstanding, without conflicting motives. A safety campaign is a splendid way to line up the whole crowd, from laborer to president, with a united front and common objective. Such a campaign will not only save lives and property,

but it will also build lasting good will, to the profit of all concerned.

In our own flour mills, investigating accidents when they do occur is considered just as important as buying wheat, selling flour, installing new machinery, or building an addition.

We do not just leave it up to the insurance company to investigate and pay the loss. We investigate personally, and we stay with the investigation until the cause of the accident has been established. Then we see that everyone concerned is suitably instructed to prevent repetition, and that any physical conditions at fault are corrected.

By the application of safety measures we have effected in our flour mill plant at Newton, Kan., a most enviable record of 1,697 consecutive days without a lost time accident for a period ending May 31, 1937. For that record we were furnished an appropriate certificate from our insurance carrier commending all of the employees and the individual in charge of safety activities. The certificate also expressed the management's appreciation for the efforts made to eliminate accidents. It has been conspicuously posted in the plant and not only serves as an incentive to continue all safety measures but is called to the attention of visitors by the employees themselves.

This kind of interest shown by the management is essential to the success of any safety campaign. Employees' safety committees, which are a vital part of a successful accident prevention campaign, depend for their results upon such support. If the rank and file know that the executives are backing the plant safety committee, its recommendations will be followed and preventable acci-

dents will be avoided. Without such backing, the committee will be badly handicapped.

The chairman of the committee should be an employee respected by his co-worker because of his thorough practical knowledge of the business. The rest of the personnel should be representative of all departments of the plant—mill, elevator, warehouse. It is often a good idea to put on the committee one or more men who have previously ridiculed or scoffed at the idea of organized accident prevention work. When they learn what it is all about and become sold on safety, they are likely to be among the best and most enthusiastic workers on the committee.

Must Know Causes

Accident prevention demands that we know more than we do about the basic causes and sources of accidents in our mills. We must have such information to remove or remedy those causes to the fullest possible extent. It is necessary to keep up to date in our analysis of flour mill accident causes. Conditions affecting accidents change the same as conditions affecting buying, manufacturing and selling.

For instance, how many of us, with buyers, salesmen and truck drivers engaged in our work on the public highways, realize that upwards of one-sixth of fatal accidents to men in industry are caused by motor vehicles? The employer who is behind-hand in his thinking may confine accident prevention activities to his premises, without realizing that the scene has shifted and a large part of the tragedy is going on out on the highway.

This means to the flour milling industry that we must schedule the work of our outside men so that excessive speed or other unsafe driving practices will not be encouraged; that we must build up the personnel among our truck drivers to employ only drivers of known ability and good judgment; and that we must join with our neighbors and our fellow citizens in continuous campaigns to make our highways less hazardous.

I am told by officials of the "Not Over Fifty Club" that in 1936 there were 20,000,000 automobile accidents large and small among the 28,000,000 cars licensed in this country. In these accidents 37,800 of our

people were killed and it is estimated that we suffered an economic loss of \$2,000,000,000.

Every accident prevented may mean a life saved and certainly means an economic saving of at least \$100, averaging all accidents, large and small.

Keep Down Speed

The most effective means of reducing vehicle accidents is by reducing speed. By "speed" as an accident cause we usually mean "excessive" speed, and by "excessive speed" we seem by common consent to mean "any speed too fast for conditions and a speed of over 50 miles per hour at any time."

It is my ambition to secure from every member of our organization, including those who come under our contingent liability coverage, their membership in a "Not Over Fifty Club," the purpose of which is to have automobiles and trucks driven at not more than 50 miles per hour.

In the discussion of accident prevention at one of our recent milling conventions some interesting data were revealed on the causes of accidents in flour mills. One of the liability insurance carriers, the Lumbermen Mutual, presented a chart analyzing 1,000 accidents in the flour milling industry. No less than 123 of these were classified as "falls of persons."

This puzzled me for a minute. I could not believe that we were stumbling around at our work to such an extent.

Then it came to me that we must realize ours is a vertical industry, with the elevating of grain upward and the grinding processes downward constantly exposing our employees to accidents from stairways, ladders, elevators and conveyors.

We cannot wash our hands of accident prevention on our premises by buying and installing guards and guarded machinery. We have a problem of upkeep and supervision that does not rely upon more capital expenditure so much as it relies on constant expenditure of care and foresight.

Many of those 123 accidents could have been prevented by removal of obstacles, better lighting, repair of stair treads and rails, discarding of rickety ladders, and so on. Proper guarding of machinery is essential, but what appears as a spectacular hazard in

an industry too often gets all the attention, while innocent appearing conditions that really cause more accidents are neglected. It reminds one of the old proverb about saving at the spigot and wasting at the bung-hole.

For instance, we have in the grain elevator and flour milling industry a device not common to other industries, known as the manlift. We have it because, as I have pointed out, ours is a vertical industry. In various forms it is used to carry our men up and down, and to save the time and labor otherwise required to climb stairs and ladders.

Manlifts can and do cause accidents, but I believe they are over-rated in that respect in proportion to other causes simply because they are more spectacular and the hazard is more obvious. State safety inspectors that come into our plants are apt to raise a hue and cry about the manlifts while paying less attention to stairs and ladders.

We in industry must not make the same mistake. Accident prevention to us means constant vigilance to detect and correct the little things that can cause big accidents.

One means of doing this is through posters. The bulletins and safety literature of your casualty insurance carrier and of the National Safety Council should be prominently displayed on bulletin boards provided for that purpose. Don't ever doubt that these graphic safety messages do good. The results of any one can seldom be seen, but we know that there is a cumulative result, like the continual dripping of water that wears away stone.

In our own plant we continuously call attention to the following few simple rules, which we keep posted in the mill over our own signature:

1. To clear a choke-up in spouts or elevators use a stick. Never place your hands in a dangerous position.
2. When throwing a switch for adjustments or cleaning, either pull a fuse or place warning sign on switch so another employee will not accidentally start machinery.
3. Unhooking of rolls must be done very carefully to avoid hand or finger amputations. Throw off drive belt at the machine and never attempt to clean at top of rolls WITH YOUR HANDS while machine is in motion.

4. To avoid serious falls report defective ladders or steps at once and make certain of secure footing when it is necessary to climb on machine frames.

5. Many exposed machine hazards can be effectively protected; report such conditions to the superintendent. Also report defective guards or machine equipment promptly.

6. All minor cuts, scratches, bruises, etc., MUST be immediately reported for proper first aid treatment to avoid serious infections.

Those in other lines of business may not catch the full significance of these rules, but any millers will appreciate them and also the following that we have posted in the packing room and warehouse:

1. To avoid injury take a comfortable position before lifting and lift with legs to prevent strain on your back. Do not undertake to lift too heavy objects alone—ask foreman for help.
2. Make certain loads are properly placed when using hand trucks and take corners and other turns carefully to prevent tipping.
3. Runways between freight cars and dock must be fastened or cleated to avoid slipping. Never step from car to dock without runway in place.
4. Pile sacks properly and avoid piling too high. When necessary to climb on a pile be careful not to dislodge. Be alert and ready to step back if pile should slide or fall.
5. Take down sacks from top of pile only and leave remainder of pile in safe condition.
6. Report defective floors at once, especially slippery conditions or holes which may trip loads.
7. All minor cuts, scratches, bruises, etc., must be immediately reported for proper first aid treatment to avoid serious infections.

Accident prevention in the flour mill is usually considered as referring to accidents to employees. It should always go further and refer also to the safety of the public. These may include customers, salesmen, inspectors, auditors, sight-seers—visitors of all kinds, even trespassers. For all of these upon the premises the owners have the respon-

sibility of providing safe surroundings. Otherwise, the owners may have heavy legal liability for negligence.

At a recent trade convention a miller told of a bakery driver, waiting for a load of flour, who stepped on the manlift for a ride, found the well narrowed to a very small opening at the top (to show it was the top) but, being a thin man, made himself as compact as possible, squeezed through, went over the top, and suffered several broken bones.

Several other circumstances are peculiar to our industry in comparison with many others. For instance, a flour mill is set up to operate 24 hours a day, with the consequent danger of adjusting and oiling machinery in motion. And the process of milling is so nearly automatic that a workman alone on an upper floor might be injured without anybody being near to help him.

Thinking these things out to control them properly is what accident prevention means in the flour milling industry, or any industry. We should never miss a chance to analyze and study accidents and their prevention. Referring to my mention of an analysis of 1,000 accidents in flour mills, I believe any flour miller would get constructive ideas for accident prevention at his own plant by a study of the following division of these accidents by causes:

Handling objects	318
Particles in eye	133
Falls of persons	123
Machinery	143
Striking objects	70
Hand trucks	51
Falling objects	46
Infections	34
Miscellaneous	82
Total	1,000

Of the 318 accidents in connection with handling objects, 147 caused strains, including hernia as well as less serious injuries. The bulk of the strains were suffered while handling sacks of flour. There were 106 such cases compared with 41 "all other." As might further be expected, 87 of the accidents resulting in strains occurred in the warehouse, compared with 41 in the mill and 19 elsewhere.

Of 143 machinery accidents the majority or 82 were in the mill, as compared with 22

in the warehouse and 39 elsewhere. Conveyors, belts and pulleys were responsible for half of the machinery accidents.

I have so far said nothing about dust, which is one of the most important topics of all. But I can do little more than mention it, because it is a vast subject in itself, to which justice could not be done if I devoted this entire paper to it.

The fire prevention engineers frequently discuss dust with us, and to all that they say I will add "amen." Dust is the great catastrophic hazard in the mill and elevator industry. Examples are the Milwaukee mill explosion in 1937 and the Omaha elevator explosion in 1934. Infrequent as these terrible catastrophes are, their severity is such as to justify incessant efforts in our industry to prevent them. And in a broad sense the answer lies simply in good housekeeping.

Although diseases are not accidents, mention of occupational diseases should be made at this time for the reason that one state after another is passing acts designed to compensate employees for occupational diseases in somewhat the same way that the workmen's compensation act covers occupational accidents.

Good housekeeping here again is the best answer to the question of preventing occupational disease claims among flour mills employees, and particularly dust control. Fortunately, while the organic dust from grain and flour is annoying, it is not serious like the inorganic dust that causes silicosis, about which we have heard so much in the past few years in quarries, foundries and dry paint manufactories. There are certain fungus spores in some grain dust that may cause disease, but not to a serious extent. Of course, any dusty condition may be harmful, especially to persons subject to pulmonary diseases.

So far the hazard in flour mills is considered comparatively light, as evidenced by the insurance rate. But the presence of dust, even though believed to be of a comparatively harmless variety so far as human health is concerned, is an ever-present potential cause of claims. Control of dust now will yield dividends to the far-sighted miller through prevention of disease claims as well as prevention of loss of property and life by fire and explosion.

THURSDAY AFTERNOON SESSION

October 14, 1937

Safety and Sanitation and Its Relation to Food Products

By R. R. KAMPE

Director of Safety and Manager of Insurance, Kraft-Phenix Cheese Corporation, Chicago

Much of the success of our safety program has been due to the active interest of our executives. Numerous letters are written by the executives to superintendents of plants and to employees, including drivers. Plaques and certificates of merit are frequently issued by our president, Mr. J. L. Kraft, and letters signed by other executives are sent to employees who do outstanding safety work.

In our analysis of an injury we naturally search for the true cause. When we find it, we try to correct or remove it. Frequently it is reported that some physical object caused an injury, such as a nail or a knife or faulty brakes. But more mature thinking points out that physical causes are seldom the real causes. What we look for in nearly every case is the man failure that brought about the injury.

Ten years ago I was given the task of curtailing injuries to Kraft employees. We first organized safety committees throughout the hundreds of Kraft plants in this country, Canada, South America and Europe. These committees, as they function today, are human machines that contribute a great deal toward definite reductions in severity and frequency.

The safety committees prepare injury and investigation reports to which we refer as supervisors' reports. To do this they must investigate each injury and determine its underlying cause.

These groups usually include the chief plant executive and foremen, supervisors and maintenance men, all of whom are familiar with the operations of the respective plants. These safety committees deal not only with injuries but also with the problems of sanitation and fire prevention. We have a standard foremen's reporting form which each foreman must complete every

month, setting forth the condition of his department, before he reports to the safety committee meeting. The safety committee also has an inspector who makes weekly surveys of the plants and turns in reports to the committee chairman. At the end of the month, when the safety meeting is held, there may be as many as four or five weekly reports of inspectors. However, many of the recommendations submitted after the weekly inspection are carried out immediately and are merely reported to the safety committee so that the activities of the inspector may be checked.

In addition we have a monthly fire brigade report. Copies of the foremen's reports and fire brigade reports are sent, with the minutes of each meeting, to headquarters in Chicago.

Contests Give Results

We have found it worth while to conduct an annual inter-plant safety contest. The contest is divided into three classes—for A, B and C plants—and it creates a good deal of friendly rivalry. At the end of the contest year beautiful engraved silver plaques are awarded to the winners, and it is interesting to note what efforts are made to win these plaques.

In addition we have awards for the accomplishment of units of 100,000 man-hours without a chargeable injury. I say "chargeable injury" because we grade our injuries according to severity, classifying them as either reportable or chargeable. Any injury, regardless of severity (except simple first aid cases) is classed as a reportable injury. Any injury where the employee does not return to work the same day or the following morning, or an injury involving amputation or fracture, is regarded as chargeable.

We classify our injuries this way because we want every employee to have proper

medical attention. This might be denied him if all injuries were regarded as chargeable. We tried the latter plan for a year and found that in many instances injured employees had been denied the privilege of going to see the doctor because this might affect the injury record. Under the present plan an employee may get medical attention and, if he returns to work the same day or the following morning, it still is not counted as a chargeable injury.

In addition to the inter-plant safety contest each plant carries on an inter-departmental contest also based upon an incentive plan.

Safety Courts

In some of our plants we have safety courts. Summonses are issued to employees who perform unsafe acts. They need not be involved in an injury; the mere fact that they perform their work unsafely is sufficient reason for the foreman to issue a summons. Sulpounded employees must appear before the court and explain why they performed in a negligent manner. The courts are usually selected from the employee group, and the employees themselves decide on the penalty to be imposed. The safety courts have proved both instructive and effective.

In plants which seem to have considerable difficulty in keeping up with other plants in the safety contest, we institute what we call a sweepstakes plan. The company appropriates a sum of money which may range from \$10 to \$25, depending upon the size of the plant. If the plant operates an entire month without a chargeable injury, this sum is split into two or three prizes, for which lots are drawn. If, in the course of the month, a chargeable injury has taken place, the fund is reduced by \$5 and the person involved in the injury is forbidden to participate in the sweepstakes for three consecutive drawings, although he must attend the drawings.

In one of our plants in Chicago an employee who had won the first prize one month was involved in an injury during the following month. The employee who won in the latter month received a lesser amount of money because of his co-worker's carelessness. He approached the injured employee and criticized him severely for causing a reduction in the sweepstakes draw. This incentive plan seems more effective than any other plan we have yet used. It brings about a definite interest among em-

ployees in watching each other to keep the fund intact.

By means of bulletins we remind the safety committee that it is not always sufficient merely to issue instructions. We insist that some active follow-up be made to see that they are carried out. Further, we caution against misinterpretation of instructions. In addition we have many inspectors of the insurance company making frequent visits to our plants and submitting recommendations regarding injury exposures found. These reports are made not only to the local plants but also to Chicago headquarters. We follow them carefully.

Letters from our chief executives to those in charge of plants are supplemented by short bulletins which I issue to the safety committees. I try to make these bulletins short, usually confining them to one page and trying to say something interesting and significant. Bulletins that are too long lose their effectiveness.

A valuable asset to our safety program is our house-organ, "Cheesekraft." Although our safety program is backed up by discipline, we try to avoid force. The attitude of both employees and management must be right. About a year ago, in a safety conference session, I asked, "How does one normally get his employees, particularly in a machine shop, to wear respirators when needed?" One individual answered, "That's easy. All you have to do is fire them."

Now, that isn't the answer to the question. The answer, as we see it, is education.

Of course, we don't believe in tolerating definite violations of rules. We feel that a safety program should be carried on firmly but not harshly. When a new employee comes into our organization, he is taken in hand by the safety committee. He is given a safety handbook containing several hundred rules and is asked to read and learn the rules pertaining to his particular operation. Further, he is asked to sign for these rules so that he cannot deny at a later date that he received them. For several months, at intervals, he is asked what he knows about the safety handbook and about our safety program.

In all of our sales, auditors' and production conventions a certain amount of time is allotted to the subject of safety. This is another way in which we popularize the work. Safety work is tied in closely with

promotions. We emphasize that no employee who is continually involved in injuries is eligible for advancement.

An educational program similar to that used in safety work, together with an efficient medical program, is carried on to promote sanitation and hygiene. The same committees supervise both the safety and the sanitation programs. In each of our many plants we have a nurse on duty to look after the physical welfare of the employees and instruct them in matters of personal hygiene. These nurses also make inspections of the plants and report any conditions which are not up to standard.

All employees are examined when they come into the organization and are re-examined annually. They are urged to go to their physician for medical attention for any ailments found. No employee is ever discharged on the basis of the findings in an examination unless he has some communicable disease. Naturally, in the dairy industry, such a condition cannot be tolerated.

Most of our employees today welcome the physical examination because it is a certain

protection to them. It gives them a degree of assurance that those working beside them are in the same physical condition. Our physical examination also helps us in the allocation of employees. We do not as a rule turn down applicants for employment because of physical disability, but we try to assign them to tasks which they can carry on without impairing their health or the safety of other employees.

We give considerable thought to lighting and ventilation and air conditioning in our plants. In many of these plants today even our lockers are air conditioned. An employee coming to work takes off his street clothes, places them in his locker and puts on a company uniform. At the end of the day, when he makes his change after taking his shower, he finds his clothing well aired out. This adds to his feeling of well-being.

In addition to our sanitation program we are carrying on an educational program among our farmers. We make suggestions for the cleanliness of their dairies and milking equipment. This promotes protection for the consumer.

Eliminating Accidents Peculiar to Women in the Food Industry

By ELLEN D. McKEON

Assistant to District Engineering Manager, American Mutual Liability Insurance Co., New York City

Within the last few months I have reviewed approximately four hundred accidents to women in your industry. As is always the case when reviewing accidents to women, falls predominated as the major cause (falls on stairs, from slippery floors, on the level, from platforms). Striking against objects, cuts, machine accidents, handling material, strains and sprains from constant action, falling material, burns, dermatitis, and stepping on glass and nails followed in the order mentioned. Falls, handling material, and falling material caused sprains and strains which should be kept in mind when considering accidents peculiar to women in your business.

Poor footwear and clothing, poor physical control, spilled material, unsuitable employment, poor discipline, inadequate supervision, careless foremanship, inadequate pro-

fective equipment, fatigue and poor house-keeping come to notice immediately when the factors behind these accidents are sought for.

An accident occurred recently to a woman in a fruit evaporating and preserving plant, when she fell while carrying glass, and lacerated her hand. The report on the accident developed that syrup was on the floor, causing a slipping hazard. The management's contribution to the investigation was an insistence that they were exerting a good quality of effort to keep floors particularly clean, especially in departments where spillage of material was practically unavoidable. They seemed proud of that and satisfied with their situation.

I have used that accident to illustrate a poor example of accident analysis. The true cause had not been determined; we knew

nothing of the actual manner of carrying the glass or the characteristics of the woman, the condition of her footwear, or the exact reason for the spillage at this part of the plant. In the face of the alleged organized purpose throughout the plant, they had not attacked their accident analysis in scientific manner.

Another preserving plant was very poorly arranged, and as a consequence, had a very poor accident record. Following a conference, the management attacked the problem of accidents to their women in a basic manner. Today they have a very fine arrangement, good housekeeping, clearly defined space, brick floors properly sloped for drainage; each girl working on wet floors is provided with rubber boots. A first class dispensary has been installed, and each accident is fully investigated and analyzed at a subsequent safety organization meeting.

As illustrating basic defects, I should like to touch on the following cases:

A girl while peeling potatoes, in a food products plant, blistered her fingers. She did not report for hospital treatment with the result that infection developed.

A girl, in a large candy factory, was cleaning a machine which was in motion. She caught her right hand in the machine and crushed the back of it, breaking three bones. The plant was in good condition from a physical standpoint; it was probably one of the best guarded plants in the vicinity. This particular girl had been instructed against the practice of cleaning machines while in motion. The accident was the result of direct violation of her instructions.

As illustrating the need to give serious consideration to female psychology, let me give you the following from an engineer's notebook. The engineer misnames it "A Comedy."

The scene is a candy factory in the East. The characters are the company management and 300 women employees. A woman employee, an enrobing machine operator, is descending in the elevator. She is alone, which is contrary to company regulations as is shown by a sign in the elevator. The woman utters a scream which runs from end to end of the factory. She falls to the floor of the elevator. The car reaches the bottom floor where it stops automatically. Foremen lift the unconscious form of the woman to the factory entrance. A few min-

utes later an ambulance dashes away to the hospital.

The factory employees, however, do not return to work. Throughout the plant they gather in buzzing groups. Some laugh shrilly; others weep. The foremen say to go back to work. Gradually most of the women return to their work, but they cannot sit still. They drink water; they go to the rest room. The management announces that the hospital has been called and the woman is wholly uninjured. She fainted when her dress caught on something in the shaftway. That is the truth, but the employees do not believe it.

The final curtain does not fall until the third day. The elevator rider has returned to work and confirmed the management's announcement. Production that has been interfered with gets rolling again.

The Moral: The shaftway should not have been unprotected; but had the management enforced safety rules, the enrobing machine operator would not have been on the freight elevator. Dislocation of work should not have occurred.

If I were a member of a food plant, I would not attack this accident problem on the basis of accidents which happen only to women. Just as the science of operation within your plan has regard for types of people, however, if you wish successfully to cope with your problem as respects accidents which seem peculiar to your women folks, you must make provision in your plan so your approach to the question will have a regard for those differences of temperament, nervous and physical balance, personal habits, and natural expectation which rest on the average between male and female employees. That is something to be superimposed on your broad treatment of types.

My suggestion, therefore, is not for an attack on the basis of women in your industry, but for an attack on the basis of people in your industry, with provisions or sciences of treatment that will meet the needs of female physique and psychology.

Women, like men, have to be painstakingly made safety conscious.

A careful analysis of the accidents in general which have occurred to women in your industry does not reveal that the same result could not have occurred to men. If accidents occurred more to women than to

men, they are to be interpreted broadly as being peculiar to women only because you employ women in those places, or because in certain respects women are more prone than men are. Defects of management, such as are shown by analysis treatment of the record, do not relate less to men than to women. When managerial neglect permits of spilled material, poor discipline, inadequate supervision, careless foremanship, inadequate provision of protective equipment and poor housekeeping, the fact of the employee being a woman has no direct bearing on the question, but when we study the woman as such, we get the answer.

In an organized way you should include in your plan the necessary ways and means of reducing the number of injuries caused by falls. That has been the leading cause of accidents to women in the food industry for some time. At the Twenty-Fourth National Safety Congress a "Call to Arms" was sounded by Governor Hoffman of New Jersey for a 35 per cent reduction in traffic accidents to be achieved by the end of 1940. Why should you not definitely attack "Falls to Women" accidents in a similar fashion? Concentrate on them; correct the conditions which the management can correct, such as, slippery floors, unsafe aisles, improper equipment, careless or incomplete supervision, etc.

Do not overlook proper choice of supervisors—people who understand and can handle women with the science that the problem demands. Bring the subject to the foreground in the minds of your women employees by friendly advice, constant vigilance, posters and signs conspicuously posted, but above all by proper instructions, and then, when an accident does occur, make it a constructive factor through an illuminating investigation.

So very often you read a cause of an accident which states something like this: "Tripped and fell at work—injured left arm and knee." "Fell by radiator—burning arm and injuring knee." "Fell on floor—burned arm." "Fell down steps—hurt her back." No constructive mention is made of the reason for the fall, and still that is the one solid contribution which hindsight can offer to foresight—the one grain of knowledge through which to help create a science.

We have found that sprinkling china clay on oily floors and then sweeping it up with a push broom, leaving just a light film on

the floor, is a good safety measure to eliminate slipping and falling. Try this on greasy floors in the food industry.

It is evident that if safety progress is to be made, the choice of women is very important. Your personnel division has an interest in this question. Excitability, age, health, intelligence, and strength are factors on which the employer can have an opinion, and it should be exercised. In the long run, a careful choice should bear in on the accident record. It is an axiom in a liability phase of the insurance business that even though accidents can and do occur on stairs of excellent design, construction, and maintenance, and on floor and walkways of equal quality, the expectation and occurrences are greatest on stairs, floors, and walkways of poorer quality. The same axiom applies to individuals. It should be a responsible function with someone in your plant to see that "hand-to-mouth" hiring is not substituted for careful and intelligent choice of employees. Women do slip and fall more readily than men. They have, on the average, less sense of physical control than men have. It is a point peculiar to them, and it is important in your accident record.

Just as it is important to hire men who can deal with and handle men successfully, it is cardinal to have supervision by women who understand, have sympathy for, can freely deal with, and successfully handle women. Women, singly or in the aggregate, are sometimes a puzzle to men, so choose women supervisors with judgment and on a plan. Accidents are peculiar to many women because many women are peculiar themselves. That is why they wear peculiar footwear and clothing, and are hard to wheedle or guide away from the habit. Only good female psychology will make progress. Women, too, sometimes impose on men; they hide behind their sex; and discipline is just as needed with them as anyone else. They must be understood to be disarmed and led.

Fatigue affects women more quickly as a rule, that is why you must consider rest periods, fatigue-reducing seats, and allied details. Any old seat won't do. A tired woman with a lame back may be a costly question in your hands. Footwear also plays a part in fatigue.

Supervision, among other things, should see that women are not unduly rushed, and do not carry loads beyond their capacities.

The age of the woman is a factor to be considered. Younger women are steadier on their feet, while older women are more reliable and stable on dangerous machinery.

As a business question, a Safety Organization should be an operating function of your plant. Women should be represented on your Safety Committee.

Safety Kinks in the Food Industry

By H. J. ALDRICH

Secretary and Assistant Treasurer, Spencer Kellogg & Sons, Inc., Buffalo, N. Y.

The strength of any organization depends upon the strength of its discipline. The best safety kink I know is a safety minded executive. We are often told that safe practices depend upon the foreman. This is only partially true. Foremen are mostly negative characters who approach a little nearer the dividing line between the negative and positive, but never get into the sphere of the positive. Hence, the foreman, like the moon, only reflects the leadership of his superiors.

We meet many difficult problems in the field of safety engineering. In twenty years' experience I have not found a single one unsolvable. I have seen those who have given up the solution, some even declaring, "It can't be done." These are negative characters and approach the matter with misgivings and doubts. They are licked before they start. A positive attitude is the solution.

Here the foreman problem comes to the fore again. There is much hue and cry about training the foreman, and I would not discourage the effort, but you cannot train into a man what he does not possess. Being of a negative frame of mind, he only sees the apparent obstacles—"It can't be done," "I never did that way," "The men won't stand for it," etc. Here the positive character of the executive enters. His foreman training consists in eliminating the "can't"—leading another "way"—and in ninety-nine cases out of a hundred the men will accept it.

There is a little sketch in the May 1937 News Letter (Food Section) "Do You Believe in Signs?" It states: "You can tell a man any fantastic story about the universe and he will believe it. But if you put up a sign 'Fresh Paint' he will have to find out for himself." Just like a small boy with a new toy, he wants to see the inside. The toy is

ruined but he has the experience. It appears much the same with our bulletin boards. Our workers seem like a lot of small boys—curious—want the experience—to their sorrow. Lick this problem—It can be done.

In the same News Letter is stated that there have been approximately 400 dust explosions in the United States in the past twenty years, with property and stock losses amounting to over \$35,000,000. It is also stated there has been a marked reduction in dust explosion losses in recent years. This is due to the fact that the problem has been fearlessly approached.

Formerly little was known concerning dust explosions, many were attributed to spontaneous combustion and forgotten. As new facilities and methods developed dust explosions became more frequent and were not so readily passed unnoticed. While we do not know all there is to know about dust explosion causes, advantage has been taken of knowledge gained, and safety kinks, both in unit and in construction, have been applied until now this hazard is being controlled.

A dust explosion occurred recently in a Buffalo, New York concrete elevator. It was of unknown origin, but due to the pressure outlets and construction of the roof being of weaker material than the concrete tanks the force of the explosion was released through the roof with no damage to the concrete tanks or structure, and no personal injury or loss of life.

Among the many problems we cannot go into at this time is the serious ladder situation. There are many safety kinks to take care of this, but neglect to use them properly is the sad story. Whenever possible the portable ladder should be replaced by the permanently anchored ladder and properly guarded cat walk.

Industrial Nursing

WEDNESDAY AFTERNOON SESSION

October 13, 1937

The opening session was called to order by Chairman Joanna M. Johnson, R.N., director of nursing service, Employers Mutuals, Milwaukee, and Vice-Chairman, Industrial Nursing Section, National Organization for Public Health Nursing, Inc.

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The Nurse's Part in Getting Injured Men Back on the Job

By LA VONA BABB, R.N.

Quaker Oats Company, St. Joseph, Mo.

The duties of a nurse in industry demand that she be a graduate Registered Nurse. If she has post-graduate public health training and education, so much the better.

If the nurse is to keep pace with the progress being made in public health nursing, it is important not only that she belong to her local, state and national nursing organizations, but also that she contribute to their programs and share her experiences with her co-workers. The nurse in industry profits by the stimulation that comes from discussing her problems with other workers in the public health field. One in this field would do well to possess many outstanding qualities. Two of the most essential are versatility and common sense.

Our title takes us at this point to the field of reconstruction and starts us with a patient who has already been injured.

Even though his injury does not appear serious, the patient reports immediately to the medical department, because he has been taught the importance of early treatment.

The nurse will recognize indicative symptoms and treat them according to the standing orders which have been signed by the plant physician. She must use her intelligence and resourcefulness in her first aid treatment as well as later. Even in the greatest emergency, the desired healing of trauma must be kept in mind and the treatment administered accordingly. She will avoid the application of over-potent antiseptics which injure tissues or retard or inhibit healing

processes. She will make herself acquainted with the more effective, less destructive or painful treatment to use for prophylaxis.

Action in the face of emergency shows the skill and training of a nurse. Will she handle the case intelligently and calmly or will she be unprepared and show inefficiency, possibly causing costly delay in recovery or even more serious losses?

All cases requiring the attendance of a doctor should have it as soon as possible. Delays are expensive to both employer and employee. The nurse who does not have the full or part time physician in the plant is entirely responsible in deciding whether a patient should be seen by the company doctor. If there is the least doubt of the advisability of calling the doctor on the case, he should be consulted for orders. The nurse cannot take the place of the physician in industry, but should be regarded as an aide to the physician in both the preventive and curative phases of industrial medicine.

Available transportation is a great asset to the nurse. In taking injured patients to the doctor or patients who are ill home and in doing visiting nurse work and follow-up calls on the injured, a nurse with an auto can accomplish much. Many companies provide this transportation or make allowance for it.

As most plants have only out patient facilities in the plant hospital, major injuries must be properly transported to an outside hospital as quickly as possible. While await-

ing an ambulance, time is usually sufficient for necessary first aid to be administered.

The attitude of the nurse when a patient reports for treatment is most important. In fact, her reception of the patient on his first visit is influential throughout the entire case. First impressions are hard to change. He is an individual who has been injured or is ill. He is probably in pain or shock. At this first contact with the injured, the nurse must establish a friendly, helpful atmosphere if she is to maintain a cooperative spirit and gain the confidence of her patient, which are necessities in early recovery of health and early return to the job. Make the patient know that you are anxious to help him in every possible way. If he believes this, he will follow orders and his return to normal is greatly expedited.

The nurse must be reassuring in her actions as well as her conversation, for the element of fear is ever present. The fear of economic insecurity and possibly lack of confidence in the medical profession are all factors which a nurse must some time face. Management and treatment of the injured worker should be directed to avoid or minimize these factors. At the very first contact with the injured, the nurse should have this in mind and continue to practice psychological treatment throughout.

The skill of taking histories must be well understood by the industrial nurse. She should never allow an employee to be cross examined or abused by severe criticism or sarcasm. The investigation of the accident must be carried on not when a patient is semi-conscious or in severe shock or pain, but when he is more quiet and can think clearly enough to understand the objective of the questioning. He is then in a much more receptive mood for instruction and correction also, and if properly approached will give a clear history and cooperate in prevention of a recurrence of the accident. It is the duty of the nurse to see that such a procedure is adhered to as long as the patient is under her care.

On less serious injuries it is often possible for the nurse to obtain a history and get a clear picture of the accident while doing a first dressing. With tact she may quietly talk with the patient and learn the entire circumstances. Whether or not she tries this method is governed by the attitude of the patient. If it is a negative one she concentrates her attention on changing it to a co-

operative one. She may explain that if she is to successfully treat the injury it is necessary to understand the conditions under which it was inflicted. This gives the man the responsibility of helping her and is many times effective.

Let us assume that our patient has had a complete, careful diagnosis, with the maximum of medical care. Everything has been done to assure him of proper diagnosis and what the expected results of his injury are to be, so that the fear of consequences of his injury has been partially overcome.

If he is in an outside hospital the nurse will call on him there and through her his fellow workmen may learn of his condition. The injured person's own family and his industrial family should interfere as little as possible with the doctor's and nurse's management of the case. Many recoveries have been retarded by many calls by a too solicitous foreman or a too "hard boiled" foreman. The nurse should be able to give intelligent information to foremen and they should feel free to talk with her concerning the prognosis of the case.

When the patient is sufficiently recovered to be removed to his home, the nurse will then perhaps personally supervise his care and under the doctor's orders she may do dressings or other treatments necessary, if the plant provides this visiting nurse service. Even in a small plant the nurse should devote an hour or two daily to making these calls. At any rate she should see that the doctor's orders are properly carried out. She will check temperatures, etc., leaving a complete report for the doctor. She will recognize important symptoms and report them immediately.

During these visits she becomes a friend of the employee's family, if she has not met them before, and has unlimited opportunities for teaching public health. She may be able to give advice for other members of the family. Johnny may need his tonsils out. Phoebe may have symptoms of rickets. The grandmother may have a suspicious cough. Any number of observations may be made and by advice serious consequences, which might later endanger the happiness and well being of the employee, may be avoided.

Through the convalescent period it may be necessary to stimulate the desire to return to work. There may be resentment or misunderstanding of the legal conduct of

his case, which creates a hesitancy to resume work or make final settlement of his claim. This uncertainty coupled with a possible fear of subsequent incapacity, due to his injury, which would cause him economic insecurity, may make him cautious and indefinitely prolong recovery. Whereas, if he can be made to understand his condition and be relieved of these doubts, his frame of mind aids him in making that recovery more quickly. The nurse, in her close association with him and his family, can do much to roll away these doubts and make explanations which are clear to him and readily accepted.

From the beginning of the treatment the individual should be studied, observed and prepared for some occupation commensurate with his subsequent physical condition. If this is done often, by the time he has been released from the hospital he has become reconciled to a different program and a new field of endeavor. On the other hand, there are injuries which probably, to the average layman, appear to be permanently disabling, but which we know from experience eventually result in no disability whatever. In this type of case reassurance, patience and gradual realization that he will recover completely must be developed in the patient's mind at the outset.

If there is no physician in the plant and an outside company doctor cares for accident cases, it will probably be the duty of the nurse to consult with the foreman concerning placement of the injured as soon as he is capable of light work.

Assuming lighter jobs before he is capable of resuming his regular occupation is many times an appreciated privilege, not only from a financial standpoint but from that of maintaining the healthy work habit and diminishing time for worry and pity for himself. The doctor will not permit muscular activity for even light duties until the patient's condition warrants it. He will then instruct the patient and the nurse of his ability and give permission to return to work.

The nurse should have a form for dismissal of a patient indicating the type of work he is permitted to do, which she sends to his foreman as soon as she has a permit to work from the doctor. The N.O.P.H.N. have various suggestions as to the forms for industrial work. I believe the more simple type of form is more satisfactory, more easily filled out and more definite in instruction.

The nurse will continue to observe the patient, do dressings and treatments per doctor's orders, or assist the plant physician with them, until the permission to resume regular work has been given, and the patient has been given final dismissal by the doctor as completely recovered.

This refers, of course, only to the group who have no permanent disability which will prevent them from resuming their regular jobs. It does not include the rehabilitation of the partial permanent disability case who cannot perform his regular occupation.

This discussion cannot include in detail the explanation of the Federal Industrial Rehabilitation Law passed in 1920. However, it is well for the nurse to know where to refer a permanent partially disabled person for Vocational Rehabilitation training.

Almost all states (44) have plans and aid from the Federal funds. The industrial commissions work together with the vocational Rehabilitations Board and cases are referred by them for correction and training. To obtain the service men or women incapacitated for gainful employment, and who desire the service of rehabilitation, should be instructed to report to the Board of Vocational Education, Division of Rehabilitation, on application blanks which are furnished upon request. This will take care of the person who, because of physical disability, cannot be rehabilitated with his old firm satisfactorily.

In many cases, however, a partial permanently disabled employee may prefer to be given some work which he can do by his employer, rather than to live on his compensation and be idle or apply for the heretofore mentioned training. In such cases the nurse may play an important part in placing him satisfactorily as she has a knowledge of his physical condition.

In consideration of this problem there are several factors which must be kept in mind: Can he be placed where he can produce sufficiently to support his family? Will he be a liability to the company? Will he be contented with a demotion and complete change of work environment?

The employer shares responsibility with the doctor and nurse in the process of rehabilitation. The major question is "Is there a suitable job for him which he can do and enjoy?"

If so, there is no problem.

If not it will probably be best for him to be advised of this fact at the outset and given assistance in securing rehabilitation vocational training; after which he may return to his former place of employment qualified to

do some special work. In this case he should be given consideration for reemployment.

He will be happy because he will have overcome a handicap and learned that he can still be independent.

Industrial Tuberculosis—A Public Health Factor

By H. J. SPECTOR, B.S., M.D.

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St. Louis Health Division, St. Louis, Mo.

The term industrial tuberculosis is somewhat misleading because it may be thought that industry is the direct causative factor in the production of tuberculosis. But tuberculosis is a germ disease, directly caused by the tubercle bacillus. No industry, no matter how harmful it may be to the human body in general, is capable of directly producing the disease tuberculosis without the presence of tubercle bacilli.

How can we explain then the high mortality rate from tuberculosis in certain industries?

To seek an answer to this question, one must consider the subject of so-called industrial tuberculosis from the broader aspect in general, but especially from the viewpoint of possible existing predisposing factors incidental to certain industries. The contributory factors which may play a role in the development of tuberculosis are many in number, but for the sake of clarity may be classified under two main headings, (1) environmental, and (2) social and economic.

Environmental Factors

Industrial environment has long been recognized as a most important contributory factor in the causation of upper respiratory diseases. For instance it is known that employees in dusty trades, and those usually exposed to high temperatures, excessive moisture, to bad weather conditions generally, and to noxious fumes are among the workers who frequently are forced to absent themselves from their employment because of sickness.

1. Inorganic Dust

One of the most serious environmental factors existing, especially in the mining and

some abrasive industries, is the presence of inorganic dust in concentrated form containing abnormal amounts of pure silica. Industries like hard rock mining, quarrying, grinding and sand blasting have a high morbidity and mortality rate from tuberculosis attributable to this cause. Employees exposed to such an atmosphere over a prolonged period of time will develop silicosis and the latter will lead to the development of tuberculosis in many instances.

Asbestosis is a disease similar to silicosis which may contribute to the morbidity of tuberculosis. However the evidence at present in this direction is not convincing.

2. Organic Dust

There has been considerable discussion as to the role of organic dust in the production of tuberculosis. The high mortality rate from tuberculosis in tobacco workers, shoe workers and tailors was responsible for the early belief that organic dust was a contributory factor in the production of tuberculosis. The work of Landis of Philadelphia, which is based on autopsy studies of the lungs of 50 patients who had been exposed for many years to organic dusts, disproved this concept since none of these patients showed evidence in their lungs of active tuberculosis. At the present time it is generally held that organic dusts do not produce disabling disease of the lungs and are not predisposing factors in the development of tuberculosis.

3. Noxious Fumes

The effect of noxious fumes on the body and their relation to tuberculosis has been studied by Winternitz of Yale, Metz of the U. S. Veterans Bureau and others. The

findings of these investigators seem to point to the fact that noxious fumes in great concentration will produce immediate irritative reactions in the upper respiratory tract leading to such serious complications of the lungs as edema, pneumonia and in some cases death of the patient.

Observations on soldiers who were gassed during the world war, made by Metz, indicate further that noxious fumes, when inhaled into the lungs, do not lead to the development of either acute or chronic pulmonary tuberculosis in most instances. From personal observations the writer is inclined to agree with this viewpoint.

4. Improper Sanitation and Ventilation

Employees exposed to changeable temperatures, to excessive moistures and working in an improperly ventilated and unsanitary room will expose themselves to the risk of lowering their resistance, thus predisposing themselves to the development of tuberculosis as well as other respiratory diseases.

Social and Economic Factors

It is an accepted fact that tuberculosis, being an infectious disease, is capable of producing and actually does produce active tuberculosis in people regardless of their social and economic rank. It is also true that poverty goes hand in hand with tuberculosis and that most tuberculosis will be found in underprivileged people.

This fact has recently been confirmed statistically by Miss Whitney, who in a study of death rates by occupation reveals that the unskilled worker, the one who usually works long hours and most often in an unventilated and unsanitary environment, the one who usually receives meagre compensation for his services, has a very high mortality rate from tuberculosis. On the other hand, the policeman who receives a fair salary and who is usually out of doors with little physical exertion has a comparatively low death rate; while the lawyers, the judges, the bankers, and the manufacturers, representatives of the higher economic bracket of society, have the lowest death rates as seen in the accompanying table.

Of great public health interest is the fact that the servant, the cook and the waiter, representatives of the lower economic rank, have unusually high mortality rates. Since these people represent frequent sources of infection to the community, the control of

TABLE I

Death rates from tuberculosis per 100,000 gainfully occupied males 15 to 64 years of age in selected states according to economic groups (1930)

Tuberculosis (Respiratory Form)	
Average, all occupations	27.4
Average, professional group	28.3
Average, lawyers & judges	21.2
Physicians and surgeons	29.4
Average, proprietors, managers & officials	24.8
Bankers, brokers, moneylenders	22.5
Managers and officials	27.9
Builders, building contractors	33.1
Average, clerks & kindred workers	22.4
Real estate agents	28.8
Average, agricultural workers	46.7
Average, skilled worker & foreman	24.2
Molders, foundrymen, casters	155.5
Police	46.0
Average, unskilled workers	143.1
Factory & building construction laborers	221.7
Average, servant classes	175.1
Servants & cooks	156.0
Waiters	169.8

tuberculosis in this economic group becomes a major public health problem.

Miss Whitney's study was based on mortality statistics of males only. Some insight into the morbidity according to occupation can be had from a recent study that we have made in the St. Louis Health Department on 31,990 reported cases of tuberculosis male and female as seen from the viewpoint of occupation.

We found in Table II that the occupations of 19,439 or 60 per cent could be classified under 10 major heads, while the remaining 12,551 could be classified under 695 occupations. It is interesting to note that "house-

TABLE II

Showing occupations of 31,990 reported cases of tuberculosis in city of St. Louis (1909-1934 incl.)

Total No. of Tuberculosis Cases	31,990
Total No. of Occupations	705
60% of Cases in 10 major occupations	
40 of Cases in 695 remaining occupations.	
1. Housework	7651
2. Unskilled labor	5119
3. Clerical work	2311
4. Shoe workers	883
5. Porters	661
6. Waiters & Cooks	660
7. Teamsters	639
8. Salesmen	519
9. Students	516
10. Laundresses	480
Total	19,439

8791 or 45% of people in the ten major occupations either did housework or handled food.

work" heads the list of the major 10 occupations, since 7,651 women, slightly less than 24 per cent of total, did this work before becoming ill.

Here should be noted unavoidable inaccuracies. First, the data go back 26 years when we were not solicitous about the details of occupations as we are today; second, the term "housework" misleads for it includes housewives, maids and women who stayed at home most of the time but did not do housework. Despite these discrepancies the chart contains pointed information since "housework" in these instances connotes that during the development of active disease these patients spent most of the time at home, living intimately with their families, eating at the same table and affording opportunities for infection.

It is of interest in this connection to contrast the usual environment of the cook, the waiter, the housemaid and the ordinary environment of the industrial worker. The former group are not exposed to silicious dusts or fumes but in most instances to food—the builder of body and maintainer of life. It seems illogical to state that food predisposes to tuberculosis despite the high incidence rate and death rate from this disease in these people.

It becomes evident that we must look for other causes to explain the high rate. What are the responsible factors?

A definite answer cannot be given. One can only speculate in attempting to find an answer. Is the high death rate due to the long hours of work? To the physical strain? To the mode of life that these people lead? To the fact that the opportunities for infection are great in this occupation? Or to the possibility that these people represent the physically inferior group who are drawn to this type of selected employment subconsciously because they are educationally unprepared to be employed in other occupa-

tions; second, because of the availability of this form of employment; and third, because of the apparent misconception that this class of work is comparatively easy to do.

On summarizing the thoughts expressed in this paper, I again wish to emphasize that there is no evidence that industry directly causes tuberculosis. There is an abundance of evidence however that, indirectly, industry shortens the life of the industrial worker, and that some occupations in industry definitely predispose to the development of tuberculosis. Of all occupations, the ones that permit the inhalation of dust containing an abnormal percentage of silica, contribute most to the development of tuberculosis.

Possible remedial measures for the control of tuberculosis in industry are:

1. Removing or controlling existing environmental factors that are hazardous to the health of the workers, such as a dusty atmosphere, poor ventilation and sanitation.
2. Granting employees a wage which will permit a standard of living commensurate with modern economic needs for a healthy family life.
3. Removing every possible existing hazard in industry that affects the health of the worker in general, leading to a lowered resistance and indirectly to the development of tuberculosis.
4. Encouraging periodic health examinations of employees to detect active cases of tuberculosis in the early stage and by isolating them prevent infection to the other employees, to the immediate family and to the community in general.

It is only in this way that the indirect contribution of industry to the morbidity and mortality statistics from tuberculosis will be mitigated and the public health improved.

How Can the Industrial Nurse Help Maintain Employee Interest in the Safety Program?

By ERNEST AUGUSTUS

Safety Director, The Mead Corporation, Chillicothe, Ohio

Given a management thoroughly in sympathy with and lending its active support to a well-organized safety program, and blessed

with the proper personality, an enthusiastic interest in her work, sound technical training and ability to perform her duties prop-

erly, plus a generous supply of initiative and originality, there is practically no limit to the ways in which an industrial nurse can be of very great help in arousing and maintaining employee interest in a plant safety program.

As each one, or all, of these essential qualifications may be lacking, to the same extent must it become increasingly difficult for the nurse to fit into the safety picture properly. In the first place, it is absolutely essential that the nurse be sold 100 per cent on safety and the safety program.

A Job of Selling

Attracting attention to, arousing interest in and creating a desire for a particular thing or objective, to that point where the prospective customer or purchaser is stimulated to take positive action in trying to obtain the thing desired, are the fundamental principles of good advertising and successful salesmanship. Promoting employee interest in safety is primarily the job of advertising and selling an idea. To interest others we must first be interested ourselves.

Interest in safety is like a contagious disease. It spreads by contact. The industrial nurse, perhaps more than anyone else in the organization, can help insure uniform and effective spreading of interest.

She should have sales ability of the highest order. To create and help maintain interest in safety, she must first create and sell goodwill.

Her most effective selling attribute is her personality. She must be temperamentally fitted for her work. She should be slow to anger, assuming almost the hotel attitude that "The guest is always right." She must not close her ears to constructive criticism, but must let ordinary "monthings" go over her head unnoticed. The industrial nurse must no longer be looked upon as a person to be tolerated rather than welcomed. It should be considered a privilege rather than a duty for men to seek her assistance and advice.

When self bobs up ahead of service the nurse is off on the wrong foot. The employee must be the final judge of her ability to render service, and he is frequently a hard task-master. He is not easily fooled. He has a way of knowing whether sincerity prompts her actions.

Psychological Ability

The industrial nurse should be able to diagnose and understand the psychology of each employee who comes to her for treatment or who comes merely to seek advice or ask for information. She must never show any bias, and above all she must remember that each employee is different, psychologically, and that it is essential for her to change her approach and observation of each case upon its merits and upon the reactions of the employee toward his particular problem.

The nurse contacts the employee in a manner no one else in the organization is able to do, and frequently she may be able to give him bits of advice that will help him solve some of his most perplexing problems. By advising and reassuring the employee who has sought her assistance she can frequently relieve a worried mind; and putting a troubled mind at ease is often worth more than physical remedies.

Through her keen observation and sincere personal interest in the employee, she can gradually build up a feeling of confidence and good will which will go a long way in interesting the employee in her and in the safety program of which she is such an important part. The employee will be encouraged to return for further treatment or to seek further advice and information, or perhaps to report some unsafe practice or condition which he has noticed.

A sure way to kill the employee's interest in safety is to "bawl him out" for having become the victim of some unnecessary hurt, or to fail to listen to, or scorn, some complaint or suggestion having to do with Safety and accident-prevention.

Mannerisms

The industrial nurse must be a very different woman than that which the hospital graduated. She must forget her aloofness and become, instead, a friendly member of a happy family. She must have a sincere interest in her fellow men, a willingness to work among all classes and treat all alike.

She should have professional dignity and at the same time a tolerance toward the workers which will not permit pettiness or gossip. She can retain this dignity and still be friendly and sympathetic, but not intimate.

She should have a sense of humor and a

keen understanding of human nature. She should be eager to learn and to teach. Expressed in another way, she should be one qualified in all respects to join the personnel director, the safety director, the company doctor and the various supervisors and foremen, as a member of the teaching faculty in the school of "human engineering."

Prompt Attention

It is important that the wants of the employee be attended to as promptly and as gently as possible. Employees should never be kept waiting for treatment or interview any longer than is absolutely necessary. Five minutes, to the man waiting to have a cut finger or mashed toe dressed and bandaged, can seem like an hour. The longer he waits the more will he be likely to doubt the sincerity of the nurse's interest in his personal welfare and comfort, and the less likely will he be inclined to follow her advice or seek her assistance the next time.

The nurse must impress upon every employee with whom she comes in contact the fact that small so-called trivial injuries must be cared for immediately. She should constantly stress the fact that the smallest wounds are large enough for thousands of germs to enter, and that infections can start within a very short time.

Another important point is in connection with people who suffer slight injuries shortly before quitting time. These employees should be made to understand that they are to visit the first aid room and receive treatment before going home.

Since men are more likely to talk about an accident and tell the real facts at the time the nurse is treating them than two hours after it has happened, the nurse has an excellent opportunity while giving a man first aid to get his story of how he was hurt. She may not learn from him the fundamental or underlying causes of the accident, but she can get a much better story from the injured worker's viewpoint than any other person in the plant. The very nature of her job inspires his confidence. He will talk more freely to her than to the foreman whose job it is to criticize him for participating in an accident; or to the safety engineer, who has an interest equal to that of the foreman and who likewise may be prejudiced.

While getting the employee's story, the nurse can diplomatically impress upon him

the idea that carelessness does not pay, either in dollars or pain. She can also draw from him his idea of what actually caused the accident and how similar accidents might be avoided in the future. The fact that someone has time to listen to his side of the story, and is apparently interested in having his suggestions as to how a recurrence can be avoided, is bound to instill safety interest.

Using Information

The nurse, without violating the confidence of the employee or involving him in any manner, can tactfully and diplomatically pass along the information thus gained to the safety director and others for further investigation and action.

The nurse should keep the foremen informed of the psychological condition of those coming to her for attention. In this manner the foremen may better know how to treat and handle certain employees under certain conditions. Likewise, she should assist the company doctor in making physical examinations and know the peculiarities found in each employee; then using her influence in getting employees to follow the doctor's advice in having some condition corrected.

The safety director should keep the nurse informed of his program and aims, so that she may assist him in his plans. In reality the nurse should be looked upon as an assistant to the safety director.

Safety Posters

Many nurses have found it to be advantageous to have a bulletin board in the treatment room, on which are displayed frequent changes of safety posters. A man looking at a bulletin board poster in the first aid department is likely to be in a more receptive mood than when looking at it on any other board in the plant. Many nurses have found it worthwhile to call the employee's attention to particular posters which they have selected for their bulletin board.

In many plants, and particularly in many first-aid rooms, it is the policy of the nurse to select for display certain posters dealing with the types of injury most frequently treated by her. In this manner the safety poster campaign is tied in directly with her work.

Keeping Records

The keeping of records is another important function of the plant nurse. An accurate and complete record should be kept of every injury reported, when, where and how it happened, and the treatment rendered, including redressings.

The employee who has been trained to realize the advantage of visiting the first aid room and who knows a record is being kept of all such visits, cannot help showing a greater interest in safety than the employee who has not been so trained. His desire is to keep his record commendable.

Records kept by the nurse can also be used by the safety director and department supervisors in helping reduce certain types of injuries.

Each minor injury should be looked upon as an accident. These should all be classified by types and causes for the use of the safety department, in helping formulate new rules and general safety policies. First aid records kept by the nurse might well be used as the basis for a systematic accident prevention program.

In this connection, the nurse should be familiar with the various departmental records and should diplomatically call employees' attention, at the proper times, to either good or bad records. Similarly, if other forms of inter-departmental competition are fostered in the plant as a part of the regular safety program, the nurse should be familiar with the relative standings of various groups and should use her ingenuity in keeping the men interested in this competition.

Because she is constantly contacting so many different individuals, the nurse should be thoroughly conversant with general company policies, and more particularly with those having to do with doctor treatment, compensation, insurance. She is then in a position to answer employees' questions so that her answers will not be misleading or offending.

The New Employee

Another way in which employee interest in safety can be aroused is by showing the new employee through the hospital, pointing out various pieces of equipment and explaining briefly their purposes. She should also briefly explain the set-up of the hospital, the

safety department, and the close relationship between the two; making mention of the methods used and the part the employee will be expected to play in helping the whole to function smoothly and efficiently.

The nurse can gain confidence and good will by familiarizing herself with the general layout of the plant, its principal operations, manufacturing methods employed, products manufactured. She should have a working knowledge of the more important and hazardous pieces of equipment, processes used and hazards involved, so that she may be able to talk the language of those who seek her assistance.

To acquire this knowledge the nurse, accompanied by the superintendent, safety director or company doctor, might well pay an occasional visit to each of the various departments of the plant, contacting the foremen or operators and asking questions.

When appropriate, both while going through the plant and when treating injured employees in the first aid room, the nurse might well make inquiry as to whether advantage is being taken of the various safety devices provided, such as goggles, safety shoes, respirators, protective aprons, etc. By knowing the plant, its processes and products, she can call the employee's attention to the importance of using the various safeguards.

The organization and conducting of first aid training classes among employees by the nurse cannot help stimulating interest in safety.

Some experienced safety men are of the opinion that the plant nurse should serve on the plant safety committee, or at least that she should attend committee meetings. It is contended that in this manner she serves as an advocate of the injured worker's point of view during an accident analysis.

It has also been suggested that because she is good natured and may be better qualified to keep records than the others, she should serve as secretary of the committee. Regardless of the merit of these suggestions, it is agreed that the nurse should be kept closely informed of the activities of the safety committee, so that she may be able to discuss them intelligently with employees.

Community Activities

The nurse's influence can even be extended to the community life of the town in which

the plant is located, depending upon her willingness to participate in community activities, such as Parent-Teacher Associations, community safety councils and safety groups in the public schools.

If there is a plant publication, the nurse might prepare occasional articles dealing with safety and health. She should also keep posted on the latest developments in

industrial nursing tactics by reading nursing magazines and other literature on the subject.

She should attend nurses' meetings whenever possible, as well as state and national safety congresses, thus keeping in touch with what others are doing in her field and getting a broader vision of her work and its possibilities.

THURSDAY AFTERNOON SESSION

October 14, 1937

The Industrial Nurse as an Aid to the Safety Department

By J. H. HOLZBOG

Personnel Director, Chain Belt Company, Milwaukee, Wis.

Broadly speaking, there are three ways in which the nurse can be of assistance to the safety department in detecting unsafe acts and conditions:

1. By keeping accurate and complete records.
2. By being a careful observer, a shrewd analyst, and a keen interpreter of the things she sees and hears.
3. By helping to educate the men who come to the department for treatment in the ways of safety.

In safety work statistics are very important. We will start with the original report of the accident, as this report is used as the basis for all other statistics and records. This report usually contains a brief description of the injury and also a brief history of how the accident occurred. Quite often we have cases where a man is unable to express himself clearly in English, and in other cases the man is trying to cover up some mistake on his own part and may not tell a true story. The nurse must get the correct facts, and she may have to call in witnesses to substantiate the story.

From these original reports it is possible to develop additional data that will prove of value to the safety department: such as the total number of injuries occurring; in large plants this might be reported daily; in others weekly, and in some monthly. This

report should be tabulated by departments so that when the safety department compares the number of accidents with the number of men employed and the man hours of exposure, as well as the hazard involved, they can determine whether the department involved is having an undue number of cases. It is also well to show the number of lost time accidents by departments and also the number of days lost by departments, because this will enable the safety department to judge the severity of the accidents occurring.

In our plant we also keep a record of the type of injuries and differentiate according to lacerations, burns, eye injuries, slivers, bruises, fractures, etc. This also helps to determine whether there is any particular type of injury which is causing us a great deal of difficulty. Charting and graphing of this information will often reveal some very interesting facts.

In our plant our nurse also keeps track of the cost of injuries. In our case, our insurance company has been requested to furnish us each month with the actual amount of money expended on each open case so that we are able to determine in dollars and cents the exact cost in medical expense and also in compensation payments. These figures are tabulated and separated according to departments and a monthly report is issued showing the cost per month,

the total cost to date for the year, the total man hours, and the cost per thousand man hours for each department. The figures are used by the safety department in conducting an annual safety contest and are very helpful in presenting the picture.

The nurse must be a careful observer, a shrewd analyst, and a keen interpreter of the things she sees and hears. She must be a psychologist, and to some extent even suspicious; in other words, she must not take too many things for granted. It is very easy to accept the story of an accident as given by the injured man and let it go at that; however, this may not always be the true story and may lead to serious results if accepted verbatim.

We believe that it is a good policy for our nurses to know something about the operations of the shop and one of the first things we do with a new nurse is to take her through the entire plant and explain the processes. Naturally, she will not remember all about it, but she will learn some things about certain machines and processes and later can make another tour of the plant. We also encourage our nurses to go out into the shop and personally investigate accidents when they do not understand the entire circumstances. This helps them to get a better picture of the machine or process involved and they will be able to write up an intelligent and helpful report. After a period of time they will become mechanically minded enough to be able to detect flaws in statements and thus get a true report.

The nurse must be a psychologist. Now psychology may sound like a big word, but psychology is nothing more nor less than the handling of human beings in a sensible way. The first aid department can be of real value to the safety department if it follows this axiom. The nurse must be a shrewd analyst and a keen interpreter. In other words, she must analyze every situation as it is presented and look beyond what appears on the surface. It might seem that this would be placing a great burden on the nurse and adding work to her already many duties; however, the cases which are involved and deserve a great deal of attention do not occur very often and it is just a matter of practice before the nurse is able to detect them more or less automatically.

When a case looks suspicious, she will then analyze it at some length and will try to get to the bottom of it. The nurse must

have the confidence of the men in the shop and if she has, she has an opportunity to detect many unsafe acts and conditions. Very often men will come into the first aid room and in the course of their conversation will make remarks, such as "this thing would not have happened if that machine had been taken care of," or "if Bill had done what he was supposed to do." Shop men will often say things at a time like that, that they would not say otherwise, and if the nurse catches these remarks and interprets them properly they may lead to the cause of some certain type of injury. Of course, the nurse must report these instances to the safety department and give a clear story and the safety department can then take action.

A third way in which the nurse can be of assistance to the safety department is in the program of safety education. A nurse has an excellent opportunity to talk safety and safe practices when the men report with injuries. Very often by questioning the man regarding the cause of the accident and discussing the situation with him, it is possible to bring out the fact that there are certain hazards and practices existing which have not been given particular attention. She may be able to sell the man on the idea that he has been doing the particular job in an unsafe manner and that to change his method would result in a safer way of doing the work. If the practice is one which applies to more than one man, she would, naturally, report it to the safety department and they would take further action to see that the practice was discontinued by those involved. Very often it is also possible for her to determine that there is an unsafe condition existing because of the type of injury coming from a certain department.

Whenever she finds these conditions, she must take the opportunity of getting the basic information regarding them from the men reporting from that department. Sometimes these unsafe conditions can be corrected in the same manner as the unsafe practices, merely by carrying on an educational program with the men.

There is no better time to talk to a man about safety than just after he has had an accident.—I do not mean while he is suffering or still excited, but when he has had a chance to think it over a little. He has seen the results of careless or thoughtless workmanship, and he is very easily impressed with good advice on safety.

We also encourage our nurses to talk to the safety groups in the plant from time to time. In our plant we have 25 different safety committees and every man in the shop belongs to the committee for his particular department. These committees meet for one-half hour each month on company time and discuss safety problems pertinent to their own division. By having the nurse appear occasionally at their meetings, we find that it gives the men a much better idea of the services that can be rendered through the first aid department. It also helps to indicate that safety and first aid go hand in hand, and that the nurse is as much interested in preventing accidents as in taking care of the injured men after an accident.

There is one other way in which the nurse may be of assistance to the safety department and may at the same time uncover some unsafe practices; that is to issue all goggles and safety shoes. In many plants such a set-up might be impractical, but we find it works out very well in our plant. We have three nurses and they are all trained to properly fit goggles and safety shoes. We feel that by doing this job in the first aid room, we have an additional opportunity to sell safety to the men, not only that, but if he has any complaints to make on the equipment, he can make them there. It takes extra time on the part of the nurses to do this, but we believe it is well worthwhile.

What the Industrial Nurse Should Know About Occupational Diseases

By A. L. BROOKS, M.D.

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In discussing what the industrial nurse should know about occupational diseases, it is important that we have a clear understanding of what we consider occupational diseases to be.

For convenience we may accept a definition of the term used by several states in setting up legislation providing compensation for disability arising from such disease. The term is defined as "a disease which is due to causes and conditions which are characteristic of, and peculiar to a particular trade, occupation, process, or employment."

With this definition as a starting point, we are able to separate diseases of employees into two groups, occupational diseases and non-occupational diseases, and further, to classify occupational diseases as specific and general.

The fact that some diseases are due to causes and conditions characteristic of certain trades was known to physicians 2,000 years ago. The effect of certain poisonous metals and of dust from stone cutting had been noted and ascribed to occupation long before much was known of physiology or the logical use of drugs.

There was a vast amount of ignorance and superstition associated with early findings,

but as time went on, this gave way as an effort was made to associate cause and effect.

Specific Diseases

There are certain diseases now about which there is little doubt in the majority of cases. These are the ones we hear most about. They are specifically mentioned in the schedules of compensation acts. They occur following definite, known exposure, they present clear cut signs, and as a rule, they respond to treatment.

We refer to such diseases as lead and mercury poisoning, infections such as anthrax and glanders, and the pneumoconioses.

These diseases we may term specific, and there can now be little doubt of the obligation upon the employer to prevent them, or having failed in this, to cure the condition and to compensate for disability arising therefrom, provided it be possible definitely to assign the responsibility to the right employer.

General Diseases

There are other diseases which may be termed general because they are not limited to people engaged in certain trades or occu-

pations. They may be encountered among the general population. Examples are pneumonia, arthritis, tuberculosis. These may be claimed as the result of working conditions, exposures, etc., but it is extremely difficult to state that they would not have occurred had the subject not been employed.

The question of what types of disability to compensate has long been a matter of dispute. In this country, each state has its own legislation on the subject. In some there is general coverage for all conditions which produce disability and arise out of employment, or which conform in general to our definition of occupational diseases. In others there is a definite list or schedule which mentions specifically each disease or injury. At present this seems to be the preferred plan.

As an example of such a schedule we may name a list of occupational diseases which has been included in legislative acts in Michigan, Ohio, Minnesota, New Jersey, North Carolina, and to a greater or lesser extent in other states.

These in general fall into the category of diseases due to microbic infection, poisoning by the heavy metals and other inorganic substances, by organic compounds like alcohol, petroleum products, and coal tar products, the effects of change in air pressure and of various noxious gases in the atmosphere, and to some extent such mechanical effects as hernia not caused by accident, synovitis, and friction blisters, and exposures to extremes of temperature.

The infectious diseases usually referred to are anthrax from contact with hides, glanders from horses, and tuberculosis from the usual sources.

Poisoning may be systemic or local, producing such diseases as toxemia from lead, arsenic, mercury, which are systemic; or there may be the effects of petroleum, which usually result in skin involvement only.

Chrome sores of the skin are characteristic effects of chromic acid exposure, and the nasal perforations of chrome poisoning are easy for the nurse to discover and diagnose in most cases.

Various gases and fumes, such as nitrous fumes, carbon monoxide, and hydrogen sulfide, may cause illness or death, but here it is difficult for the industrial nurse to afford much assistance, except to learn as much as possible about the exposure so that she may

aid the doctor in arriving at an early diagnosis.

Compensate for Disability

In all cases, in connection with a workman's right to compensation, it should be remembered that it is never the purpose of legislation to compensate for the disease, but for the disability arising therefrom.

Statistics apparently prove that the life of industrial employees is shorter than that of the general population. But thus far it has been impossible to state how much this has been contributed to by living in large industrial centers, by improper housing, improper food, bad habits, the choice of certain trades by people who are mentally or physically not adapted to such occupations. Certainly some of the latter factors can hardly be charged to industry's neglect.

Nevertheless, whether specific or non-specific, compensable or non-compensable, these diseases are the interest of the industrial nurse.

It is her business to look impartially upon these conditions, to discover significant signs, to give aid and comfort in minor cases and to bring to the attention of the plant physician anything she sees which requires more than she can offer.

There are many diseases which definitely have no relation to employment. We may mention such contagious diseases as the acute exanthemata, syphilis, various congenital conditions, and degenerative diseases of old age. Here again, we may find that some of the above mentioned, non-specific occupational conditions are intimately connected with employment environment, but the degree of responsibility if any will have to be determined by someone other than the nurse.

Must Know Plant

The industrial nurse will be an important aid in the management of occupational diseases if she has the industrial point of view. She should know what diseases might reasonably be expected to occur in her plant. It is true here as elsewhere that we find what we look for. The man with a sallow complexion, complaint of chronic constipation, weakness or soreness in the forearms, with occasional abdominal cramps will suggest plumbism to the nurse who knows that lead is used in his department. This means that

she should be as familiar as possible with processes in manufacture.

Conversation with men, and well directed questions concerning the work, are welcomed by the men, as they indicate interest on the part of the nurse. The nurse is clever, indeed, who will notice characteristic signs of disease which might have originated elsewhere, but which could hardly be expected in his present occupation. Equally clever is the nurse who is able to judge the nature of the employee so well that she is able to differentiate the sufferer from the chronic complainer who has an honest face and a good line. She may even have to bring into play that intuition which all women are said to possess.

Thus far we have spoken of the nurse largely as a case finder. She is valuable in this role because she will see a greater number of cases than the physician. Having had complaints, or having had her suspicions aroused, it becomes her duty to transmit employee and facts to the plant physician who will make the necessary investigation. This may require a special effort, and may occasion some expense in cases where there is not a full time plant physician, but it is time and money well spent.

Should Keep Records

A very important part of the nurse's work is the keeping of adequate records. This applies particularly where there is a possibility of lost time and compensation. The nurse should have the whole story from the time the employee first presents himself until he has been cleared, including the doctor's finding and treatment, so that it may be used at any time in the future for the benefit of both employee and employer.

The industrial nurse will handle occupational diseases more successfully still if she is acquainted with the management and the foremen. She will recognize supervision as a source of reliable information and will be able to utilize information from these men in building up material for a diagnosis. Her interest and sympathy for the workmen will encourage foremen to make greater efforts to protect their men.

The duties of the industrial nurse having been outlined in general, let us take a hypothetical case which will illustrate how the nurse may function who has a knowledge of the essentials of occupational diseases:

John Brown, handy man about the drafting rooms, comes into the dispensary one day complaining of a fine itching rash on both arms. The nurse notes the condition, and inquires about the work. He states he has worked here two years and has been doing the same kind of work. He has been out in the country week ends, but does not think he has been exposed to poison ivy, although he admits he does not know what it looks like. The doctor is out at present but will be back in the afternoon. The nurse knows the superintendent of the drafting room. She calls him and upon inquiry finds that a part of John's work is to carry blue prints to the mailing room. A new process has been developed in blue printing within the last week. The man is given routine preliminary treatment.

This information is submitted to the doctor upon his arrival, and when, next day, the condition seems much worse, the diagnosis is fairly well clinched. The doctor makes a patch test, changes the man's job, the condition clears up, and the nurse deserves credit for helping to steer the case into the proper channels. Had she not known something of the nature of contact dermatitis, or the nature of the work, and had she not contacted the proper authorities in the drafting room, the case might have become serious before the doctor saw it, and it might have run into disability and compensation.

The importance of occupational diseases is not likely to be overlooked now that so much is appearing in the press on the subject. There are approximately 50 million people gainfully employed in the U. S. at the present time. Of these, about 15 million are engaged in industry. A statement is made in a recent U. S. Public Health report that it is estimated we are spending five billion dollars annually for compensation and other costs due to injuries and occupational diseases.

To be sure, only a small percentage of this outlay goes for occupational diseases, while accidents claim a much higher figure. But the trend is toward a reversal of this. Accidents have been controlled to a great extent so that their cost is decreasing, while occupational diseases, though probably not increasing are certainly receiving a great deal more attention than heretofore.

One hesitates to state how many states now

provide compensation for industrial disease disability at a time when new legislation is being enacted so rapidly, but most of the important industrial states now compensate for some or all of the conditions which can be attributed to occupational diseases. Some have blanket coverage for all such conditions, while others name specific diseases or specific occupations. There have been injustices to both employee and employer, but with time and increased study of conditions

we shall eventually arrive at fairer, more equitable adjustments.

The Industrial Nurse finds herself today in this arena of changing policies and evolutionary social adjustment. It is her privilege to be one of the connecting links between employee and employer. If she is the type that commands the respect and trust of the men and realizes her responsibility to them, she will likewise be most valuable to her employer.

The Nurse's Part in the Sickness Prevention Program

By PHOEBE BROWN, R.N.

Consolidated Water Power & Paper Co., Wisconsin Rapids, Wis.

The extent to which the nurse enters into the sickness prevention program depends upon the type of industrial medical service maintained.

Some industrial plants maintain a nurse primarily for their Employees' Benefit Association, and thus her work is chiefly that of welfare. She administers not only to the members, but to their families as well. What a fine opportunity she has to influence such employees and their families to a keener understanding of good health and better living. For after all, the problem of sickness prevention concerns not only the individual employee, but also his family.

To fill her place successfully in such a program the nurse must recognize one basic principle—*she must be a humanitarian*, and regardless of the problem confronting her she must give relief through aid or counsel, whichever the case may be. She must have knowledge of the personnel she serves, their modes of living, their idiosyncrasies, their families and environments. By keeping her ear to the ground constantly she learns of their problems so that she may then solve them.

Naturally a knowledge of the community served is vital, for often through constructive criticism she is able to elevate the health standards through better sanitation and civic pride.

Perhaps a better conception of the sickness prevention program in connection with welfare work may be had by actual case analysis:

Not long ago I was called to the home of an employee who had been reported sick at frequent intervals during the past two years. He was underweight, nervous, and irritable. On my first visit he was confined to bed and vomiting excessively. His wife informed me that he had attacks of this type periodically. He would not have a doctor because his doctor did nothing for him except give him a prescription that cost too much and tell him to be careful what he ate.

While in the attack he was careful enough, for he ate nothing for two or three days; but as soon as the illness was over he went back to his old diet of meat, potatoes, plenty of spices and relishes, copious amounts of coffee, two packages of cigarettes a day, plus a goodly amount of beer each week-end.

At one time the doctor had said he should have an X-ray of the stomach, but he complained that this would cost him \$40 which he couldn't afford, and anyway he couldn't get away from work when he wasn't sick.

I finally made him realize that he was losing much more time and money being ill every two or three months, losing four or five days at a time, than if he were to find out just what did ail him and then do something about it.

I took him to a clinic which was conducted on a part-payment basis, and complete examination was made with X-rays and blood work. After he was convinced of the necessity of a proper diet, his attacks became less frequent, he gained weight and was a much pleasanter fellow at work.

In another instance an employee's wife had undergone an operation at a local hospital. Visiting her later at home, I learned that she was recovering satisfactorily but that there were desperate financial troubles. The husband earned 92 dollars a month. There were seven boys in the family, the oldest 18 and unemployed. Questioning the children, I discovered that one, aged 12, was graduating from school but did not even have a graduation suit. His father couldn't afford it because he was paying \$5 weekly on his wife's \$90 hospital bill. He was taking care of the doctor's bill by doing some repairing and cleaning in his office.

After discussing the problem with the employee, I visited the hospital authorities. Hearing the story and realizing the effort the man was making, the hospital gladly discounted \$50 from the bill. Payment of the remaining \$40 was made by the Employees' Welfare Loan Fund, and this in turn was deducted from the employee's pay check at the rate of \$2 a week. The total cost to the Welfare Association was slight, but the assistance and feeling of security given this employee was immeasurable.

But let us leave this type of program and turn to the industrial nurse who serves chiefly in a first-aid department and very seldom contacts the family or the home of the employee. How does she best serve in a sickness prevention program?

Here, again, her knowledge of the personnel is indispensable. She should review the personal record of the employee with the employment manager to obtain a better understanding of the individual. This should be followed by a study of the employee's job; where he works and under what conditions, especially sanitation; the product manufactured and the raw materials it is made of. There the nurse may obtain valuable information as to latent hazards that eventually may affect the health of the employee, oftentimes recognized too late to cure effectively.

From this and a study of past sickness she maps her program of prevention as follows:

1. By suggesting better working conditions, such as improved illumination, sanitation, housekeeping, ventilation, and use of proper and adequate protective equipment.
2. Education of the employee to higher health standards. This requires constant

attention through bulletin boards, mass meetings, news items and personal contacts.

3. By advising and assisting the employee in securing correction of physical defects and social maladjustment.

The following case is an example:

An employee had repeated attacks of rheumatism and had been advised by the family physician to have his teeth extracted, but he did not know where he would get the necessary dental fee.

We had introduced a plan whereby our employees were allowed dental services, in special cases, through the Welfare Association. If an employee were a reliable workman and had been with us for more than six months, we had an opportunity to investigate his financial condition. If he were honest but having a difficult time establishing his credit, he was given an order to one of three dentists whom we were assured were giving our employees fine dental care at a minimum charge. The dentists were glad to render this service, for they were not only sure of their accounts but were also increasing their practice by developing new contacts. This employee as well as many others profited by the plan.

The following are only a few examples of a nurse's function in an industrial health program:

A sudden increase in the number of athlete's foot cases indicated that someone was a carrier and was spreading the germs in the shower rooms. A suggestion to the sweeper brought the condition under control when proper spray and foot baths were installed.

The use of corners by employees as a place to expectorate was effectively solved by painting white triangular areas in the corners and providing cuspidors containing a disinfectant, thus reducing the spread of diseases from respiratory infections.

In another instance three employees from the same department made regular trips to the first-aid station for aspirins each week. Reviewing their personal record cards indicated normal health and habits. A trip to the department revealed inadequate and glaring lights. A proper survey not only corrected the condition from a physical standpoint but likewise increased production to such an extent that a similar survey was made throughout the plant.

A high frequency of indigestion, nausea and fatigue is often traceable to improper ventilation, suggesting proper air-conditioning or protective equipment to eliminate this hazard.

It is quite true that such a program presents a real problem in selling the idea of sickness prevention to executives—but patience and frequent reference to the time lost through sickness will eventually bring results.

I wish to quote a few paragraphs from the reports of disabling illness among industrial employees in 1936 as compared with earlier years. This report was released by the Division of Industrial Hygiene of the National Institute of Health and compiled by Dean K. Brundage.

Respiratory Diseases

The respiratory group of diseases accounted for most of the increase in the incidence of illness in 1936. With the exception of tuberculosis of the respiratory system and diseases of the pharynx and tonsils, each respiratory disease sub-group occurred at a higher incidence rate in 1936 than in 1934 or 1935.

The frequency of influenza and grippe in 1936 (15.1 cases per 1,000 men), was 19 per cent higher than the rate for 1935 (12.7 cases per 1,000 men) and 50 per cent greater than for 1934 (10.1 cases per 1,000 men). Nevertheless, the rate for 1936 was 4 per cent below the average rate (15.8) for the preceding five-year period."

"Another development of an unfavorable nature was an increase in the number of cases of bronchitis, acute and chronic. In 1936 this disease occurred at a rate of 4.8 cases per 1,000 men which was 41 per cent above its average incidence during the years 1931-1935. The incidence of diseases of the pharynx and tonsils in 1936, although 4 per cent higher than in the preceding five-year period, was below the rate for 1935. The rate for pneumonia (all forms) in 1936 (2.6 cases per 1,000 men) was 13 per cent above the rate for 1935 (2.3 cases per 1,000 men), and in turn exceeded the rate for any year since 1929. Among the industrial policyholders of the Metropolitan Life Insurance Company, the death rate from this disease in 1936 as compared with 1935 increased 5 per cent."

"Other diseases of the respiratory system,

including diseases of the upper respiratory tract, showed a sizeable increase in frequency in 1936 as compared with all the former years. Most noteworthy in the record since 1921 is the downward trend in the new cases of tuberculosis of the respiratory system. The incidence has decreased from 1.9 cases per 1,000 in 1921 and 1922 to .8 cases in 1936."

This is an excellent indication of the effectiveness of educating the child and the adult.

"Rheumatism, acute and chronic, which showed definite improvement in 1934 and 1935 (4.0 cases per 1,000 men) as compared with earlier years increased to 4.2 cases per 1,000 in 1936. This rate was below the five-year average. Diseases of the organs of locomotion, except diseases of the joints, occurred at a rate of 3.2 cases per 1,000 men in 1936, which exceeded the rates for 1933, 1934, and 1935, as well as the average for 1931-1935."

How frequently and to what extent sickness among employees is a factor in causing lost time accidents is often revealed when a thorough investigation is made of all incidents leading up to the accident; such facts properly presented enable one to improve plant conditions for better health.

A good share of the sickness prevention program is education. Few employees, for example, realize that they have more leisure time than they have ever had before. The employee should be taught to use this with discretion. Today we practically have a national 40-hour work week, and allowing at least 56 hours for sleep, we find the employee has 72 hours left out of every week to use as he wishes.

Does he spend his idle time disastrously, thus adding fatigue to an already fatigued body? To safeguard against this you may find it worthwhile to afford him recreational facilities, stimulating in him a desire for hobbies, home ownership, or any other activities that may enable him to spend his time more profitably.

Plan a definite program of Better Health talks during the winter months.

The National Safety Council and leading insurance companies can provide excellent material for these discussions. Your state and national health departments are glad to furnish valuable information free of charge.

One of your local physicians will be pleased to talk to the employees on sickness prevention. Carefully located bulletin boards with timely health topics are useful. Articles in plant magazines are far reaching, and pay-envelope inserts discussing health topics have proved beneficial.

ADJOURNMENT

Marine Section

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Secretary—CARL F. VANDER CLUTE, Admiralty Attorney, New York, N. Y.
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 A. O. WOLL, General Petroleum Corp. of Calif., Terminal Island, Calif.
 JOHN WRIGHT, American Export Lines, New York, N. Y.

TUESDAY AFTERNOON SESSION

October 12, 1937

The opening session was called to order by Byron O. Pickard, Pacific American Steamship Assn., San Francisco, Calif., program chairman of the section. Captain E.

C. Holden, Jr., United States P. and I. Agency, Inc., New York City, general chairman of the section, submitted a review of the year's activities.

The Advancement of Safety in the American Steamship Industry

By R. J. BAKER

President, American Steamship Owners' Association, New York City

The advancement of safety at sea is the result of an endless process of trial and error. It is amusing to compare the present day attitude toward safety with the one of some eighty years ago, as indicated in an article published in the "Nautical Magazine and Naval Chronicle" of London in 1856, in which it was declared that the chief causes for loss of ships at sea are:

1. Teetotalism—the serving of coffee instead of rum;
2. The presence of the captain's wife and other women;
3. Insanity;

4. Drunkenness and revelry;
5. Mutiny and insubordination;
6. Discord and dissension;
7. No devil being on board;
8. The devil having been let loose.

Today our reliance on safety at sea is placed in the results of the navigation laws of the country; the ice patrol; study of ice and current conditions; load line and stowage regulations; removal of derelicts; installation of safety devices which provide the best available fire detection and extinction apparatus; constructive requirements which will enable an endangered ship to

remain afloat until help arrives; requirement of life-saving appliances which are adequate in number and easily available to all; the use of navigational instruments which will reduce operating risks; the quality of Governmental inspection service; the high efficiency of ship operating personnel.

In all of these factors the United States has kept pace with the rest of the world. When in 1929 the nations of the world met in London to attempt to agree upon standards of safety for vessels operating in foreign trade, the American delegation found itself out in front, fighting to have other nations agree to adopt the high standards already in effect here. Our delegation can take the credit for the high standards set by the Safety of Life at Sea Convention which resulted from that meeting. And afterward, it was the shipowners who consistently urged ratification of the Convention by the United States.

As a matter of fact, practically all American ships to which the Convention would apply were voluntarily equipped in accordance with its provisions long before the Convention was ratified by this country. By working constantly with Congress and the executive departments of the Government the shipowners have aided in the development of regulations covering every phase of ship operation. While they must at times temper theory and idealism with practicality, they are at all times eager to establish standards which must be uniformly observed.

Shipowners realize that it is a tragedy to adopt a standard that does not equal the danger. On the other hand, in fairness I must point out that it is equally objectionable to adopt standards that are excessive and unnecessary, that do not afford the increased safety supposed, and that add materially to the cost of the construction and operation of ships without gain in safety. Frankly, the adoption of such standards defeats their purpose. About 70 per cent of the American passenger traffic is enjoyed by ships of foreign flags. To set standards that will make commercially impossible the construction of American ships, or their operation under the American flag, will drive all our passenger traffic to ships not governed by the same stringent laws.

With respect to loss of life at sea I do not wish to make comparisons with vessels of

other countries, but reports of the United States Department of Commerce indicate that the average loss of life at sea on American vessels during the past ten years is one passenger lost for every 3,500,000 passengers carried, and the American record is as good as, if not better than, that of foreign ships engaged in similar trades and services.

Safe vessels are of little avail unless manned by trained and disciplined crews. The shipowners have been continually behind every constructive movement for the training of men to man our ships. They have taken great interest in the four school ships for officers which are maintained, and their graduates are eagerly employed. In the various shipping associations standing committees are constantly working over the problem of a proper personnel for the ships. Contrary to the belief of some people, shipowners do not go out and pick up officers for a ship on the curb. These men are all licensed by the Government after examination. No one without such a license can serve. Ship officers, therefore, who fail in an emergency are as much of a surprise to the owner as to the public.

American officers and seamen are the equal of any in the world. The minimum training and manning requirements for officers on American vessels as a whole are stiffer than those of most other countries, and the performance record of American crews in emergencies is excellent.

Another phase of safety which is but little appreciated by the public but which is of relatively greater importance than the danger of loss of life by accident, is that which concerns health. Disease is the cause of more deaths at sea than marine accidents. About 98 per cent of the world's total passenger deaths at sea are due to diseases, contracted ashore, not on the ships. The progress made in modern times in this field, as compared with conditions which existed in the days of sailing ships and the first steamships, is remarkable. In the United States we have the Public Health Service with its highly efficient force and stringent regulations to prevent the spread of disease. Aboard ship all operations involving handling of food, passenger accommodations, and sanitation are maintained at a high standard. All passenger ships carry physicians, and the larger ones have well-equipped hospitals.

In addition the shipowners are carrying on an organized drive of their own to still

further reduce the chance of injury to employees, passengers, and others through man failure or equipment failure. This work is carried on by the various shipping associations and individual companies by men

trained in the best known methods. Aside from its direct purpose this work furnishes a fine example of the practical cooperation possible between employers and employees.

What Is the Next Step in Controlling Accidents To Longshoremen?

By ASHFIELD E. STOW

District Manager, American-Hawaiian Steamship Co., Baltimore, Md.

The Pacific Coast employers had an inspired vision when they realized that a safety campaign in the highly casual longshore industry must be standardized and unified to be effective. Standardized at least in policy and rules; unified as to minimum standards of working conditions, safe gear, safe stowage, proper lighting, statistics, first aid instructions and safety lessons, posters and all the other numerous and well-known tools whereby industrial accidents are prevented. This inspired vision and the acts of the Prevention Bureau have achieved unification of accident prevention work among the companies on all the water fronts on the Pacific Coast. The results prove the soundness of this program.

Unified accident prevention should be worked and can be worked on a national scale. The next step is for the Atlantic and Gulf Coasts to realize the efficiency and efficacy of a unified group movement and start it right now! The place to start is New York Harbor, and in the City of New York, where the power is concentrated.

Realizing the difficulty of conquering New York, why insist on starting there? Because when New York makes the effort and subscribes to a unified program for New York, I know that all other ports on the Atlantic and Gulf will fall in line overnight. Briefly, I prove it in this way:

The Pacific Coast—the whole Marine Safety movement affecting longshore labor—took its first toddling step in Seattle and got nowhere very fast. Why? With all respect for the great and courageous Puget Sound Port, the power is in San Francisco, and San Francisco and its executives were too busy to tackle the problem. Then some flicker of light percolated to San Francisco—struggles—a survey—meetings—a safety engineer—a small appropriation—the hiring

of Mr. Pickard—a year's effort, six months of which produced a slogan and the first poster. Los Angeles, only 400 miles away, heard what was going on—got jealous and demanded service. Then an authorization to try to bring in the other ports on the Pacific Coast.

Pickard and I hoped to do it in a year. We took a trip and were home in a week—the other ports were in. The power had been educated. The child was born, has grown rapidly in strength, and the member companies of the Association support it with enthusiasm.

Furthermore, Labor—conservative when the Bureau was started, frightfully radical of late—recognizes and trusts the Bureau. The Bureau is not regarded as an "employer" institution; it is apart, beneficent, not paternal, but sincere and true to its sole purpose of preventing accidents.

There, gentlemen, is my message. The simple way to take the next step to save lives, suffering and expense, by reducing your accident frequency and exposures, is to unify and standardize your efforts so that your casual labor is de-casualized, so far as their safety consciousness, safety training and working conditions are concerned. And New York is the place to start it, because there is where the power lies.

The tremendous size of New York Harbor, the magnitude of the duties of an executive in New York make the problem most difficult. In the smaller ports—even in San Francisco—economy demands that the expensive outlay for starting an accident prevention bureau be spread beyond one company; in New York, a small company—according to New York's standards—is plenty large enough to employ a safety engineer and staff of its own.

This produces certain natural jealousies, and as rugged individualists, each company feels its methods are best, and jealously competes in safety, as in other lines. To cover New York Harbor alone, an accident prevention bureau with as large a staff as the whole bureau on the Pacific Coast would be needed, and would cost more.

I venture to make one further assertion. The Longshoremen and Harbor Workers Compensation Act empowers the Federal Employees Compensation Commission to study safety and make recommendations to employers and to Congress. They have studied and are studying and are compiling statistics, and if you do something, as has the Pacific Coast, the Commission may perhaps continue to let you run your own affairs. But if you do not do something concrete, by way of unified accident prevention, and standardize, as the Pacific Coast—and do it soon—I fear, and predict, the Commission will take from you your opportunity of doing your own work for yourselves.

The present Commission, under the chairmanship of Mrs. Jewell W. Swofford, has shown great intelligence and cooperation,

and has led, but not driven, the employer and the employee. We have an obligation to justify the Commission's faith and forbearance, and I hope that the Commission will remain as presently constituted for many years, and that the Commission, however constituted, will feel justified in retaining its present attitude. But we must realize the possibility that even this Commission may decide that the employers are not making sufficient effort; even this Commission, and possibly one not so able in the future, might deem it expedient to recommend to Congress a Safety Code, which if passed by Congress, would have the force of law and which would have as one undesirable feature the impossibility of change or amendment except by Congress itself. Your safety rules would then be frozen. Certainly our opportunity is to do as was done on the Pacific Coast, frame our Safety Code with the advice of our own practical superintendents and practical representatives of our Labor and the Union delegates; then the finished code is a voluntary code and is observed without driving and penalty, and hard feelings.

WEDNESDAY AFTERNOON SESSION

October 13, 1937

What Insurance Carriers Can Do to Prevent Accidents in Maritime Trades

By CAPT. EDW. C. HOLDEN, JR.

Manager, Safety Department, United States P. & I. Agency, Inc., New York City

Although industry ashore has been studying and applying technical measures to solve the accident problem, the steamship industry of all nationalities, until recent years, has lagged far behind in these matters.

The American steamship industry has been the pioneer in development of safety engineering as applied to ship operations, largely through the instrumentality of marine insurance safety leadership which has

promulgated safe practices among their assureds.

We are facing a new era through the medium of safety education in overcoming reactionary traditions of the sea, with their unsafe practices. Steamship men who opposed anything and everything new are now endeavoring to cooperate so that their ship operations will be safely and efficiently conducted. The persistent endeavors and manifestations of good faith on the part of the

American marine insurance institution have been responsible for this successful accomplishment. We must also extend the industry's appreciation to the excellent work of the Accident Prevention Bureau on the Pacific Coast. Through the medium of the National Safety Council we have been able better to coordinate our activities.

Purposes and Policies

It should be the purpose and policy of an insurance carrier to furnish its assureds a safety engineering service which will scientifically develop and establish safety education principles, safe practice standards, health data, and information pertaining to living and safe working conditions. These measures are accomplished through study and analysis of assureds' operations. It is a highly developed consulting service in safety engineering and a practical guide toward safe and efficient operations.

But the service provided by the insurance carrier can only make recommendations; application is entirely the responsibility of the steamship managerial organization.

The effectiveness of a safety program, therefore, is proportionate to the ability of steamship management and the extent to which they give it their attention. In all the details of an insurance carrier's procedure in providing assureds with safety engineering service, the position of an interested consultant for efficient management is maintained.

Three factors are involved in steamship accident prevention—safe ship, equipment, safe methods, and safety-minded men. These factors are functions of steamship management and are factors in efficiency as well as safety.

Management Responsibility

We emphasize the psychological factor in connection with these elements. Unless men aboard ship are convinced of the sincerity of the steamship company's top-management in their safety welfare, by their providing safe equipment, it is impracticable to enforce safe working practices.

For example, we have found that some ship purchasing agents in order to keep expenses down, have furnished vessels with

"safety" goggles of the five and ten cent store variety. In such cases, the safety requirement that men wear goggles when chipping and scaling or working at the emery wheel, has been largely disregarded, and continued eye injuries have resulted. This is but one of many cases at point. It calls for better coordination between the operating and purchasing departments ashore.

Management achieves the best results by anticipating accidents and by removing hazards before injuries occur; this is accomplished by installation of mechanical safeguards and by directing the accident prevention program in cooperation with the insurance carrier. Management should recognize that the insurance carriers have a broad experience among many fleets and their safety engineering service can provide information for anticipating conditions in advance of accidents. How many times do we hear the old story "what you say is probably true, but it has never happened here." Consequently practical safety measures are not taken until accidents occur. We found this situation, for instance, when we first recommended the adoption of safety belts for men working overside or at hazardous elevations.

Some operating department heads (deck, engine and stewards) have false ideas on economy. Supplying new and safe working equipment or mechanical safeguards is charged directly against their department, hence their opposition to safety—it costs money. If an accident occurs as the result of their operating inefficiencies, it is simply a matter for the claims department to handle with the insurance company, and the operating department slips out from under.

The solution to this problem is for steamship management to charge the cost of all accident claims to the operating department concerned.

Safety Engineering Service

The insurance carrier's safety engineers become acquainted with problems confronting not only the shore operating staff but with department heads aboard ship and with officers. They become familiar with the characteristics of the management, the vessels, and the personnel. No two ships are alike. Safety engineers develop as full an understanding of each situation as is possible.

Systematic ship inspections by the insur-

ance carrier's safety engineers are a great incentive toward creating ship safety efficiency. Periodical check-ups have the effect of keeping all concerned on their toes for the removal of accident hazards.

The ship inspector must not only be thorough but also thoroughly trained in detecting unsafe conditions and unsafe practices; such training is acquired only by experience in many different operations. Far too often, we find marine superintendents, port captains, superintendent engineers, and port stewards overlooking ship hazards due to concentration on other problems; they may know of the hazards but have not been trained to recognize them. This is often equally true of shipmasters and officers confined to but one field of operation for many years.

Ship inspections must cover hazards involved in rigging and handling cargo gear, condition of ship's equipment, hatch covers, ladder rungs, standing and running gear, gangways; in oiling winches, electrical hazards, fire hazards, maintenance operations, use of boatswain's chairs, stagings, deck conditions, engine and steward's department conditions, machinery guards; and in other sources of danger.

It is desirable to know not only the conditions existing at the moment of inspection but to form a judgment as to probability of their continued effectiveness and use when the vessel is away on a voyage and removed from the eyes of a safety engineer. Ship housekeeping conditions receive particular attention.

The attitude of the master and his officers relative to safety problems is studied and noted. Officers are given a liberal course in safety education through cultivation of their confidence and interest in safety engineering. Of course, there are often limitations as to such efforts. The safety knowledge of a department head aboard ship and his ability to control subordinates is most essential; these requirements are met by trained safety engineers.

Safety recommendations provided by insurance carriers are the result of coordinated study by the inspecting safety engineer. Thus, the complete experience of an insurance carrier is applied to each situation. Recommendations are kept within bounds of practicability and also take into account the fallibility of human nature.

Safety Organizations

To attain ship safety efficiency, each vessel should have a safety committee which meets regularly to consider safety problems and make recommendations to the management. The insurance carrier should establish uniform standards for these safety committees and the minutes of each meeting should be prepared in conformity with these standards.

An example which we have established is as follows:

- (a) Chairman—master.
Secretary—Selected by master.
Members—All officers who are off watch.
Members—Boatswain and selected crew representatives.
- (b) Read and approve, or amend, minutes of previous meeting.
- (c) Unfinished business: Note action taken or recommendations made at previous meeting. (Follow up details.)
- (d) New business: Discuss and analyze each accident which has occurred since previous meeting, taking such action to prevent a recurrence as seems proper to the Committee, both by way of remedying physical conditions and by instructing the crew in the avoidance of hazards.
- (e) Discuss and analyze "near accidents."
- (f) Bring up, discuss and act upon any safety suggestions, recommendations or new ideas for educating the crew in the safety program.
- (g) Hold a general discussion of ways and means for accident prevention.
- (h) Make a general safety inspection of deck, engine and stewards' departments periodically, especially covering conditions of working places and of gear and equipment.
- (i) Check up on any slackening in use of safety measures by the crew.
- (j) Enter into the minutes any suggestions and ideas that have proved effective in the ship and which may be of value to other ships in the fleet.

This procedure has been put into effect by many shipowners with unquestionable success.

Similar attention to employer-employee relations may disclose to each employer important opportunities for progress, mutual understanding, confidence, loyalty and goodwill.

It is a proper question how far to go in thrusting information about the business upon the workers. There is a risk that the agitator will misinterpret. The greater risk, however, is lack of reliable information in the hands of workers. With facts, they themselves may combat irresponsible or self-seeking agitators. The employer is the only one who can ensure correct information reaching his workers as an antidote for misinformation.

Indifference on the part of management usually encourages men to combine against it and to make unreasonable demands.

A company's efficiency and prosperity are best evidenced by the instant and sincere cooperation between employees and management.

Organizations Ashore

In order that safety organizations aboard ships may be properly directed, it is necessary that a shore safety organization be established to pass on all ship safety minutes, taking action on all recommendations and advising ship organizations relative thereto. We have found this plan successful.

The shore organization should consist of the following members:

- (a) Vice-president in charge of operations. (Chairman)
- (b) Marine superintendent and port captain.
- (c) Superintendent engineer and his assistants.
- (d) Port steward.
- (e) Pier superintendent.
- (f) Secretary to keep the minutes.

Some apparently unsound recommendations may be made by ship Committees.

However, each case should be thoroughly discussed and explanation made. This will insure confidence in the management by the men afloat.

Safety Posters

To reduce frequency of accidents caused primarily by the men themselves—by carelessness, heedlessness, and inexperience—it is necessary to acquaint them with the hazards they encounter, instruct them thoroughly in the best methods of performing their jobs, exercise proper supervision over their work, and especially to create a safety consciousness.

An educational program of this kind involves many factors both because of the diversified nature of the jobs which the men perform and because of the variety of minds and temperaments. One of the most important factors is the safety bulletin board for safety posters.

The marine insurance carrier should supply a monthly safety poster-bulletin service. Posters should be original in design and be prepared by safety experts.

The master, department heads and ship safety committee should see that bulletin boards are placed where they will receive the most attention, and that the safety posters are changed regularly. To attract attention to the bulletin boards, the insurance carrier should also furnish current news posters.

These safety principles, procedures, and practices have passed the experimental stage and can be regarded as tried and established doctrines for the practical advancement of safety of life at sea. They furnish a safe medium for protection of passengers, crew, cargo, and the ship itself. They have brought the problem of safety out of theory and speculation into reality.

Safety engineering, apart from the humanitarian interest, means increased profits. Continued progress in ship safety must be regarded as the key to success in operations, in development of proper employer-employee relationship, and in the achievement of public confidence.

A Plan to Create Interest of Seamen in Prevention of Accidents

By A. O. WOLL

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Organization is the first essential of any ordered safety program. In our company there is a central safety committee, comprised of all operating department heads of the company, dealing with every phase of the petroleum industry. A port safety committee handles marine department safety. Ship safety committees are the media for reaching the ships' personnel.

A high degree of enthusiasm of the management in accident prevention work (which is a vital essential) sets the pace. Pride or shame in results of continuous record competition departments is usually sufficient "needle" to inspire men of the calibre of department heads to their best performance.

Marine management is directly responsible for its departmental results. It functions through the port safety committee comprised of practical port engineer, port captain and representative operating personnel. The port safety committee is responsible for the sustained enthusiasm of every ship safety committee and utilizes most of the tried practices or devices of accident prevention applying to ship and (particularly tanker) operation and maintenance.

The ship safety committees are the real backbone of the marine safety movement. They have proven so successful that their activities have been allowed and even encouraged to spread from purely safety matters to matters of general operating practice.

The ship safety committee existing on each of our ships as presently constituted embraces only the officer personnel but all officer personnel participates. The second and third mates and assistant engineers rotate necessarily as meetings are held at sea. This gives all officers the benefits of inspiration and discussion to be derived from the meetings. The unlicensed personnel are not included in the ship committee. (This is a controversial point. Much practical good would no doubt issue from attendance of unlicensed men but we decided against it for the reason that their attendance might serve to restrict frank discussions where ship's liability possibly was involved and all are agreed that frankness is essential to arrive at accident causation.) Officers are

expected by constant contact to bring to the meetings the ideas and reactions of the unlicensed men. Moreover, calculated to minimize loss from the absence of unlicensed men from the committee, a \$5 award is made monthly for the best safety suggestion received during the month.

Our program starts when new employees are hired. To impress them with the importance of accident prevention in our fleet and give them some immediate groundwork in safety, they are required to sign a safety declaration or pledge to abide by a very definite set of smoking rules posted aboard our tankships, to familiarize themselves with and obey our general rules of safe practice, to act as "their brother's keeper" where necessary in matters of safety, to think before they act, and otherwise to conduct themselves in a manner that will contribute to the safety standing of the ship.

Next it becomes the duty of the officer under whom the new employee is assigned to work, to sell the new man upon the idea that safety work is essentially in the interest of the worker and for him is common sense and simple good business. The more general precautions directly connected with the particular worker's immediate duties are outlined and the officer then takes particular care for the necessary time to observe the new worker's aptitude for safe practice and to guide him away from any bad practices.

In late years of our accident prevention work we concentrate chiefly on training the individual, having gleaned from the records, which are essential to any intelligent program, that the great preponderance of accidents result from human frailty. Many years ago the prelude of our safety campaign was to make the ships safe—to give the men a safe place in which to work—by providing all reasonable mechanical guards, devices and equipment for safely performing their duties. Occasionally we still find minor conditions which require mechanical correction but by and large results are now chiefly to be attained through education of the worker in safe practices.

As a vehicle for this education, the ships' officers, if themselves sold, educated and

trained in safety, are naturally the most effective. But as a supplement to this means of educating the worker, complete practical and effective Safe Practice Pamphlets and instruction books are invaluable, and there is a dearth of such literature in the marine industry.

Two such outstanding contributions however were made during the past year by the U. S. Department of Commerce, Bureau of Marine Inspection and Navigation. They are entitled "Manual for Lifeboatmen and Able Seamen" and "A Manual for the Safe Handling of Inflammable and Combustible Liquids." The Marine Section, N.S.C., might well officially commend the Department and Bureau for these manuals. They serve the manifold purposes of manuals or instruction books, cause desirable familiarity with the laws relating to seamen, and very definitely are real safe practice pamphlets.

Two other outstanding contributions of this character that have come to my notice were by the Union Oil Company of California. These are two illustrated pamphlets pertaining to the oil tanker field entitled "Tanker Safety" and "Barge and Motorship Safety." Unfortunately, so far they have been employed only in a limited manner, their use being confined to the Union Oil tanker fleet. This however, is not because of any selfishness on the part of the sponsors who have long since announced their willingness to donate their work to the general cause of safety.

Besides the direct educational benefit of definite printed rules, they often aid in fixing responsibility for accidents caused by gross carelessness or deliberate disregard of rules. We believe in a measure of penalty for accidents from such causes, severity of the penalty ranging from dismissal to suspension for varying periods of time, depending upon all of the circumstances involved, but particularly the past record of the offender. To be effective, punishment must be meted out as quickly as possible before the remorse occasioned by responsibility for the accident disappears. It must be impartial and consistent. On the other hand, we advocate certain forms of recognition or reward for outstanding safety performance, not to the extent of buying Safety but to spur it on.

The ship safety committee is required to report on every accident occurring on the ship. For personal injuries a searching form is provided which insures that all the factors

usually contributing to injuries have been explored. The injured's version is given, followed by the version of his superior, after which the ship committee is required to make definite analysis as to cause and recommendations to the Port Committee as to remedial action.

R. H. Dana wrote of the sailing ship days—"If a man comes within an ace of breaking his neck and escapes, it is made a joke of, and no notice must be taken of a bruise or cut." Our policy is the other extreme from this state of affairs; near accidents are treated like real accidents for they are often potential of more serious consequences than many a real accident. The difference between near accidents and real accidents is usually simple LUCK, an element not to be reckoned with in accident prevention work.

Meetings conducted as forums (having assigned a subject to an individual officer some time previously for research and study) often stimulate real thought by individuals especially when there are signs of lag for lack of immediate business to transact.

While the ship safety committee is conceded to be the backbone of any accident prevention program, the Port Committee is required to inspire and assist the ship committees to attain maximum productivity by appeals, education, contests, discipline, responsibilities, rewards. Some of the devices employed are:

Prompt disposition of recommendations received from the ship committees with sympathetic treatment.

Circulation to the entire fleet of a condensed analysis of all suggestions, the ship committee's recommendations and the port committee's action and instructions for the treatment of the particular condition on the entire fleet.

Insistence upon a monthly meeting and report from each ship. Condemnation of barren reports as indicative of lack of interest or observation, or both. Where a barren report is made, suggestions are conveyed to the Ship Committee calculated to revitalize their activity. On the other hand, upon receiving minutes of a ship committee's meeting which indicate unusual interest and activity, immediately address a commendatory letter to the ship committee.

Supply current poster material and safety literature.

Publish a house or department organ disseminating general safety hints and inspira-

tional and educational matter, analysis of accidents, standing in inter-ship record contests (a paper can be gotten out surprisingly cheap if necessary).

Award card certificates of safety to ships' officers (foremen) attesting the completion of various goals of man-hours worked by employees under their immediate supervision. These card certificates are signed by corporation officials of rank depending on the number of man-hours so reached. They appeal to the pride of the officer and inspire him to greater effort. Their value is enhanced by making the award an occasion of praise at the current ship committee meeting. These attestations of actual safety performance have come to be valued and prized by the officers as supporting recommendations for any future employment.

Furnish records and analyses indicating the causes contributing to injuries and urging sustained concentration on them.

Furnish statistics showing what sum of money both the employees and the employer lost and wasted as the result of accidents.

Inspire them to vigorous and sustained action by an appreciation of the personal gratification to be derived from the consciousness of life, pain and money saved their fellowmen; and the pride to be derived from a job well done instead of sloppily performed.

Urge them constructively to destroy

fatalism in old-timers, to discourage contempt of risk growing out of intimacy with hazards and derision of accident prevention efforts, pointing out the inexorable law of averages.

Bear down on officers who practice unsafe or sloppy habits.

Advertise the safety cause by making the most of outstanding individual performances or suggestions.

Spotlight a glaring and common unsafe habit occasionally by causing a conspicuous momentary cessation of operations and capitalize it by brief instructive explanation or demonstration.

Obviously, contentment of men induces the best mental condition for the elimination of accidents and their reasonable physical comforts should be guaranteed.

The measure of results obtained from any of these instrumentalities is directly related to the amount of intelligent and persistent effort exerted in their application. One frequently hears complaint that such and such a scheme was barren of results. Often it isn't the scheme of things so much as the "follow through." To illustrate, the ship safety committee idea is often tried and only desultory results are obtained because the management is indifferent about barren reports received from the ship safety committees. And so we find, with usual exceptions, that results reflect the management.

Building Safety in Ships

By L. WESTLING

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The modern vessel has become a complicated assembly of an endless number of details, most of which have in their development been subject to influences which are primarily economic in nature. Through extensive research we have developed hull forms of high propulsive efficiencies, power plants of high thermal efficiencies, vessels of excellent structural efficiency, and all manner of means have been forthcoming for providing effective service to the passenger.

But details which involve safe conditions for the individual passenger, seaman or longshoreman have been somewhat restricted

in their development because of the traditional manner in which such things are done by the industry. The proposed United States Merchant Marine, if it becomes a reality, should be made the safest on the seven seas.

Such a vessel as we hope to see developed will have little difference in appearance to other modern ships, and the arrangement cannot differ greatly. But closer study should show new details which will reduce accident hazards to a minimum. Like all vessels it will be a unit composed of a steel structure enveloping fuel tanks, water tanks, cargo spaces, machinery, and living quarters,

each division having its peculiar type of accident hazard.

Tank spaces for example generally represent dangers peculiar to repair work, particularly those in which the fuel is bunkered. Inner bottom tanks represent small hazards in falling because of their small vertical dimension. But there are dangers within which can be minimized principally through the precautions of those who work in or near them. Tanks which have contained oil are not easily made gas free, due to the difficulty in adequately cleaning and due to the tendency of the gases to lie in pockets.

Access to such spaces is through a manhole, and the location and number of these openings should be the result of some study of interior and exterior arrangements. A manhole should be of ample size to give easy access to a large man, its dimensions should be not less than 14 x 18 inches. There should be a sufficient number and in such locations that ventilation of the complete tank is possible. Where practical the openings through the interior structure and framing should be so arranged to provide easy access and permit active air movements.

Limber holes should be so located to provide quick and effective drainage. Where hinged manhole covers are installed they should be so located that they lay horizontally when in the open position, precluding the possibility of their being accidentally closed. When possible and practical, guards should be provided for temporary erection about an open manhole.

So-called deep tanks are more easily freed of gases, but the falling hazard is greater. Access is generally through manholes located on the tank top, and the location of the ladder underneath should be such that one who enters should not have to hunt for the rungs nor affect any contortions to negotiate his entry or exit. The ladders should be foot-sure, even when oil coated.

When it becomes necessary to install access openings in the bulkhead of a tank, its location should be such as to preclude possibility of anyone standing upon makeshift ladders or boxes. Where such heights are necessary access platforms should be provided of a permanent type.

Fresh water tanks are subject to the same rules, particularly ballast water tanks where the air may become too foul for safety.

Access openings of any description in

decks or tank tops should be carefully located with respect to deck ladders, passageways, and where possible with respect to adequate illumination.

Closely associated with the manhole are the expansion and access trunks, which usually terminate in a deck coaming. Trunk coamings should never be less than 36 inches in height, which will minimize the hazard of one losing his balance when working in way of such an opening. The cover should be subject to the same rule as the manhole cover to prevent accidental closing. When the covers are too large for ease of handling, stanchions and rigging should be provided for opening and closing with tackle. A trunk meant for access of men should be not less than 24 x 24 inches, unless piping or other obstructions should require larger dimensions, to permit free movement of arms and legs. The ladders in such trunks should be foot-sure and ample toe space should be provided.

In close relation to the tank structure we find the anchor chain locker, which is a danger spot on many ships. Chain lockers of excessive width, or of inadequate depth, require that the seaman must go below to stow the heavy chain as it is brought in. The tipping of piles of chain, the jumping of the chain over the wildcat with the resulting sudden out-rushing of the stowed chain, are not uncommon hazards aboard ship.

Such a danger can be completely eliminated by the construction of a locker of proper dimensions and capacity. A locker should have not less than 150 per cent capacity for the chain which the vessel is required to carry. Access to such a space should be through a generously sized hinged manhole. The ladder should be of the plate type with half-moon foot openings to prevent damage by the heavy chain. The manhole should be equipped with a protecting rail or guard.

Other spaces which are often accessible only by means of access trunks are steering gear and pump rooms. These trunks generally should always be of such a dimension that a proper arrangement of sloping ladders and gratings can be installed. The ladders should not exceed two decks in length, and they should not be of greater slope than can be safely negotiated by a man who may have in one hand tools or supplies. The trunk should have adequate illumination and lifting gear should be installed overhead for

handling of the heavier pieces of machinery.

Deck openings are necessary evils aboard ship, not the least of which is the cargo hatch. These openings are responsible for many serious accidents. Much study has been given to this item in hopes of reducing its hazards but little improvement has been forthcoming due to its particular function and purpose. The depth of the weather deck hatch coaming, and its height above deck, have minimums set up by strength requirements and by load line regulation.

The hatch coamings in 'tween deck spaces represent a somewhat different problem, in that with limited head room the coaming must be low to permit free movement of cargo to the hatch way. Consequently, when such a height is not possible the other extreme must be attained to minimize tripping hazards. Where possible 'tween deck coaming should be flush with the ceiling (planking) where laid; or, where the steel deck is bare, a low pitch ramp of steel should top the hatch angle.

When it becomes necessary to work cargo from lower levels and to leave the 'tween deck hatches open, there should be stretched tightly around the open hatches, guards of chain well secured to the ship's structure.

Where hatchways must be trunked through one or more decks, and where hatch covers are used at its lower levels, the trunk should be stopped in way of the covered level with sufficient walkway to permit a man to handle strongbacks or boards without danger of falling. Should conditions make a stepped trunk impossible a strong disappearing walk-way should be installed. In either case recessed hand-holes should be provided around the sides of the trunk.

The development of improved hatch coverings has been a problem not easy of solution, and has in general been stalemated by practical barriers. While weather deck coverings have seen some recent improvements in the form of steel panels, the 'tween deck hatches are almost universally equipped with the conventional strongback and hatchboard assembly. Strongbacks, because of the loads and abuses to which they are exposed, are of heavy structure, and as they make the complete span of the hatch, prove to be difficult to handle.

When properly built and maintained they must fit neatly into the coaming sockets and provide ample load bearing surfaces. The sockets should be so designed that it is not

necessary for the strongback to be dropped into the slots to obtain full bearing. Strongbacks should be equipped with web openings and winch bridles of chain, which will prevent tipping when suspended, and a lanyard should be attached for safe control of the piece. The ends should be fitted with protected sliding bolts which will prevent the strongback from being lifted by a draft of cargo when the hatch is worked in sections.

Many attempts have been made to improve upon the hatch covering board, but little success has been made, except perhaps in minor detail. The use of pressed metal in lieu of wood, and the capping of the ends of wood boards with iron or steel have produced hatchboards which are easily maintained and the ends of which insure good, full bearing surfaces. When practical the strongbacks should be so spaced throughout the ship's hatchways that all hatchboards will be of the same dimension and will fit in any assembly. Where hatch lengths will not easily provide this, one row of boards should be of such extreme difference that a partial landing of the ends will not be possible.

Heavy responsibility lies upon the ship's officers in the proper maintenance and use of hatch boards and chain guards, for negligence in their placement has caused many a serious and fatal accident.

Since time immemorial access to cargo spaces has been by means of hatchway ladders, and despite the obvious hazards it represents we find them in general use. These ladders are frequently difficult to negotiate because of offsets at the coamings and being exposed are generally distorted or damaged by cargo, thus magnifying their dangers. Access to cargo spaces should be gained by means of well protected manholes and ladders, offset at each deck level. They should be arranged to permit one to face the hatch, if it be nearby, and designed to prevent fouling of ladder or rungs by stowed or shifted cargo.

When access is gained through bulkhead doors, the sills should be as low as is consistent with regulations or local conditions and ample head room should be provided. Doors not having high coamings should have permanently built non-slip ramps.

Of all hazards found on deck, cargo gear is the most serious and the most difficult of solution. It has been subject to the "rule of thumb" more than any other equipment

aboard ship. The original lay-out for cargo gear should be the result of extensive and accurate calculations and observations. Overloading, and poor control of hoisting machinery, subjects cargo gear to excessive and incalculable stresses and it behooves the designer to employ generous factors of safety in his calculations. Precedent should have little influence upon design.

Since the invention of methods of producing tubular steel booms, there has been little justification for the existence of the wooden boom. The strength of wooden booms can be approximated when new, but when age, weather, and stresses have had effect, their strength becomes an unknown factor. The success of the wooden boom has been largely due to a great but unknown factor of safety which experience has dictated. Steel booms have known and calculable strengths, and their failure through stressing is slow enough to permit all hands to clear.

Cargo boom fittings should be forged from an approved alloy steel, and subjected to severe tests for flaws. Links, padeyes and similar rigging fittings should be oversized to permit a safe reduction of section due to wear.

Standing rigging wire should be carefully selected with respect to strength and flexibility. It should be expertly spliced in lieu of the use of seizing, or clamps. All thimbles and fittings should have proper radii to prevent stressing. While not pleasing to the eye, we can look forward to the general acceptance of self-supporting structure which will practically eliminate the use of standing rigging.

Cargo falls should be rove through blocks whose sheaves are of ample diameter to prevent fatigue of strands, and patent heel blocks which do not whip in service should always be used. Cargo falls should be protected from the edge of hatch coamings by hatch rollers, which equipment should be so designed that falls or cargo cannot be fouled, endangering those working below.

Cleats, pads, bitts and other deck fittings should be placed where they give the best and safest results in working cargo, but when practicable they should be kept clear of walk ways and mounted on bulkheads or bulwarks. When mounted on deck they should be painted white to make them more visible in the darkness.

Cargo hoists are subject to considerable refinement, and where possible they should be electrically driven. The electric controls should have sufficient number of stops to simulate the desirable characteristics of the steam hoist. Steam hoists should have reciprocating parts under guards, and like the electric unit, the gears should be enclosed. Lubrication should be possible without attendant hazard. The controls should be so located that a single operator should have absolute control over the movement of the cargo hook, and the load should be within his sight as much as is practical.

The hazards to which crew and passengers are exposed are by no means confined to weather decks, the living quarters contributing heavily to the accident records. Fortunately they yield more easily to solution than do those outside. The most common accidents are slipping or tripping with consequent falling. This type of accident seriously involves the passengers, many of whom are not familiar with peculiarities of ship construction or with the action of a vessel in a sea way.

The entrance doorways from weather decks are responsible for many accidents. Their sill heights are usually high, to meet regulatory or practical requirements, and to one not familiar with such construction it represents a tripping and falling hazard. Inside entrances to staterooms or public rooms should have little or no threshold. It is not uncommon to find high sills in these doorways, their existence being due more to tradition than to necessity.

For convenience in housekeeping a small raised sill is desirable at the door of a bathroom or toilet. A curb is a necessary part of a shower bath compartment; such a curb or coaming must not present a sharp edge, but may be topped with slotted pipe, a flange or with tiling. All door treads should be of distinctive color for the sake of visibility and of course adequately illuminated.

Not unlike the high door sill, the coaming usually found at the top of weather deck ladders or stairs represents the same dangers. These can usually be cut flush to the deck level by compensating for strength under deck. When such a procedure is not possible a low pitch non-slip ramp should provide equivalent safety.

The ever present slipping hazard is one that reflects upon the character of deck coverings, as far as construction is con-

cerned. No passenger and where avoidable no crew member should have need to traverse a bare deck plate. Such a surface becomes polished and slippery when worn or wet and becomes particularly dangerous to the wearer of rubber heeled shoes. Weather doors should have non-slip treads or deck coverings on either side. Ladder treads should be similarly equipped.

Deck coverings of rubber or linoleum are very desirable for decorative features and the designer must depend upon the operator to provide reasonable safety in preventing coatings of wax polish.

Ceramic unglazed tiling for baths, wash rooms, etc., provides a safe deck covering, which can be improved upon only through the addition of abrasives to their composition. Galley and pantry deck coverings are subject to an accumulation of cooking fats and other materials, which add dangers to the other natural hazards of such a place. Tiling with small and sharp grooves are satisfactory from a safety point of view, but difficult to keep clean. Terrazzo decking with a liberal content of abrasive or scoria presents the best compromise between safety and sanitation, but it does take heavy toll of kettle bottoms—a lesser evil.

Maintenance of a vessel is a continuous and oftentimes a hazardous procedure, particularly the work that must be done overside or from elevated positions. Safe means for reaching such places should be provided when the ship is built. Steel mast ladders should displace the shroud ratlines which are notoriously neglected. Inside ladders and walkways should provide safe access to stack tops, and clips, sockets, and grab rails should be installed in way of bridge fronts, superstructure, light and air trunks, to which the maintenance man can secure his staging, man's chair or safety belt.

The doors, ladders and gratings which provide access to machinery spaces represent the same type of hazards as similar equipment elsewhere aboard ship and they yield to the same solutions in providing safety. However the dangers are magnified due to the proximity of moving machinery and to the presence of lubricating oil which makes surfaces slippery.

Ready and safe access should be provided to all parts of the machinery spaces, including the different working levels about the main and auxiliary machinery, to various control valves and equipment, to boiler

drums, stop valves and gauge glass fittings.

Floor plates in machinery spaces should have a non-slip surface even when coated with oil. This is difficult of solution, although recent attempts have been made to improve upon the diamond plate, which has been a notable failure in providing safe walking surfaces. Floor plates should be well secured and supported, and if conditions make necessary that sections be portable, they should not be too large in section. However, the concealed piping systems should be equipped with accessible valves or stems which would make frequent plate removals unnecessary. Guards should be provided for such openings and they should be well lighted. Shaft alley walkways should be of steel with flanged edges, and hand rails and shaft coupling guards should be installed.

Like the mainshaft couplings all moving machinery should have guards which will prevent one from being struck by or thrown into machinery, which is a very real hazard when the vessel is in a seaway. Such guards must be designed with the thought that they may be frequently removed and replaced to facilitate repairs.

Machinery spaces should not be crowded even though revenue space is sacrificed. Spacious engine rooms are invariably safe engine rooms, and loss of revenue is largely compensated in the reduced costs of making repairs in uncramped quarters. Fortunately, progression in machinery development has been in the direction of enclosed moving or revolving parts, and the engine rooms are rapidly becoming one of the safest places on shipboard.

But with this development higher pressures and temperatures have become commonplace, and with these we find great possibilities of serious accidents. Regulations point the way to safe design, but thoughtful details will make safe operations more easily attained. The provision of locking devices for boiler and other stop valves, the proper labeling of all valves, the marking of pipe lines with distinctive colors, stencils or symbols, contribute to safe procedure.

Care should be exercised in the properly insulating of hot pipes and surfaces, and pressure relieving devices are essential to safe operations. There should be provided also proper ventilation of spaces which might accumulate vapors or gases from fuel oil, lubricating oil, or that might become too heated for safe occupancy.

Refrigeration machinery spaces should have adequate safeguards against the dangers of leaking refrigerant. Where possible on freight ships, and always on passenger vessels, the refrigerant should be nontoxic. Ammonia as a refrigerant has very desirable characteristics, particularly in tropic waters, and when employed, the refrigeration machinery rooms should be enclosed and separated from other spaces. It should be equipped with a sprinkling system which may be operated from without the space. Regulations and good judgment demand that gas masks be kept near at hand.

Electric generating and distributing systems when installed according to the rules and regulations set up by the various agencies represent small hazards, but when potentials of 230 volts or more are employed, special care must be provided to insure the safety of operating personnel. Deadfront switchboard panels are desirable and there should be adequate space behind the board for repairs and trouble-shooting. The area back of the switchboard should be enclosed by mesh guards and provided with locks. When livefront switchboards are installed a guard rail should be placed to support the operator, and an insulated grating should cover the deck. Lights should be installed

over the boards which are supplied by current from an independent source.

Illumination of all parts of the ship should be in accordance with the accepted standards, and upon completion of the vessel, a thorough study on conditions should be made of the efficiency of the lighting arrangements, and alterations and corrections, which are not apparent on the plans, should be made. Adequate light is perhaps the greatest of safeguards.

Machine tools and other similar equipment throughout the ship should be driven by direct connected and independent electric motors. Drive belts have no place aboard ship.

Safety in machinery spaces is not possible without adequate and well located lifting gear. The store or tool room should have tackle and hoists capable of supporting the heavier pieces of equipment during repair and proper connections to the ship's structure should be provided which will support and steady these pieces during repairs at sea as well as in port.

For purposes of regular maintenance duties, in the engine casings, ship's side or at boiler fronts, there should be installed pads, sockets and other facilities which will support stagings designed for the operations.

The Value of Safety Posters in Accident Prevention

By FRANK E. AMES

Manager, Safety Department, Lykes Bros.-Ripley S. S. Co., New Orleans, La.

We are reminded of the old adage that a picture is as good as ten thousand words, and undoubtedly this is true; however, in the case of accident prevention, it is also true that there is no way of knowing just how much good safety posters do or how many accidents they prevent. They have become an accepted and necessary part in accident prevention propaganda, and to discontinue their use in any commercial activity would, without doubt, create a void which would gradually become apparent in the frequency record.

You will agree with me that posters depicting traffic accidents are of little value in the safety education of seamen. Posters of this nature certainly do not assist in training

the seaman to beware of the various hazards peculiar to his calling. Neither do traffic posters or those illustrative of hazards in machine shops appeal to the longshoreman whose work and surroundings are vastly different from any other industry with which I am acquainted.

The Poster Committee of the Marine Section has accomplished much in cooperation with the National Safety Council in supplying a series of posters applicable to the marine industry, but the supply of those which present an appeal to both the floating and shore personnel is limited. Therefore, those of us who carry the responsibility of safety education and accident prevention in our respective spheres are handicapped for

material of a type that will convey a mental job to our men in a visual language they understand. The illustration should present a subject or hazard familiar to them in their everyday work and surroundings.

In our operations, we lay great stress on the use of posters on each ship of the fleet, and with frequent changes are satisfied that this policy has been productive of much good in the safety education of our floating personnel. However, with the mental attitude displayed by American seamen both as regards discipline and safety, we are faced with the problem of providing posters which present a safety appeal and, at the same time, endeavor to awaken a sense of respect for discipline.

How can this be accomplished? The same type of poster in vogue for the past several years will not suffice to meet the situation. Whatever the cost may be, we should change our pattern, dispose of the shop-worn goods and start over, realizing that safety appeal must be lifted from drab surroundings and presented in a more striking manner, because the worker of today, especially the younger generation, is not the serious-minded individual of the past decade.

For several months during 1936 the Travelers' Insurance Company provided us with cuts of "OZZIE," a character featured by their safety department, and we published them in our monthly house paper, "Lykes Fleet Flashes." Likewise, a nationally known soap manufacturer has provided us with semi-comic posters advertising their product which we have mailed to the ships of our Fleet.

It is my conviction that these two comics have accomplished more in the cause of safety on our ships than any of the old line type of posters. I have reached this conclusion because of the many comments made by seamen, these comic pictures having appealed to them to the extent that certain careless seamen have been nicknamed "OZZIE." Get the point? The absurd actions of this OZZIE person, strikingly true in everyday industrial life, has made such a mental impression on the men that they were constantly on guard lest they handle their work in a similar careless and ridiculous manner. Likewise, the soap posters with their crude characters aided in awakening safety consciousness to a greater degree than the ordinary type of slogan safety posters.

Now let's consider the longshoremen, the

men who really pile up frequency, severity and compensation, and give us a first-class financial headache. How about posters appealing directly to the men of that craft? Where are they? I have searched high and low without results, and yet there are something like 350,000 men employed in this activity.

Ask the Underwriters whether they are sitting on anyone's door step for the purpose of writing coverage on this industry? Ask them concerning their rates in comparison with the coverage of other industries, and your reaction to their answers will indicate whether or not you have high blood pressure.

And why is this? Simply because the industry from a safety standpoint has been neglected in the sense that posters, appealing to the type of man employed, are not obtainable for the purpose of supplementing verbal appeals and other methods designed to awaken their safety consciousness. We have an elaborate system of bulletin boards at the eight ports in the Gulf at which our ships call, and subscribe to two poster services, but the type of poster provided does not carry the appeal necessary to reach the type of labor employed.

Longshoremen, as a class, are distinct from the types of men found in other industry. The majority of them have had no special training and, aside from the proper stowage of cargo in a ship's hold, their job is that of handling material; almost every kind and class of material known to the commerce of the world. Their work presents many hazards which would not be apparent were they to become expert in the handling of a certain commodity. The safety education of longshoremen therefore requires special effort, and I know of no better way than to appeal to them in a striking manner through illustrated posters that will stop them in their tracks.

Give us a one quarter size bill board type of poster about 30 x 45 inches illustrating in colors the usual type of accidents and unsafe practices during the loading and discharge of cargo, and one poster per week at each loading berth will, in my opinion, do more actual good than 20 small size posters illustrating subjects entirely foreign to longshoremen and safety slogans that 50 per cent of them can neither read nor understand.

When we consider the millions of dollars expended annually on ships and stevedore

payrolls and the percentage of these sums that go for P&I coverage, an economic waste is presented which demands a concerted move toward curtailment.

We all agree that safety is an individual proposition and that it must be sold to our employees. Imagine a manufacturer attempt-

ing to sell his product by the use of 17 x 23 inch or 9 x 12 inch posters. He would get nowhere; and although we are selling a limited amount of safety ideas by the use of the posters presently available, the surface of our opportunity has not been scratched.

Investigation of Personal Injuries Involving Seamen

By GILBERT R. JOHNSON

Secretary, Lake Carrier's Association, Cleveland O.

Obviously, the first step in the investigation of a seaman's accident is an inquiry into the facts. The investigator should be no novice, for it will be difficult, if not impossible, for him to get at the real facts in every case unless he has a pretty good working knowledge of the parts of a ship and the work of seamen. No investigation should be taken lightly. It is the facts in every case which determine the rights of the injured person and in my judgment it is the responsibility of the employer to have developed during the investigation the truth regarding the manner in which the seaman was injured and this responsibility should not be avoided where the facts are unfavorable to the employer's interests.

In many cases of injury the manner in which accidents occur is readily apparent to the investigator. There will be a failure of some appliance by reason of wear or concealed defect, and the rights of the seaman under the law will be very easily ascertained. However, there are numerous cases not involving the failure of equipment, but the act or acts of some other person, or the failure of such other person to do that which he should have done to avoid accident.

I refer to those numerous cases in which there is negligence of officers and members of the crew, and it is with particular respect to those cases that I believe the inquiring person should have a knowledge both of the work aboard ship and the maritime law establishing the rights and liabilities of the parties.

The problem with respect to the investigation of accidents involving conduct of other members of the crew, may be illustrated by a review of some of the cases which have been adjudicated in the courts. In the *Antinous*, (C.C.A.3) 49 F. (2d) 762, a libel

was filed to recover damages for the wrongful death of a seaman, one Boykin, who was washed overboard during a storm.

The vessel, having a cargo of wheat and a deck load of heavy timbers, was caught off the coast of Florida in a hurricane and during the night she was swept by seas which carried away the plugs and canvas covers with which the ventilator drums had been covered. They were all replaced except for one ventilator on the port side, located immediately forward of the bridge. The carpenter made a new plug and the boatswain called Boykin and two others to go with the boatswain out upon the deck load to insert the plug and to make fast the cover over it. The seas were high and breaking in spray over the vessel. There were no life lines strung along the center of the ship or across the deck cargo and as the men were performing this work neither the course of the ship nor her speed was altered. While Boykin was assisting in this work, a very high sea washed over the deck of the vessel and he was carried overboard.

The sole question in the case was whether or not there was negligence on the part of the officers of the ship in requiring Boykin to go onto the deck cargo and perform this work without the speed of the ship being checked and her course altered, so that she would meet the seas and weather under more favorable conditions. The court ruled with the estate of Boykin.

In *Harris, Administratrix, vs. Pennsylvania Railroad*, (C.C.A.4) 50 F. (2d) 866, an action at law was brought to recover damages for the death of a seaman, one Harris, who had fallen overboard by his own misfortune or carelessness. Harris was a member of the crew of a tug which had a car float in tow. It was his duty to cast off the

hawser between the float and the bow of the tug and then walk aft along the deck of the tug and make the tow line fast to a towing post or cleat on that end of the tug.

When Harris reached the stern of the tug, he fell between the tug and the car float through no fault on the part of the tug. While he was in the water, Harris called several times for a line. One of the members of the crew of the tug threw Harris a hawser but no other effort was made to rescue him, notwithstanding the availability of life buoys and other equipment aboard the tug.

The question raised in the case was whether or not, in view of the admitted fact that Harris had fallen overboard without any fault on the part of the tug, there was any duty on the part of her officers and crew to use ordinary care and skill in rescuing Harris. The court held that it is the obligation of a ship "to save the life of a sailor who falls overboard through a misadventure not uncommon in his dangerous calling." The court stated, in effect, that it was the universal custom of the sea for a ship to put forth her best efforts in rescuing the life of a member of her crew, who, through inadvertence or misadventure, falls overboard.

A novel question was presented in *Jamison vs. Encarnacion*, 281 U. S. 635. An action was brought by Encarnacion, a member of a crew engaged in the loading of a barge at Brooklyn, against Jamison for the negligence of his foreman in assaulting Encarnacion. The facts were that, while the foreman was directing the crew in the performance of their work, he became angered with Encarnacion and struck him. The question was whether or not the employer, Jamison, was to be held negligent for the assault of the foreman. Jamison contended that the foreman's act was in excess of the authority which was conferred upon him as a foreman. The court, however, held that the assault was committed in the course of the foreman's duties and in the furtherance of Jamison's business; that the assault was a negligent act on the part of the foreman and that, therefore, Jamison was liable in damages for the act of his foreman.

Cortez vs. Baltimore Insular Line, 287 U. S. 358, defines when illness becomes injury within the meaning of the maritime law entitling seamen to compensation for injuries caused by negligence of their employers. In that case a deceased seaman, one Santiago, became ill with pneumonia while the vessel

on which he was employed was on a voyage from Florida to New York City. The ship was not put into port to place Santiago ashore; nor was effort made to obtain medical assistance from shore for the seaman. Upon the arrival of the ship at New York Santiago was placed in a hospital, where shortly thereafter he died from pneumonia. The question was whether or not the failure of the master to obtain medical treatment for the ill seaman constituted negligence for the consequences of which the shipowner was obliged to respond with damages.

It was the opinion of the Supreme Court that the act of the master constituted negligence which resulted in injury to the seaman within the meaning of the act entitling a seaman or his representatives to recover damages for injury occasioned by negligence of the shipowner.

In each of the foregoing cases the investigator should have possessed training in the character of the work of the ship involved and the duties and obligations of the employer or shipowner to the injured seaman.

I would not go so far as to say that no one but a person trained in the law is capable of rendering any service in connection with investigation of accidents to seamen. Experience on the Great Lakes has demonstrated that among themselves members of the crew of a ship can do a very good job of investigating accidents.

About twenty years ago the Welfare Plan of Lake Carriers' Association recommended to member shipowners that a Safety Committee be organized on each ship. These committees consist of six members, three from the deck department and three from the engine department. With the exception of two licensed officers, including the one lowest in rank from the two departments, the personnel of the committees consists entirely of unlicensed men. Originally it was proposed that these committees meet once each month for the purpose of discussing ways and means of making the work of the ship safer for the men who perform it, and promulgating suggestions or rules for the benefit of the entire industry. In later years some of the shipowners have made the Ship Safety Committees investigating bodies.

When an accident occurs on board ship, the committee is immediately convened. They visit the scene where the accident occurred, examine the equipment, interview the eye witnesses and, based on this investiga-

tion, submit a written report to the master, who in turn submits the report to the shipowner. This method of investigation serves the useful purpose of presenting the factual situation as it existed at the time of the accident. The observations of eye witnesses are related as of a time when the facts are fresh in their minds.

Where a case, which has been investigated in this manner, is turned over to a trained investigator or lawyer, he has the benefit of

a fairly comprehensive presentation of the facts, and it has been our experience, that in handling these cases, we often need only make some further inquiry to develop some phase which the ship investigating committee has not considered. Valuable as these investigations may be, however, they are at best, in my opinion, only preliminary inquiries and they cannot be relied upon as a complete substitute for the work of the trained investigator.

THURSDAY LUNCHEON SESSION

October 14, 1937

The joint luncheon session of the Marine and Petroleum Sections was called to order by John E. Long, superintendent of safety,

The Delaware and Hudson Railroad Corp., Albany, N. Y., and past president of the National Safety Council.

Government Aid in Preventing Injuries to Longshoremen and Harbor Workers

By JEWELL W. SWOFFORD

Chairman, U. S. Employees' Compensation Commission, Washington, D. C.

The Marine Section of the National Safety Council is particularly concerned with the problem of safety as it affects different industrial operations, maritime in character. Included are stevedoring and ship repair work upon the navigable waters of the United States. Many thousands of workers are engaged in these employments and more than 40,000 of these employees were reported injured during the 12 months ended June 30, 1937.

As chairman of the United States Employees' Compensation Commission during the past four years, I have noted with increasing concern the number of injuries reported to the Commission annually under the Longshoremen and Harbor Workers' Compensation Act. It is difficult to believe that so many men should be needlessly disabled for life or killed as a part of the everyday routine of such industrial operations. But

the records are available, and in all too many instances the reported cause of injury is also a cause for astonishment. Many of those charged with the responsibility for directing these large industrial operations seem indifferent to the tremendous increase added to operating costs by industrial accidents.

There is also another side to the picture. The workers themselves seemingly have been content to risk life and limb day after day with little regard for their own safety, for they have contributed little to promote safe working practices. Here is a situation difficult to understand.

There appears to be but one tenable explanation. Apparently we must charge the responsibility for it to an indifference on the part of a great number of employers and employees to circumstances affecting their own best interests.

The industrial operations, like other com-

mercial enterprises, are operated for profit. The employer is in business to make money, and his employees give their skill and labor for the same purpose. Alertness to reduce operating costs and to develop new methods and procedures that promise greater profits is the mark of an intelligent employer. And at the same time the intelligent employee is eager to increase his annual income and to provide security for his family.

There is a mutual interest involved between these two in all matters of common concern, and certainly a business is neither directed rightly nor operated intelligently when either employer or employee is apathetic towards the development of accident prevention methods for the industry in which both are engaged. Such an employer fails to take advantage of the opportunity to reduce operating costs and to increase profits directly through savings in compensation costs and indirectly through greater efficiency on the part of his operating personnel. Such an employee fails to take advantage of the opportunity to increase his earning power directly by escaping periods of incapacity for work due to injury. The proof of possible profit through accident prevention in industrial operations is so overwhelming that it should be one of the first considerations of every business executive and every wage-earner.

The employments we are discussing are within the scope of Federal authority, and within the purview of The Longshoremen and Harbor Workers' Compensation Act. The thousands of industrial workers engaged in these enterprises are confronted daily with the possibility of accident while at work. The Federal Government must assume responsibility for protecting the physical well-being of these workers since this responsibility may not be exercised by the respective states. It is my conviction, therefore, that it is clearly the duty of the Federal Government to aid actively in the prevention of accidents in these industries.

There appear to be two methods by which the Federal Government may discharge this obligation. It may be able to do so by cooperation or, this method failing, it apparently must do so by compulsion. The first method is preferable if it can be made to work successfully. I make this observation conditionally, and I raise the question as to the effectiveness of this method because the answer rests entirely upon the willing-

ness of industry to extend its full cooperation to the Government by undertaking to accept and enforce suitable safety regulations. If the industry as a whole extends this measure of cooperation and will unite in adopting and enforcing approved safety standards and practices in all of its operations, the cooperative method can be made to work in an acceptable manner.

Under this plan of cooperation the Government must do its part. In behalf of the industry it must determine the cause of accidents, prepare safety standards and develop methods and practices for making them effective. The United States Employees' Compensation Commission, under the authority conferred upon it by the Longshoremen and Harbor Workers' Act, apparently is authorized to render this assistance. The law authorizes the Commission to study and investigate safety provisions and the causes of accidents, and to make to the Congress of the United States and to employers and insurance carriers recommendations for preventing such accidents.

Acting pursuant to this authority and subject to the limited financial resources available to it, the Commission has endeavored to sell the idea of safety to employers engaged in longshore and harbor work and to assist the industry in making voluntary safety plans effective. It is a regrettable fact that the response of the industry as a whole to this proffer of assistance has proved disappointing. For some reason not apparent, the industry has failed to unite for the purpose of cooperating in the development of accident prevention methods. On the Pacific Coast and in certain ports of the Gulf Coast a keen interest has been shown, and employer and employee organizations have cooperated in developing safe working practices and in providing methods for the voluntary enforcement of approved safety codes.

The Accident Prevention Bureau organized by Marine Associations on the Pacific Coast furnishes an example of successful cooperative effort in formulating and administering a voluntary safety code for the prevention of accidents in maritime employments. The form of organization and the methods of enforcement that have operated there with such marked success appear equally appropriate for other sections of the country. It requires only the sincere desire of employers and their willingness to cooperate with one another to make similar associa-

tions equally effective in other localities.

However, the industry as a whole has been apathetic and the sections which have responded favorably represent only a minority of the industry. The ports on the Atlantic Coast have not undertaken similar safety programs. It is from these ports that nearly 54 per cent of the injuries were reported under the Longshoremen and Harbor Workers' Compensation Act during the year ended June 30, 1935. Some of the more progressive employers in these ports, acting individually, have installed safety departments and have established excellent safety records, but instances of this kind are the exception.

There must be a decided increase in interest shown by the industry as a whole before programs for voluntary accident prevention can be made to function properly. From contacts with leading employers I have gained the impression that the industry would not welcome statutory regulations of its operations for the purpose of bringing about greater safety in such employments. But what other alternative is there if the voluntary method fails?

As I have pointed out, this voluntary method has proved effective wherever a genuine attempt has been made to apply it to individual ports. It has proved equally suitable for a sectional safety program, and there appears to be no good reason why it could not be made to operate effectively upon a national scale, provided the industry actually wants it to operate.

The development of this voluntary method will continue to have the practical assistance of the U. S. Employees' Compensation Commission. Careful studies of the causes of accidents comprise, of course, one of the first essentials in devising plans for preventing them. These studies have been made regularly by the Commission and they may now be compiled to cover nine years' experience under the Longshoremen and Harbor Workers' Act, and will be made available to the industry. The Commission is also conducting investigations of all fatal injuries as they occur, and special reports of such cases will be made available from month to month. The operations of employers with poor safety records will be studied with a view of urging such employers to adopt safer working practices.

During the past year the Commission began the publication of a monthly safety bulletin to be utilized as far as practicable for the

promotion of safety in this employment. The facilities of this publication are available to all employers within the purview of the Longshoremen and Harbor Workers' Act and your suggestions as to how it can be used to the best advantage in promoting safer practices are earnestly requested.

The Commission will assist further in the formation of additional local, state, and regional committees for this industry, and will supply to such committees available material relating to the cause of injuries and suggestions for preventing them. The Commission can and will do these things and will aid in such other ways as may be proper to help the industry prevent accidents by voluntary regulation.

However, more than this is necessary to insure a fair trial of voluntary safety code enforcement. Coordination of the work and cooperation on a national scale are essential. The Commission has encouraged this for some time, but with little success due to the apathy of important sections of the industry.

There should be a national safety code for stevedoring operations that will at least provide minimum standard requirements of safety for this employment, and there should be appropriate facilities for the voluntary enforcement of this code. It is not my purpose to discuss the provisions of a code of this kind or the manner of its enforcement. These may be worked out with comparatively little difficulty if the industry will evidence a real desire to make this voluntary plan operate successfully.

The second method by which the Government may aid in preventing injuries in this employment is the compulsory system. The Federal Government may by law provide for the safety of workers in this industry and prescribe penalties for failure to conform to such standards as may be established. A safety law of this kind might be in the form of a statutory code of safety regulations, or it might confer upon a Federal administrative agency authority to prescribe an administrative code, which when promulgated, would have the full force and effect of law.

Such a compulsory system would undoubtedly make it possible to eliminate unsafe working practices, but it would be more costly to the industry than voluntary regulation. It would necessarily entail considerable expense for administration, which in my opinion should properly be charged against the industry. The enforcement of a com-

pulsory code, either statutory or administrative, would present certain complex administrative problems, particularly in connection with the servicing of vessels of foreign registry. Among some groups in the industry

there apparently is considerable sentiment in favor of the compulsory system for the prevention of accidents; but I cannot escape the feeling that the industry as a whole is unsympathetic to it.

Following a brief address by Governor Harold G. Hoffman, of New Jersey, a statistical review and forecast of the petroleum industry was presented by H. N. Blakeslee, Director, Department of Accident Prevention, American Petroleum Institute.

Presentation of awards in the 1937 Petroleum Section Safety Contest were made by Mr. Long. Details of the contest and the names of the winners will be found in the record of the Petroleum Section starting on page 489.

THURSDAY AFTERNOON SESSION

October 14, 1937

Eliminating Dangers of Cargo Hazards

By BILLINGS WILSON

Assistant General Manager, Port of New York Authority, New York City

The port interests of this country have invested upwards of one billion dollars in harbor facilities which provide employment to more than 300,000 men. Experience has shown that waterfront fire losses usually run into six or seven figures, and we are constantly seeking ways and means of reducing this risk. When several cargo fires and explosions occurred on ships in our harbors, with heavy loss in property and life, we undertook to find out who was responsible.

The burning and sinking of the steamship "Muenchen" at her pier in New York harbor in February 1930 provided the initial impetus for our activities. This was a passenger and general cargo carrier in part loaded with bags of potash (or nitrates) stowed on top of peat moss and rolls of print paper. A few hours after discharging commenced a small fire developed in the peat moss. An explosion occurred blowing plates off her bottom and she settled in the mud over one of our busiest rapid transit tunnels.

We opened up the subject of marine rules with the Interstate Commerce Commission and at once encountered opposition from the

steamship fraternity who inferred that they were fully competent to run their ships and did not need any suggestions on stowing cargo, hazardous or otherwise.

Admitting their many capabilities we offered a few pointed examples, and things got going in the Commission with the result that their rules covering the packing, marking, stowing and handling of explosives and other dangerous cargo finally became effective on April 1, 1935. These rules are binding upon all common carriers engaged in interstate or foreign commerce by water within the limits of the jurisdiction of the United States and upon all shippers making shipments via such common carriers.

It might be well at this point to have a clearer picture of what is meant by the general term "Hazardous Cargo." The Marine Rules of the Interstate Commerce Commission recognize some 11 groupings and specify precisely how each dangerous commodity shall be packed, what kind of a special colored label it shall carry, if any, and how and where it shall be stowed in the ship. These groups are as follows:

1. **FORBIDDEN ARTICLES**, such as nitro glycerin, dry fulminates, wet rags, oily waste, dry fish scrap, and many others—not permitted to be carried at all as ship's cargo on account of great risk of explosion or spontaneous ignition.
2. **EXPLOSIVES**—substances capable of conversion with great rapidity into gaseous form with evolution of heat, of which there are three sub-classifications:
 - (a) Dangerous explosives such as dynamite and all high explosives.
 - (b) Less dangerous explosives such as fireworks and smokeless powder, and
 - (c) Relatively safe explosives such as small arms ammunition.
3. **INFLAMMABLE LIQUIDS** (Red Label) are those having a flash point of 80° F. or less. They give off inflammable vapors at ordinary temperatures which when mixed with air in an inclosed space can be exploded with violence. Examples are gasoline, alcohol, ether.
4. **INFLAMMABLE SOLIDS** (Yellow Label) are those solids other than explosives which are liable to cause fires by ignition through friction, through absorption of moisture, or through spontaneous chemical changes. Examples are matches, celluloid scrap, charcoal.
5. **OXIDIZING MATERIALS** (Yellow Label) include all commodities that yield oxygen regularly to stimulate combustion of organic matter. Examples are nitrates and chlorates.
6. **CORROSIVE LIQUIDS** (White Label) include the strong mineral acids and other strongly corrosive liquids that are liable to cause fires when mixed with chemicals or organic matter, or to damage other cargo in case of leakage. Examples are nitric acid, sulphuric acid, caustic soda.
7. **POISONOUS ARTICLES** (Poison Label) include three groups:
 - (a) Poison gases or volatile liquids which are highly poisonous when present in the air even in small proportions, such as hydrocyanic acid, phosgene, etc.
 - (b) Poisonous liquids or solids chiefly dangerous by the actual contact with the body or by contamination

of foods and feeds. The vapors of some of this class are also offensive or dangerous. Examples are carbolic acid, arsenic and the cyanides.

- (c) Tear gas, which is intensely irritating to the eyes, nose, or throat but not dangerously poisonous in normal concentrations.

8. COMPRESSED GASES, with two sub groups:

- (a) Inflammable (Red Label) such as acetylene and hydrogen.
- (b) Non-inflammable (Green Label) such as helium or compressed air. Compressed gases are commonly shipped in steel cylinders at pressures varying from 50 to 1800 pounds per square inch. The inflammable gases are liable to be ignited if they escape, while any of them may burst their cylinder through internal pressure such as exposure to a fire in a ship's hold. These cylinders have exploded when dropped or exposed to external violence, such as could occur by dropping down a hatch or out of a sling.

9. COMBUSTIBLE LIQUIDS are those having a flash point above 80° F. and below 150° F., such as turpentine, whiskey, tar oil.

10. ODOROUS ARTICLES are those which have strong or offensive odors, such as sheep dip, aniline oil, bleaching powders.

11. SEMI-HAZARDOUS ARTICLES are those which have some properties which will under some conditions cause ignition, such as sulphur, oakum, rags, jute, sawdust, calcium carbide.

Gasoline is a hazardous commodity in a class by itself. Almost any kind of an accident, where it is present, can be counted upon to produce at least a serious flash fire. Most of the gasoline in the marine trade moves in bulk in tankers whose fires are always news because they are so spectacular. But large quantities of gasoline are also handled in drums and cases on general cargo ships, such as the "Fijian," which burned and sank in mid-Pacific last March after reporting by wireless that gasoline had exploded in her forward hold.

Most big tanker operators preach and practice safety for their own self-protection. Their ships are well built and their crews are well trained. Unfortunately regulations

cannot be written to make a big hole for the big cat and a little hole for the little cat, and there are some small operators, particularly on our Atlantic seaboard, who do not maintain high standards of equipment or operation.

Coming now to the general or package cargo field, the new Interstate Commerce Commission rules are at present the best insurance against hazardous cargo accidents providing vessel operators will require their employees to be familiar with and conform to them. These rules start right at the factory and require that hazardous commodities must be packed, described, and labeled in a very precise manner and a series of colored labels is mandatory for certain of the more hazardous classifications to facilitate identification. The stowage rules, if followed, greatly reduce the risk of spontaneous combustion, explosions and asphyxiation.

The Steamboat Inspection Service has been backward with respect to promulgating general stowage rules but I am informed that they will shortly adopt the Interstate Commerce Commission rules in toto and make them applicable to all vessels whether common carriers or otherwise. Even though you may not be operating as a common carrier you should voluntarily observe the Interstate Commerce Commission rules for the sake of your passengers and crew as well as your ship.

In the general cargo field cotton and nitrate cargoes are the outstanding fire risks. The hazard with cotton is spontaneous combustion. A nitrate cargo possesses the unholy faculty of generating its own oxygen in case of trouble, and there is no known method of stopping a nitrate fire in the hold of a ship once it has a good start, except by scuttling the ship.

Explosives themselves, strange as it may seem, are the least troublesome. This is largely because of their limited volume; the fear that all regulatory authorities have of them, and the fact that they are always given special handling by trained men. The red flag, red paint, and the word "DANGER" are all over the place. In this connection I commend a copy of the Interstate Commerce Commission rules to every pier superintendent, master and mate. Do not worry about the men not reading this booklet as it is much too interesting and will answer their hazardous cargo questions in a very practical way.

Our Federal Steamboat Inspection Service

(Bureau of Marine Inspection and Navigation) should be the last word in the matter of maritime safety from hazardous cargo risks and their rules and their enforcement procedure should command the respect of business men and the investing public. The cargo rules so far promulgated have been formulated for the most part by members of the trade, working in close cooperation with officials of the Department of Commerce.

The nation is gradually getting a fine set of maritime safety rules drafted, in large part, by the industry itself. Let's give them a chance, including the men who enforce them. Don't condone any of your captains offering a steamboat inspector \$20 to facilitate an inspection. We all know the curse and the temptations of the gratuity system and how seriously it can be abused, and the potential consequences where safety is involved are more than criminal. Changes in the rules will, of course, be necessary from time to time and can be made in the proper manner, as experience indicates, but in the meantime local inspectors must not be encouraged to violate or ignore the rules.

And lastly a word in recognition of the crews of the vessels. They give their best aloft or ashore and accept the risks allotted to them without question. Even though he carry no passengers and hull and cargo are insured to the limit, an operator should not trifle with the lives of his crew. Don't fire a mate who reports unsafe conditions on your ship. Don't ask your captains to forego repairs or replacements of equipment which they feel are necessary for the ship's safety just because you can get some other master, who needs the job, to take her out for you.

It might open your eyes to sit where I have sat in this work for several years and read the hundreds of letters and reports that have come to me; desperate cries from men on ships and their relatives ashore about conditions that should be remedied. Some of them possibly were from malcontents but others were obviously genuine in their concern. I considered passing some of them along to the vessel owners involved but abandoned the idea when there appeared to be more interest in locating the complainant than the complaint.

In closing I leave with you six suggestions for reducing (though not guaranteeing to eliminate) the dangers of cargo hazards:

1. Educate your men to understand, and require them to follow without excuses, the

Federal regulations which have been drafted for your guidance.

2. Make certain that your manifests and stowage plans indicate all hazardous commodities including any gas producing refrigerants.

3. Require your ship masters to notify the United States Coast Guard by radio at the immediate outbreak of any fire on board a ship carrying any hazardous commodities, and give the name of the United States port which the vessel intends to enter while afire and the approximate time of arrival. (Of 18 vessels arriving on fire in U. S. ports since 1930, of which I have a record, only 11 gave advance information.)

4. Modify the enforcement procedure of the Steamboat Inspection Service as to put the burden of correcting unsafe conditions squarely on the owner of the vessel by requiring immediate removal of the vessel's certificate by the inspector, for any serious violation of the safety laws—same to be returned on application to local inspectors after compliance with the law.

5. Require the Coast Guard to seize and impound all vessels without certificates.

6. Provide the marine industry with a joint, privately supported technical agency for dealing with hazardous cargo problems, investigating accidents, studying causes and advising on improved technique.

Creating a Sense of Responsibility in the Individual Seaman

By ALBERT O. PEGG

Superintending Engineer, Union Oil Co. of Calif., Los Angeles

All steamship companies who are interested in safety have established on board their vessels a safety committee whose function it is to investigate all accidents and make recommendations to avoid a recurrence. The findings of these committees, as a rule, indicate that something was wrong mechanically, with recommendations for mechanical corrective measures, and the company may spend a large sum of money to correct a seemingly hazardous condition which in all probability existed for many years without causing an accident.

Very seldom do these reports give any history of, or recommendations about the man. The man usually gets well again and returns to the job, or if permanently disabled, he will most likely sue for damages. If he returns to work he will do so with the thought in mind that, "Well, I should worry; they will fix that condition so I won't get hurt like that again." And the company usually does just that thing, thus leaving the man in a state of mental laziness regarding his responsibility towards safe practices.

If he is permanently injured and sues for damages, the first and paramount issue made by his lawyer will be the responsibility of the company for his injuries, and in nine out of ten cases the company will be found fully responsible and pays heavy damages.

This responsibility must be divided. Why should the employer carry all of it? For the present we should attempt to obtain a 50-50 division and watch results.

It is my suggestion to give consideration to the certificating of the unlicensed personnel aboard ship with reference to their knowledge of safe practices.

Establish in each steamship company a committee of at least three members whose knowledge of safe practices in the marine field would make them competent to examine the applicant and issue a certificate indicating that he was found to possess competent knowledge of safe marine practices.

The certificate would in no way indicate the examining committee declared the applicant a safe worker. It would merely state that he was examined and found to have a knowledge of what safety meant.

The certificate would be designed to indicate an accident by punching a hole in the margin.

As time goes on and sufficient certificates are issued, the employer will give preference to holders of unblemished certificates.

The certificate could be issued by the National Safety Council in suitable engraved form and worded to indicate that the Council considers the bearer to have good common knowledge of what safe practices are.

Training of Officers

By CAPT. W. O. BOWEN

Manager, Safety Department, United States P. & I. Agency, Inc., New Orleans

When we commenced safety training of officers, it was found that there was a minority of keen alert officers who strive for an ideal and take every opportunity to keep themselves well informed of new developments.

The majority of officers seemed mainly concerned with their everyday work—navigation—cargo handling, stowage, etc., with but little serious thought or consideration given to the application of safe practice principles so as to prevent accidents either to themselves or their men.

This state of affairs was analyzed and it was determined this apparent indifference and lack of safety consciousness were due to deficiencies in the officers' safety education and training. They did not wish to be victims of an accident nor did they wish to see their men injured; they simply had not been trained to recognize accident hazards or to administer safe practices. And the accident toll had become staggering. Operating profits were being greatly reduced due to the cost of accident claims to the steamship owners.

Object of Training

We always endeavor to explain that the object of all training is skill and efficiency.

To be efficient, it is essential that all members of our merchant marine should have pride, ambition, and loyalty. To be well trained and skilled, it is necessary that all officers must possess qualities of courage, resourcefulness, leadership, safety activity and sufficient moral fiber to require that none but safe practices should exist aboard any vessel on which they serve.

We must all recognize that the licensed and unlicensed personnel are complements of each other; each has its important duties; each must have thorough safety training; each depends upon the other; safety inefficiency on either part would lessen or destroy the efficiency of the ship. Therefore, it is a corollary that unless the officers possess proper safety training and require the exercise of proper safe practices in the conduct of ship affairs, it cannot be reasonably

expected that the unlicensed personnel will perform their work and function in an efficient and safe manner.

Training of Officers

The safety training of officers is a matter that cannot be performed except through a course of systematic instruction by experienced safety engineers. Haphazard methods become dangerous.

The best results in officer safety training are derived through the medium of ship safety meetings in port. The Masters and officers are thereby trained in safety principles, practices and in how to conduct their own safety meetings at sea.

Three safety fundamentals are taught as follows:

1. Proper instruction.
2. Proper supervision.
3. Safe methods.

Instruction

By proper instruction we mean that experience should always demonstrate that the safe way of doing work is the best way. Therefore, the department head or subordinate officer in direct charge of men should always think ahead for safety before giving an order. See that reasonably safe working conditions exist and explain in each order what safety precautions are necessary. Give definite instructions so that safe methods will be used. Make certain that the man to whom the orders are given understands their nature; if there is any doubt make the man repeat the order in detail.

Supervision

By "proper supervision" we mean that no officer should give an order and then proceed to forget about it; every officer who issues an order has the status and responsibility of a supervisor—he must see that the instructions previously given are properly executed.

The supervisor must understand the hazards involved and should make sure that the necessary safety precautions are employed.

No master, department head, or other officer ever acquires real proficiency in his work unless he religiously observes and practices these fundamental safety doctrines at all times. The old practice of resorting to lame excuses and alibis in the event of preventable accidents must be thrown overboard.

Each officer must be held responsible for the safety of each man working under him. The issuance of proper safety instructions and check-ups through supervision are but efficient methods; it is but plain, ordinary common sense—there are no secrets to accident prevention. When it is considered that a large majority of all ship accidents are preventable, then the problem is clearly one of operating efficiency.

Safe Methods

To train officer personnel in the art of preventing accidents, they must be taught to think out safe methods.

As a guide in the development of safe working methods aboard ship, a manual or handbook covering the subject of accident prevention and safe practices has been published and is available without cost. In order that the greatest benefit may be obtained, it is necessary that frequent references be made to safe practices—it is never enough to speak casually of them. When this manual is studied, read and reviewed at ships' safety meetings, all officers become indoctrinated with the spirit of safety and in the actual practice of safety measures. Herein one will find the most practical accident prevention technique ever devised for safe ship operations.

Mechanical Safeguards

As a part of the officers' training course, we point out that preventive work is much better than to lock the door after the horse is stolen. We instruct that every near accident is a warning which should initiate careful investigation on the part of the Master and Department Head so that preventive

steps may be taken to avoid a serious accident later.

Provision should always be made for the mechanical safeguarding of every hazard of a physical or mechanical nature.

Although accident statistics may indicate that not more than 15 per cent of accidents can be prevented by mechanical safeguards, the fact is that the psychological effect of complete mechanical safeguarding goes a long way toward establishing the idea among all hands that the company is sincerely interested in safety.

Complete mechanical safeguarding helps greatly to get all concerned to appreciate the importance of safe work. To neglect obvious means for safeguarding is to set up a tremendous handicap in developing the necessary cooperation to prevent the other 85 per cent of accidents which can only be prevented by safety education—proper instructions and proper supervision.

Inspections

Too many officers circulate about a ship seeing nothing.

We instruct officers in the inspection technique—how to see and recognize accident hazards and unsafe working practices.

We emphasize that regular and systematic inspection on the part of the master and department heads is an essential factor in keeping each department safe.

Crew's quarters should be inspected daily for cleanliness, ventilation, hazards, etc.

Accident Investigation

It is surprising how few officers have ever shown any genuine interest in protecting the interests of the owner relative to procuring accurate accident data. A department head will casually write out a personal injury report as stated by an injured man, pass the report on to the Master, and the latter merely forwards it to the office. Due to these lax methods, steamship owners have been mulcted for years by false and fraudulent claims. In many cases, minor accidents have later been magnified into cases of major degree. The entire system has been loosely administered and has been inefficient.

Instructions should be given as to how to

investigate accidents. Emphasize that investigations should not be confined merely to apparently serious accidents, but should apply to minor accidents as well because every minor accident has the possibility of being a major accident the next time it happens, or if not investigated, it may be manufactured into a major case. The same causes which result in a minor injury might just as well result in a major injury.

If a master is guilty of sending a slovenly personal injury report through to the office, the claim's manager should provide the marine superintendent with a copy, and the

latter should jack up the master in no uncertain terms. Such departmental cooperation will tend toward increased efficiency in this respect.

A well trained officer is a great asset to his employer—the shipowner. The cooperation that is developed in the prevention of accidents is easily transferred to cooperation in all of the activities of the departments aboard ship.

Furthermore, there has never been any time in industrial relations when factors which build goodwill are more valuable than today.

Marine Section Safety Contest

The high lights of the 1937 Marine Section Safety Contest were reviewed by Captain Holden.

Ninety-one units were entered in the Sixth Annual Contest of the Marine Section. Represented in the contest were 83,331 men who worked 8,820,852 man-hours, with 1,065 disabling injuries. The average frequency rate was 13.016. The average rate in the 1936 contest was 12.629.

Seven contestants finished without a single disabling injury. Twelve plaques were presented to first place winners; ten certificates were awarded to winners of second and third places.

Awards were presented by Harry Guilbert, Director, Bureau of Safety and Compensation, The Pullman Co., Chicago. Winners of plaques were as follows:

Liners Division—The New England Steamship Co., New York City.

Tankers Division—Lago Shipping Co., Ltd., Aruba, N. W. I.

Harbor Equipment Division, Group A—U. S. Engineer Dept., South Pacific Div., San Francisco, Calif.

Harbor Equipment Division, Group B—Three tied for first place—Standard Oil Co. of Louisiana, Baton Rouge; Tide Water Associated Oil Co., Associated Div., San Francisco, Calif.; Atlantic Coast Line R. R. Co., Port Tampa, Fla.

Stevedoring Division—Lago Oil & Transport Co., Ltd., Aruba, N. W. I.

Shipbuilding and Repair Division, Group A—U. S. Navy Yard, Mare Island, Calif.

Shipbuilding and Repair Division, Group B—Four tied for first place—Erie Railroad Co., Weehawken, N. J.; The New York Central Railroad Co., New York City; U. S. Engineer Department, South Atlantic Div., Richmond, Va.; Mystic Steamship Co., Boston, Mass.

ADJOURNMENT

Meat Packing, Tanning and Leather Industries Section

Officers 1936-37

General Chairman—WILSON PALMER, United Shoe Machinery Corp., Beverly, Mass.

Vice-Chairman—PHILIP G. RHOADS, J. E. Rhoads & Sons, Wilmington, Del.

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N. L. BRAINARD, Swift & Company, Chicago, Ill.

H. L. CLOVER, International Shoe Co., St. Louis, Mo.

E. E. DREWS, Libby, McNeil & Libby, Chicago, Ill.

MAURY HOPKINS, Wilson & Company, Chicago, Ill.

T. H. JONES, American Hair and Felt Co., Chicago, Ill.

JOHN LAUERMAN, Armour and Company, National Stock Yards, Ill.

E. J. McCANN, Jacob E. Decker & Sons, Mason City, Iowa.

W. F. McCLELLAN, Armour and Company, Chicago, Ill.

A. C. MITCHNER, John Morrell and Co., Ottumwa, Iowa.

DEAN MONEYMAKER, International Shoe Co., St. Louis, Mo.

R. R. ROACH, Geo. A. Hormel & Co., Austin, Minn.

EDGAR K. RUTH, The American Oak Leather Co., Cincinnati, Ohio.

Officers Elected for 1937-38

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Vice-Chairman—PHILIP G. RHOADS, J. E. Rhoads & Sons, Wilmington, Del.

Secretary—A. A. SIERVELD, The E. Kahn's Sons Co., Cincinnati, Ohio.

News Letter Editor—JOHN MCARDLE, Armour & Co., Kansas City, Kansas.

Engineering Committee Chairman—C. W. SLOAN, Swift & Co., Chicago, Ill.

Membership Committee Chairman—H. G. SCHAFFNER, Schaffner Brothers Co., Erie, Pa.
Poster Committee Chairman—A. C. MICHENER, John Morrell and Co., Ottumwa, Iowa.
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 K. R. ROACH, Geo. A. Hormel & Co., Austin, Minn.
 EDGAR K. RUTH, The American Oak Leather Co., Cincinnati, Ohio.
 W. E. TENNERY, Armour & Co., Oklahoma City, Okla.

TUESDAY AFTERNOON SESSION

October 12, 1937

The opening session was called to order by N. L. Brainard, Personnel Director, Swift and Co., Chicago, who presided in the absence of General Chairman Wilson Palmer.

Personal Protective Equipment in Meat Packing Plants

By E. J. McCANN

Employment Manager and Safety Director, Jacob E. Decker & Sons
 Division of Armour & Co., Mason City, Iowa

In October, 1935, our company was purchased by Armour & Company. This affiliation gave us the benefit of a very complete safety program. While we had had our machinery guarded and had used some personal protective equipment, yet this was not to be compared with our new setup. W. F. McClellan, safety supervisor for Armour & Company, visited our plant shortly after the transfer and talked to our employees. He outlined the safety program in operation throughout the Armour organizations and instructed our people in the value of personal protective equipment.

Our employees entered wholeheartedly into this program and are now using the following safety devices to prevent injuries to themselves and their fellow workers.

Wire mesh finger guards are used throughout our industry and have saved the employees numberless knife cuts and lost time. This guard is made to cover the thumb and index finger, which takes care of the majority of the operations. This guard has been a big boon to our industry, as about 70 per cent of our men are employed in work that requires the use of knives or other sharp cutting tools.

Knife guards placed on the handles of knives prevent the man's hands from slipping over the blade, when the point of the knife strikes an object. There are various types of these guards. A metal guard used on the side of the knife at the heel or underneath is very successful. The leather strap or thong used by the sticker works out satisfactorily and in some operations the chain swivel guard fastened to the end of the knife handle can be used advantageously.

Knife pouches are very essential to butchers for transporting their knives to and from work. They prevent injuries to the men and also fellow workers.

Abdominal protectors or leather aprons are used on all operations where it is necessary for a butcher to pull his knife towards him. Abdominal injuries often prove fatal. This brings to mind a case we had in our plant five years ago. We had difficulty in converting one of our old butchers to our safety program. He was the type that scoffed at new methods and believed in the old tobacco cud for knife cuts, until one day while boning hams his knife slipped and inflicted a flesh wound in his abdomen. He turned white, said he knew he would die. After a thorough examination we were convinced this wound was slight, yet it took considerable time to convince this man, as he was completely unnerved. This man walked into the office the next morning and said he was sold on our safety program and told me he would wear a suit of armor if we advised it.

Skull guards are worn by employees in our hog coolers, beef coolers, ice storage, by beef luggers, beef dropper, and floor men on the hog kill, and all employees that find it necessary to do work where there is danger of head injuries.

Wire mesh guards have reduced the hazard of knife cuts caused while steeling knives, nevertheless we insist on a leather guard pulled down over the steel. It is inexpensive and takes care of the employee that might by chance attempt to steel his knife while not wearing the finger guard.

Goggles protect one of the most vital parts of a man's body and we are fortunate today in being able to purchase goggles for every type of work in our industry. We fully realize that bones can be set and in a given time the employee can return to work in a normal condition. Tendons can be sutured with excellent results in 80 per cent of the cases. In-

fection can be combatted, hernias can be fixed, but a lost eye is gone forever. Therefore, goggles are very essential to every employee that is exposed to eye hazards.

We have just gone through the experience of a lost eye, the first one in the history of our plant. I would like to tell you the circumstances surrounding this injury, as I feel we all learn from the experiences of others. Our construction foreman put several of our employees to work tearing down a cement tower. He equipped each man on the job with a pair of goggles with instructions to wear them while engaged in this work. Everything progressed smoothly until the second day when the man operating the air hammer got the drill stuck between some concrete and reinforcing rods. Being unable to pull the hammer loose he took a sledge hammer, raised the goggles upon his forehead and proceeded to drive the point of the hammer backwards. A sliver from the sledge or hammer struck him in the left eye and penetrated the pupil. In order to protect the other eye, the doctors deemed it advisable to remove the injured one. This man suffered severe pain for several days and is now trying to become accustomed to wearing a glass eye.

Safety toe shoes and boots are two more items that have played an important role in preventing injuries in our industry. There are several toe hazards in packing plants that can be eliminated through the use of these items. I want to congratulate the shoe and boot manufacturers for their untiring efforts and the progress they have made on this protection.

Arm guards prevent injuries to the workmen's forearm and are used by hog headers, shoulder boners, ham boners, fat back trimmers, plate trimmers and all other operations that bring the workman's knife close to the forearm.

Safety belts are provided to employees working on our electrical equipment in the ice storage tanks and any operations that necessitate men working above the ground where it is difficult to build platforms. There are various safety belts on the market today and there is no reason why the proper belt cannot be secured for any operation in our industry.

The switch boards and transformers are protected with an iron fence. The gate is locked and the keys are retained by the head electrician and our chief engineer. This per-

mits only those with authority to enter. The floors are covered with 1 inch rubber matting which will withstand 5,000 volts. Electricians working on switch boards and oil circuit breakers are equipped with rubber blankets to prevent contacting the opposite phase. The late type switches are built to disconnect all working parts from the line and can be locked in an open position while men are working. Other type switches in use are equipped with doors that cannot be opened until the switch has been pulled.

Fuse pullers, safety pliers, blue point handle screw drivers, safety ladders, safety toe shoes with sewed soles, rubber gloves and belts for line work are other safety devices that will prevent injuries.

Safety ladders are furnished all workers and have reduced injuries by preventing falls and fallen tools. They also avoid delay to the worker, as the present type ladder is built with recesses in the top which enable the workman to keep all his tools at his fingertips. Safety shoes on bottom of ladders and non-skid safety scaffolds are essential.

Respirators are worn by spray painters, rail cleaners, and on grinding operations in

the machine shop by employees spraying insect powder, and any operations that may arise where dust causes a hazard.

We maintain two masks at our machine shop and two at the power house. The masks at the power house are kept in metal containers on the outside wall at the south and east entrance. This gives the worker an opportunity to don the mask in the open air and makes it convenient as invariably men will leave the building when ammonia is escaping and attempt to go back for a mask.

Rubber hoods, gloves, and aprons are used while spraying caustic during the process of washing smoke houses.

Hog shacklers wear padded shinguards to prevent hog bites and back slap of shackle chains.

In the wool house 50 millimeter spectacles with rubber frames, also rubber gloves are used during the process of depilation.

Salt tablets cannot be classed directly as protective safety equipment, nevertheless I feel they play an indirect part in the safety program, as they protect the employees' health in avoiding cramps, dizziness, and fatigue on hot days.

An illustrated talk on "Safeguards Used in Leather Re-Manufacturing Establish-

ments" was given by H. L. Clover, Safety Director, International Shoe Co., St. Louis.

THURSDAY AFTERNOON SESSION

October 14, 1937

Why the Employer Is Not Responsible

By CLAYTON C. KELLER

Claims Department, Wilson & Co., Kansas City, Kan.

It is my job to prove to you that the employer is not responsible for accidents.

All large employers of men must act through agents, servants, and employees. They are members of national, state, and local safety organizations. They receive help from these agencies through bulletins, safety

meetings, classes on various phases of the safety movement are attended by their men in a constant endeavor to learn more from the other fellow, as well as to help the other fellow by relating his experiences.

The employer hires safety supervisors because of a genuine desire that everything

possible shall be done to bring about a safe place to work. No better advertisement for any industry can be had than that it's a Safe Place to Work. The safety supervisor attends to the details of education along safety lines. He supervises the selection and erection of bulletin boards, provides suitable motion pictures, directs safety contests. He studies particular hazards, investigates accidents, should one occur, thus preventing recurrence by removing the cause. Safety appliances are recommended, such as guards, goggles, warning signs, booklets, containing safety rules and safe practice instructions are issued.

The responsibility for a continuous campaign of accident prevention rests on the employer. But that does not mean that an employer should be held responsible for the accident, should one occur.

Under the common law an employer in an action for damages in a personal injury suit had three defenses: the doctrine of assumption of risk; the fellow servant rule; or contributory negligence.

In the old days an employee assumed the risk naturally incident to his employment. If, due to the carelessness of a fellow servant, a man was injured, no responsibility fell on the employer. If a man, then, due to his own carelessness, became injured, the employer was sorry, but that was about all.

Workmen's compensation laws have brought about an economic awakening to the value of safety, and the employers everywhere are beginning to see the light. One cement company close to Kansas City has gone over ten years without a lost time accident. This is a splendid record, but it can't go on forever. Some day they too will have an accident, but who is it that will hold this company responsible? No one, of course, because such a record can not be obtained except through strict adherence to safe rules and practices brought about by a continuous campaign of education and supervision, the cost of which has all been borne by the employer.

Responsibility for Accidents

Responsibility means the obligation to answer for an act done, and to repair any injury it may have caused, in other words, answerable, accountable or liable. If a man

is hurt arising out of and in the course of his employment due to an accident *under statutory law only* is the employer held answerable, accountable or liable. So that the employer may be responsible but only because the state legislature passed the law that made him so.

Therefore, it seems foolish for one to try to prove an employer is not responsible for accidents when every one knows the workmen's compensation act makes him so.

Let's for the sake of argument substitute another word which I think is really the word the sponsors of this program had in mind.

The Word Blame

Blame, according to Webster, means imputation of fault. An employer may hire a one legged man who because of his disability falls and breaks his neck. The employer may be responsible but certainly is not to blame. He may hire a man with a hernia that becomes strangulated so that the man dies. The employer is responsible, but surely there is no imputation of fault. A one-eyed man may become involved in an accident that but for his disability he could have avoided; of course, the employer is responsible, but unjustifiably so, and certainly not to blame. Out of an experience of over twenty years as manager of the casualty department of my company, I can not recall a single accident to an employee that was caused by the negligence of the employer alone.

An efficient surgical and nursing staff approved by the American College of Surgeons serves to effectually reduce the period of disability in those infrequent cases of lost time accidents.

Industry everywhere is going the limit to reduce accidents. Workmen's compensation laws have taken away the old defenses, so that now it is not only the humane thing to do, but accident prevention actually pays dividends. Your very presence at this meeting indicates that your employer is not merely interested but anxious that you acquire all the knowledge possible of the many safety problems common to our industry, so that you may return to your respective plants with a sincere determination to stamp out forever this wholly unnecessary loss of life and suffering.

Why the Supervisor Is Not Responsible

By CURTIS W. SLOAN

Master Mechanic and Chief Engineer, Swift & Co., Kansas City, Kansas

The supervisors or foremen in an organization are undoubtedly largely responsible for the success or failure of a safety movement and are now commonly recognized as the key men in such work. But this is true only when certain other conditions are fulfilled.

If we get the idea that the foreman is responsible for all work in his department and therefore is responsible for safety, we will not have any degree of success with a safety movement.

We must realize that this foreman got his job because he had been trained in the duties and responsibilities of the department over a long period of time. He is, therefore, quite capable of handling all ordinary duties of the job. When, however, we also give him the responsibility for the safety of his department, we must, if we want good results, give him the necessary training and information that he has been given on his other duties. Otherwise he cannot be properly held responsible for safety, since he is not fitted to cope with the problem without his training or experience.

In handling his department any supervisor or foreman finds many matters beyond the scope of his authority which must be handled by others to enable him to produce results in his department. This is also true of the foreman's safety work. He is not responsible for the company's policy on safety, but can only see that this policy, whatever it may be, is made effective in his department.

Thus if the company policy is only a half-hearted effort toward safety this will undoubtedly be reflected by the foreman in his department. If the company policy is a strong effort toward safety, so also will be the policy followed by the foreman in his department, with correspondingly better results. In other words, he is responsible only to the extent that he is backed up by those having authority over him.

The foreman must be supported by the company in promptly making repairs to correct hazards. This does not mean that the foreman has no responsibility with regard to correction of hazards. It is decidedly his

duty to discover hazards requiring attention, to place orders for their proper handling, and to make every effort to see that those in charge of repairs complete his orders promptly. After the foreman has handled matters within the limits of his authority he cannot be held to answer for accidents resulting from these hazards.

In addition to repairs there are such matters as the physical condition of buildings, arrangement of space for various operations, placing mechanical equipment, proper and adequate guards on equipment, layout of equipment, adequate and proper lighting, and general condition of floors, all of which are beyond control of the foreman and result in hazards for which the foreman cannot be considered responsible.

It has now become generally recognized that the most effective safety activity is education. It is questionable if the supervisors or foremen can be responsible for this work. The training of workmen to form proper working habits or safety habits is an extremely difficult task. It involves the art of teaching, which in itself requires more specialized ability than we have a right to expect from the general run of supervisors.

A foreman may be an expert in his line of work and in all respects known as a good supervisor, but in all probability his teaching ability will be quite limited. It is true that he must have some teaching ability in order to be a good supervisor, but very likely what little ability he has along this line, is the result of his rather hit or miss experience over a period of years. In all probability he does not know any of the fundamentals of teaching, and his results are bound to be very limited when he attempts to teach his men safety habits.

As an example, the first element of teaching is that the teacher should know what is to be taught. In most instances, as far as safety education is concerned, the foremen have at best only a hazy idea of what is to be taught their men. Under these conditions it is hardly to be expected that holding the supervisors responsible for safety education could produce any effective results. Some one must first teach the supervisor and definitely organize the plan to be followed.

Another very important factor affecting the responsibility of foremen for accidents is the workers themselves. Some people seem to have a mental makeup that makes them prone to accidents. It cannot be said that they do not care whether or not they get hurt, as after all no sane person enjoys pain, but they do not seem to have sufficient mental perspective to realize what actions are productive of accident and injury.

There are also many reasons why otherwise normal, alert, workmen lapse into a state of mind where they become accident prone. Among these are worry; sickness; outside interests causing day-dreaming; fatigue, both mental and physical; over-anxiety to excel in the work, which leads to hurry. Sometimes men are not physically in condition to work. Often they know this, but as they are anxious to earn their wages they do not lay off. Sometimes the men are not aware of their own physical deficiencies,

and this also leads to injuries. Then, too, there is the inherent gambling instinct, stronger in some than in others, that causes people to take a chance on using some faulty piece of equipment, such as a patched ladder. Often they win the gamble, and all too often they do not.

All of these things are decidedly not under the supervisor's direct control, and he cannot be properly held responsible for them, since they respond only to medical and educational treatment.

If and when all of these factors affecting the discharge of a foreman's duties are properly handled in line with a strong safety policy, only then can the foreman be held responsible for his part in the safety program—which is admittedly an important, if not the most important, single part of such a program. His part is, however, only one link in the chain, and no one link can carry the responsibility for the entire chain.

Why the Worker Is Not Responsible

By PHILIP BEIL

Safety Director, The Cudahy Packing Co., Kansas City, Kans.

A child in its growth to maturity is yearly held more accountable for its actions, and when maturity has been reached we expect rational conduct. If the child has been properly trained, it has acquired to some extent fixed habits of responsibility.

The training of every employee, up to the time he enters industry, has been in the hands of parents, school and church. However, in the matter of "safety" that employee has received no training.

The employer knows that training to get out production is necessary and he is the one to give that training. In the matter of "safety" the employee is not responsible until the employer has taught him the right way to do things, thus making the employee accountable for his "safety actions."

Now, is the employer through? No. True, the employee has reached the stage of rational safety thought, but the employer is still responsible, and will be until that thought becomes a fixed habit.

That is the necessary principle in preventing accidents—formation of the right habit.

The acquirement of fixed safety habits will largely do away with what is known as the "human element," that is, the uncertainty of what an employee may do next. The acquiring of the safety habit does not make a machine of an employee—neither does he become a "creature of habit"—nor does it destroy initiative, because the employee with the safety habit can introduce a new idea that will be a success because it has "safety" built into it.

The employer is equally responsible for an experienced employee newly hired. That employee knows his job, but he does not know his work room and the various things that are different. It is the duty of the employer to teach him these things. The liability of the employee commences only after his employer has taught him "Safety, the right way always."

The moral and legal liability of the employer for accidents is emphasized on the day he hires an employee who is not capable of rational "safety" conduct and tells that employee to "Hop to it" instead of "Watch your step."

Who Is Responsible for Industrial Accidents?

By JOHN M. McARDLE

Safety Supervisor, Armour and Company, Kansas City, Kans.

The gentlemen who have preceded me have attempted to set up a vindication for each of the interested parties; namely, the management, the supervisor, and the employee, and at the same time have pointed an accusing finger in the direction of the "other fellow." From their remarks, we would be led to believe that no one is responsible for accidents.

Yet negligence on the part of someone is the basic cause of almost every accident, either by act of commission or omission. Accidents sometimes are the result of a lack of knowledge on the part of someone.

Inasmuch as we do not have a specific accident to deal with, we must confine ourselves to a general discussion of all accidents and deal with the responsibilities of the interested parties in their order.

This brings up questions for the management to answer.

Have they been sincere and honest about a safety program?

Have they been so busy directing their seemingly more important business affairs that they did not have time or take time to engage in a program of safety? They are vitally interested in the production costs of their products; do they not know that accidents and injuries create a hidden cost which has been estimated at from three to five times higher than the direct cost?

Have they inaugurated a systematic routine of inspection?

Have they carefully selected supervisors according to their knowledge and ability to perform the duties assigned to them?

Is the supervisor's authority equal to his responsibility?

Is the remuneration paid him an inducement to others to aspire to the responsibilities of the modern supervisor? Are the working conditions of a standard to attract high types of workmen, and are they an incentive to the present workmen to produce better products without accidents to men, machinery, or equipment?

Next, we have the supervisor. The supervisor has been chosen because he has shown ability as a leader of men and because of

his knowledge of the business. The supervisor should know conditions, insist that the management provide safe working conditions and equipment, and insist that the safety rules be lived up to by the employees under his supervision.

When safety rules are made, and the supervisor does not see that they are enforced, there is only one conclusion: that is that the supervisor is not big enough for the job. The failure to detect and correct a hazard, just as the proper training of an operator, is the responsibility of the supervisor.

Something can and should be learned from every injury, which will help to protect those depending on their leaders for safety, and this is part of the job of every supervisor. Leadership is absolutely necessary to triumph over all enemies, whether they be accidents or not.

In the old order of industry, foremen were referred to as bosses, sometimes drivers. In the modern order of industry, they are referred to as leaders and teachers. A knowledge of safety and the ability to impart this knowledge to those under their supervision is a requisite of every modern supervisor.

When the management has honestly inaugurated a safety program, and has provided safe working conditions, safeguards and proper safety equipment, when it sponsors an educational program for supervisors and workers, and when the supervisors have carried out the safety program of the management, then management can rightfully expect that the workmen will take necessary precautions in performing their duties in a safe and sane way. We all know that the first law of nature is the law of self-preservation. If for no other reason, an employee should avoid injuries because of the loss to himself, loss to his family, breaking his future plans, destroying his ambitions, and the pain and suffering that every injury entails. No man can expect someone else to take no interest in him equal to the interest he should take in himself.

Sometimes management is charged with the responsibility for accidents because

certain changes in equipment, building or materials have not been made. This charge is sometimes unjustified. Profits from a business must be taken into consideration before certain changes can be made; in other words, dollars which have not been earned cannot be spent.

I will agree that management has profited by safety; but if we stop and think of the lives saved, the bodies unmaimed, the mil-

lions of hours of lost time and suffering that have been eliminated, certainly we will agree that the gain to the employee has been even greater than that to the management.

An illustrated talk on "How Equipment in Meat Packing Plants Can Be Safeguarded," was given by W. F. McClellan, Safety Supervisor, Armour and Co., Chicago.

Berthold L. Lange, Superintendent, Fouke Fur Co., St. Louis, Mo., spoke on "The

Quest of the Alaska Sealskin." The talk was illustrated with slides.

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F. A. LAUBMAN, Republic Steel Corp., Chicago, Ill.
 T. H. McKENNEY (retired), Carnegie-Illinois Steel Co., Chicago, Ill.
 D. V. MEDVILL, Interlake Iron Corp., Chicago, Ill.
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 C. S. PHILLIPS, Revere Copper & Brass, Inc., Rome, N. Y.
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 J. E. CULLINEN, Bethlehem Steel Co., Bethlehem, Pa.
 C. A. BRANCH, H. H. Robertson Co., Ambridge, Pa.
 H. W. DARR, Bethlehem Steel Co., Johnstown, Pa.
 M. W. DENDORE, Beloit Iron Works Co., Beloit, Wis.
 B. T. DYE, Republic Steel Corp., Warren, O.
 E. A. EDIS, Wheeling Steel Corp., Wheeling, W. Va.
 EARL FYLER, Carnegie-Illinois Steel Corp., Chicago, Ill.
 E. F. BLANK, Jones & Laughlin Steel Corp., Pittsburgh, Pa.

J. P. GATHERUM, Great Lakes Steel Corp., Ecorse, Mich.
 O. F. HARVEY, American Car and Foundry Co., New York, N. Y.
 S. E. HAWKES, MacWhyte Company, Kenosha, Wis.
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 T. H. McKENNEY, 2542 E. 73rd Street, Chicago, Ill. (Retired)
 D. V. MEDVILL, Interlake Iron Corp., Chicago, Ill.
 C. S. PHILLIPS, Revere Copper & Brass, Inc., Rome, N. Y.
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 FRANK ROWE, Wheeling Steel Corp., Portsmouth, O.
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 J. A. VOSS, Republic Steel Corp., Cleveland, O.

TUESDAY AFTERNOON SESSION

October 12, 1937

The session was called to order by General Chairman C. M. Allen, The American Rolling Mill Co., Middletown, Ohio, who introduced the speakers.

Safety as a Morale Builder

By ROY W. KELLY

Chief, Personnel and Training Division, Soil Conservation Service, Washington, D. C.

The maintenance of morale is readily conceded to be one of the major objectives of management. Whether the executive is responsible for building locomotives, making mattresses, managing a Government bureau, or commanding an Army division, his success is dependent in large upon keeping up the morale of his associates.

All of us tend to be influenced by, and to be upset and kept in a most unsatisfactory frame of mind by unsatisfactory living or working conditions. If we want high morale, we must expect to pay constructive attention to such matters as wages, hours, working conditions, basic causes for grievances and complaints, improvement of sanitation, elimination of unnecessary noise, and proper heating, lighting, and ventilation of the work place. Perhaps no other causes contribute more to lowered morale than a feeling of insecurity in one's occupation, fear as to the

future of one's earning power and doubt as to opportunities for advancement and for satisfying achievement.

These are all recognized as matters properly belonging in the field of personnel administration or labor management. They are mentioned merely for the sake of pointing out that safety is an integral part of this functional field. Organization for accident prevention and the maintenance of the safety program, if they are to contribute to improved morale, must be planned and carried out with a view to their direct relationships with these other essential human factors in management. This is a point on which there is much diversity of opinion as well as practice.

Nevertheless, the experience of many organizations tends to indicate that a safety program cannot hope to succeed, no matter how well planned, unless conducted in an

administrative atmosphere conducive to its acceptance and furtherance. This requirement, coupled with the fact that many safety activities, because they deal with men and women in their work environment, are inextricably interwoven with the whole fabric of personnel administration, appears to imply that the subject of safety should be planned and broadly supervised by the same executive who is responsible for industrial relations or personnel policies. In no other way are the full morale-building values of safety work likely to be fully realized. We will try to develop this point further as we proceed.

In a list of essential factors which must be considered in developing high morale, I am inclined to place at the top security in one's job and a feeling that the opportunities for advancement in the work where one is employed are not closed. If the employee is marking time financially, he must feel that he is making progress by improvement in his methods or in his output, or in his general civic, social and economic relationships.

Next in order come *safe, sanitary and attractive* working and living conditions. You will, of course, readily concede the first two adjectives and I am hopeful that you will sympathetically consider the third point of "attractiveness." Streamlining has taught us that even trucks and locomotives can present an attractive, pleasing appearance. Progress in architecture, in interior decoration, in the manufacture of office furniture and plant equipment, no longer leave a place for ugly, inharmonious or displeasing surroundings.

A third factor of much significance is the establishment of appropriate goals or objectives and is connected with the nature of the work itself. Pride or joy in accomplishment, with consequent upswing in morale, never go along with a feeling that the work represents a useless waste of funds, that it accomplishes no constructive purpose, or that it is not properly related to the general worthy goals or objectives of the organization or work unit. A high level of morale can only be based on pride in workmanship, pride in the product, and satisfaction in the fruits of labor.

A fourth factor implies the existence of an organization, administrative procedures and methods, and executives of such character as to inspire confidence, create loyalty and enthusiasm, and able to hold a position of true leadership.

Let us now turn back to the general statement which was made at the outset, namely that accident prevention is a management function inseparably interwoven with other functions in the field of industrial relations or personnel administration. It is largely useless to debate how much a safety campaign contributes to improved and more harmonious labor relationships, or whether better personnel administration automatically tends to reduce accidents. It is equally futile to argue that either safety or certain other aspects of personnel administration ought to be started first, in a new organization, or emphasized most in an established organization where improvements are sought. Without care in selection of new employees, without attention to promotion and transfers, without a constructive and harmonious labor policy, in the face of bad housing, or poor health, or low sanitary standards, or with an ineffective and poorly devised organization structure, no safety engineer, no matter how competent, can hope to succeed in accident reduction and much less to use his program effectively as a morale builder. There is no heart for safety where bitterness and discontent, gloom and discouragement, are spread from these sources.

This point is emphasized because it is believed that the safety engineer or the executive who faces his problems from a truly constructive, long-term point of view will strive for the establishment of good personnel procedure and constructive labor policies. Certainly no other kind of safety engineer or administrator is interested in furthering morale through accident prevention. Possibly what is most needed for the sake of improvement in organization, as well as better morale, is more personnel administrators who have a practical working knowledge of the field of accident prevention, as well as more safety engineers who are intelligently and constructively paying attention to personnel problems and labor policies.

Possibly, it will be helpful to briefly list some of the ways in which organized safety activities, viewed in the light of the foregoing discussion, can be expected to contribute to improved morale:

1. The safety program tends to remove fear as to the future. Accident prevention is one form of job insurance.

2. Good housekeeping with its natural companion, improved housing, arouse and

sustain pride in the work place, in the local community, in well-kept tools, equipment and facilities.

3. Service on safety committees, cooperation with supervisors in the investigation of accident causes, free discussion of equipment and work practices, all bring management and men easily and naturally together on common ground with a community of interest. Improved morale grows out of better understanding and mutual respect.

4. Training in foremanship as well as general occupational training should be closely linked with the safety program. The general values of training for morale building, such as pride in the product, satisfaction in waste elimination, gratification in improved craftsmanship, can be helpfully coupled with learning how to avoid personal injuries.

5. Medical plans, physical examinations,

first aid training, emergency first aid provisions, a long list of matters pertaining to health and sanitation, are the natural accompaniments of all well organized safety work. They yield direct returns in happiness, contentment and higher morale.

6. Keeping accident statistics and the publication of comparative severity and frequency rates or unusually good records of departments or units, provide an objective, insure team play, and develop a healthy, competitive spirit.

7. Perhaps no other activity gives management an equally good opportunity to demonstrate a constructive, sympathetic, personal interest in the employee. Confidence is inspired by concrete examples of willingness to expend funds and to devote executive time to protecting the life and health of the worker.

Welding and Cutting Fires Are Preventable

By J. I. BANASH and H. F. REINHARD

Consulting Engineer and Secretary, respectively, International Acetylene Association, New York City

The purpose of this paper is to set forth, from the viewpoint of the oxy-acetylene industry, a few simple, inexpensive precautions—the adoption of which is strongly urged.

Studies prove that fires occur largely in portable cutting operations, that is, cutting done during repair, alteration or demolition work or in some intermittent use, and usually when the operation is not under the direct control of the foreman of the department where the work is being done. We estimate that about 90 per cent of all welding and cutting fires occur while using portable equipment, and that from 80 to 90 per cent of these fires occur during flame cutting, rather than welding. In these portable cutting operations, our studies make it obvious that some lack of knowledge, supervision or interest on the part of the operator has been largely responsible for the fires.

The oxy-acetylene flame has no place in any location where a flame or open light of any kind would not be permitted. But it is surprising how many times an oxy-acetylene flame, with its very high temperature, is employed in places where a match or a spark or a forge or a gasoline torch would not be

allowed. In nearly every plant or shop there are such places. For instance, extreme care is always necessary near combustible gases or flammable liquids, and such things as blowtorches, open lights, sparking tools and other possible sources of ignition must be prohibited. But welding and cutting can be done in most other locations with safety if certain reasonable precautions are taken. Knowing the way that fires may start is an important step in learning how to prevent them.

Heat sufficient to start fires may come from the oxy-acetylene flame itself; from metals being welded or cut; from the molten slag or metal that falls or drops from the cut; or from sparks that fly from the work. Some materials will, of course, catch fire from these sources of heat more quickly than others.

Flammable gases and liquids with air or oxygen present are examples of materials that will flare up at once. Oily wastes and rags and materials such as burlap, excelsior, straw and paper catch fire less easily, but burn vigorously once started. Wooden flooring, timber structures, scrap lumber, wood

chips, tarpaulins and similar material are less apt to catch fire than the others mentioned, but precautions must be taken with any such combustible materials.

Fires started in them may only smolder at first and then flare up sometime later due possibly to a gust of air or a natural draft created by the heat from the smoldering material.

The oxy-acetylene flame is itself rarely the cause of a fire; probably because it is subconsciously evident to anyone that the extremely high temperature flame and flammable or combustible materials should be kept apart. Heat from the metal being welded or cut may sometimes be the cause of fires if hot pieces of metal are allowed to touch materials that burn readily. This may happen in the case of cutting steel and iron when small pieces are cut away from larger pieces and allowed to drop onto the floor or ground.

The smaller or narrower the piece cut away, the higher its temperature is likely to be, and the more likely, therefore, to set fire to burnable materials. Pieces of iron or steel which have been heated to a bright red heat may remain above the kindling temperature from 5 to 15 seconds or even longer under some conditions. Even though the piece may appear to be at a black heat in daylight, it can scorch such things as wood or paper, and a fire may start if there is enough draft.

Fires that do occur during the use of the oxy-acetylene torch are largely caused by globules of hot metal and slag from cutting operations. Because of this, for immediate results, it seems that most of our efforts should be directed toward the cause of most of the trouble—the use of portable oxy-acetylene cutting equipment. It does no good to debate the question of whether a fire has been caused by a spark or a drop of molten metal or hot slag. The practical fact remains that hot globules of metal, hot slag and sparks are all formed in flame cutting operations, and all of them are capable of igniting flammable liquids, gas-air mixtures, or combustible materials.

Because sparks from cutting or welding, particularly from cutting, may fly in so many directions, and because they sometimes travel for a considerable distance, they must be watched closely to make sure that they do not start fires. Sparks are really little glowing particles of metal oxides, and some of

the larger ones may retain enough heat to start fires for several seconds after landing. The heavy sparks from cutting work sometimes travel 25 feet from the point of cutting and can readily set fire to light materials such as excelsior, paper, or oil rags. If sparks should fall into containers holding flammable liquids or spaces containing mixtures of flammable vapors and air, quick and dangerous fires will result.

It is also important to realize that sparks which fly some distance or which roll along a floor may cause smoldering fires. Smoldering fires may start by sparks getting in the cracks of floors and woodwork or by sparks flying on materials such as rags, tarpaulins, paper wrappings, wood chips, scrap lumber, and cushion padding. Sometimes these fires go out of their own accord; sometimes they smolder and burst into flame as long as one-half hour later. Sparks may also drop through cracks in floors or between floors and columns and ignite combustible material on the floor below. Special attention should be given to such sparks when using the cutting torch in the construction, repair or demolition of buildings.

Certain rules for the prevention of fires when welding and cutting have been formulated. Although we are dealing here with gas welding and cutting only, the same rules with one exception, apply to any hot operation. These suggested safe practices are as follows:

1. Do not perform "hot" work where any open flame would be dangerous, as in or near rooms containing flammable vapors or liquids, or exposed loose combustible stock.

2. Be sure that cutting and welding equipment is not used near dipping or spraying rooms, or rooms containing loose, readily combustible material, unless there is no possibility of the vapors or of sparks and molten metal passing through broken or open windows, open doorways, or cracks or holes in walls or floors, or otherwise reaching combustible vapors which are often heavier than air.

3. If the work can be moved, take it to a safe place for cutting and welding; do not perform the work in a hazardous location. A non-combustible room or building, or one provided with an automatic sprinkler system is usually a safe location.

4. Where welding or cutting has to be done in the vicinity of combustible material,

special precautions should be taken to make certain that sparks or hot slag—from cutting operations particularly—do not reach the material and start a fire. If the work cannot be moved, exposed combustible material should, if possible, be moved a safe distance away. Sweep floors clean and if combustible, wet them down before starting work. Wooden floors should preferably be covered with metal, sand, or other suitable non-combustible material where sparks or hot metal are likely to fall. Brick is not suitable unless all crevices are filled with sand. Wherever there are floor openings or cracks in the flooring, make certain that there are no highly combustible materials on the floor below, which would be exposed to hot metal or slag that might drop through the floor.

5. Observe the same precautions outlined in Rule 4 with regard to cracks or holes in walls, open doorways and open or broken windows. Use sheet metal guards or asbestos curtains where needed. Make sure that the guards and curtains are adequate. Because hot slag may roll along the floor for considerable distances, it is important when using asbestos blankets as curtains that no openings exist where the curtain meets the floor.

6. When it is necessary to do welding or cutting close to wooden construction or in locations where combustible material cannot be removed or protected, small hose, chemical extinguishers or fire pails should be conveniently at hand.

7. Whenever combustible material has been exposed to molten metal or hot slag from cutting operations, a man should be kept at the source of the work for a half hour after completion, to make sure that smoldering fires have not been started.

8. All welding and cutting equipment should be kept in good order. Use good hose and renew it when necessary. When hose is worn near the couplings, cut off a few inches and renew the connections, making sure that they are tight. Good connections between regulators and cylinder valves are important. Torches or blowpipes should never be hung from regulators or across the tops of cylinders. Only cylinders which comply with Interstate Commerce Commission shipping container specifications and which are equipped with safety devices approved as to

type and location, shall be used for any compressed gas.

9. For the installation and operation of gas systems for welding and cutting, the regulations of the National Board of Fire Underwriters should be followed.

Take no chances. Everybody loses from a fire, employer and employee alike. It is safer and much more to one's credit to keep fires from starting than to put them out afterwards. Remember, one is always some sort of an example for his helper or others less experienced.

Men who are to be entrusted with welding and cutting jobs should be men who handle oxy-acetylene equipment safely and sensibly. They should know that it is just as important to prevent fires as it is to prevent accidents, and that a small fire is a potential big fire that will cause severe hardship to his employer and his fellow workmen as well as himself.

The Inspection Department of the Associated Factory Mutual Fire Insurance Companies urges that before welding or cutting is performed at a point not regularly set aside for such work, permission be secured from some specified responsible person such as a superintendent or foreman. We heartily subscribe to this, and further urge that no such work be performed without the knowledge or consent of the person responsible for the department in which the work is being done.

Discussion

Mr. Allen: What is the best chemical to use on acetylene fires?

Mr. Banash: Follow recommendations of I. A. A.

Mr. Banash: A thing to remember is that outside contractors sometime fail to use proper precautions. A clause covering this should be in the contract.

Mr. Medalie: Is there any danger of having cylinders too close to work benches?

Mr. Reinhardt: Keep cylinders far enough away from work benches.

Mr. Filmer: We do not let any one use a torch until they have taken an examination from an instructor.

Mr. Banash: Never burn on a concrete floor; use a steel sheet or plate.

WEDNESDAY AFTERNOON SESSION

October 13, 1937

How I Made Safety Effective in My Department

By BEN J. HARLAN

Superintendent, Blast Furnace Dept., Lackawanna Plant, Bethlehem Steel Co., Lackawanna, N. Y.

My department consists of five modern blast furnaces, equipped with the usual auxiliary equipment; an ore dock, equipped with four Hulett unloaders, and four ore bridges. The capacity of the furnaces is 130,000 tons of hot metal, per month, and the dock is capable of handling about 4,500,000 tons of ore, coal and limestone, during the lake shipping season of seven months. Daily working force at times of full operation is 443 men.

During my first years at Lackawanna, the blast furnace department had a safety record which was not all that could be desired, and we realized something had to be done about it.

We cleaned up the plant, guarded all the equipment, lighted the department so that a man could see to work as well at night as during the day, took the coke salamanders out of the stockhouses, and installed a modern heating system, installed handrails, corrected improper clearances, and moved foot walks to their proper and safe locations. In other words, we put the department in order mechanically and physically.

Then we started to work on the personal element.

We wrote a safety code for all operations in the department, organized a special Safety Inspection Committee of foremen and men, who inspected a certain unit of the department each week for unsafe equipment, cleanliness, and unsafe practices, established a "safety court" and tried before a jury of men all who violated the safety code, or who had an accident of any kind, minor or "lost time." Our employee representative acted as judge of the Court.

We divided the departments into groups, held monthly safety contests, and awarded safety shoes to the winning group. All foremen held five minute safety meetings daily. We held weekly safety meetings of foremen. We held a monthly safety meeting of foremen, permanent safety committeemen, and

as many of our men as our office would hold.

We provided free to the men in the department safety equipment, such as protective clothing, goggles, and all other devices that they needed.

The improvement in our accident record follows:

Year	Total Lost Time Accidents	Fatalities
1929	18	0
1930	22	2
1931	10	3
1932	6	2
1933	0	0
1934	0	0
1935	5	0
1936	9	0
1937	5	0

In the four years preceding our intensive safety drive, we had 56 lost time accidents, and seven fatalities; in the following four years, 14 lost time accidents, and no fatalities; which is a reduction of 75 per cent in lost time accidents, and the elimination of all fatalities.

During this period our best record of elapsed time without a lost time accident was 35 months.

In general, prevention of accidents divides itself into two phases: mechanical safeguarding, and the human or personal factor.

Mechanical means of preventing accidents are as follows:

1. Proper design of plant and equipment. Under this head comes guarding machinery; proper clearance; adequate walkways, steps, ladders, hand railings; proper electric wiring, and the numerous other mechanical safeguards with which we are all so familiar.

2. Good lighting. In order to be safe, a plant operating continuously must be as well lighted at night as it is during the day.

3. Good maintenance. I mean inspections and maintenance of equipment so as to have it always in safe operating condition, rather than repairing expensive break-downs. This, of course, applies to hand tools, ladders, extension cords, crane hooks, cables, ropes, tackles, blue flags, and other equipment in daily use, as well as the major mechanical equipment.

The human factor is by far the most important item in accident prevention: being responsible, in my opinion, for at least 90 per cent of all industrial accidents.

We believe the approach to this problem is best made through education, discipline, and competition.

By education, we mean safety codes; bulletins; safety meetings; study of minor and lost time accidents as they occur, explaining the reason for their occurrence, and means of preventing similar accidents to the foremen and the workmen involved; planning all jobs before they are started from the view point of safety as well as efficiency; the study of all operations to eliminate unsafe practices.

Discipline must be maintained at all times, and all cases involving carelessness, infraction of safety rules, or any other conduct of

the foremen or workmen creating unsafe conditions must be called to their attention, and disciplinary measures applied firmly and equitably.

All normal animals love competition: fox hounds love to lead the pack; thoroughbred horses love to win races; boys love to win baseball games; and 99 per cent of all men, who are treated fairly and encouraged in their efforts to make their department or plant safe, will co-operate to the fullest extent to lead in the safety parade.

Discussion

Mr. Byram: How do you arouse safety consciousness in your men?

Mr. Harlan: We divide departments into six groups. We publish the name of any employee who has an accident.

Mr. Filmer: If a man makes a suggestion which is not feasible, how do you handle it?

Mr. Harlan: We explain the reason why.

Mr. Byram: Are safety shoes required?

Mr. Harlan: No, but we do stress the wearing of safety shoes. Ninety-five per cent of our men wear them.

The Safe Use and the Abuse of Wire Rope and Wire Rope Slings

By R. B. WHYTE

General Superintendent, Macwhyte Co., Kenosha, Wis.

The safe use of wire rope can be expected only if wire rope is made safe for use.

Wire rope must have tensile strength and toughness, and it must be uniformly strong and tough throughout its entire length. This means that each coil of wire going into the wire rope must be uniformly strong and tough from end to end. There are 114 individual wires in the most commonly used rope.

Unlike many other steel products, rope wire is not heat treated at finish. The properties of strength and toughness and resistance to fatigue are gained through the cold working of the properly heat treated steel. This cold working or drawing is a continuous test of the material, for only suitable steel properly prepared will stand this cold drawing. All of the finished wire

is check tested for strength, toughness and fatigue resisting properties.

Rope wire can be laid into practically any size of rope. It is also true that rope can be made with practically any combination of wires. The size, strength, and combination of wires in a rope are determined by the service the rope is called upon to render.

The centers used in wire rope can be either fiber or wire, depending on use to which the rope is subjected. If flexibility and resiliency are desired the hemp fiber is used; if the rope is subjected to heavy crushing pressures or intense heat, wire center ropes should be used. Wire centers add approximately 7½ per cent to strength of ropes.

Since the life of wire rope is largely determined by the amount of bending it can

withstand, it follows that the larger the diameter of sheave or drum, the less severe the bending stresses in the rope, hence the longer will be the life of the rope. In addition to reducing bending stresses, larger sheaves reduce the unit pressure between rope and sheave and this reduces wear on both rope and sheave, a further argument in favor of large sheaves.

Some types of equipment permit the use of larger sheave rope ratios than others, but the important fact to keep in mind is that the larger the sheave the longer will be the rope life.

Sheaves and drums may be either flat faced or grooved, the grooves being of various shapes to suit various conditions.

The U groove supports the rope best and should be used where conditions permit. Many flat faced drums are used however, particularly on small hoisting equipment. Naturally the rope life will be reduced with a flat faced drum especially if it is less than the economical minimum diameter for the rope used.

When designing U grooves for sheaves or drums, the diameter of the groove should always be larger than the nominal diameter of the rope and when rope is wound on a grooved drum, the grooves should be spaced far enough apart so that the turns of rope do not come in contact with one another.

The V groove is used only where the rope does not dead end on the drum and it is necessary to get traction between the rope and the drum. V grooves are generally very destructive to rope, the wedging action causing about 10 times the pressure between the rope and drum that is found with the U type of groove. Furthermore, this heavy pressure is distributed over a very small area of the rope, causing concentrated and rapid wear.

Factors of Safety

Wire rope should always be several times stronger than the load to which it is subjected, thus providing a factor of safety to take care of abnormal conditions, wear, etc. If the strength of the rope is five times greater than the load, we say that the rope has a factor of safety of five.

Factors of safety in excess of five, varying up to eight, and even more, are often required for safe and economical operation. The proper factor of safety for a wire rope

should be determined by careful and thorough consideration of all pertinent data. Such data should include all loads, acceleration, retardation, rope speed, attachments, the number, size and arrangement of all sheaves and drums, existing conditions causing corrosion and abrasion, length of rope, economical rope life and the degree of danger to life and property.

For general hoisting work on derricks, power shovels, hoists, etc., the equipment is usually designed for a factor of safety of five, while traveling cranes and passenger and freight elevators are designed for six, eight, or even twelve, depending on the type of machine, speed of travel, etc.

Sometimes conditions will not permit of safety factors as great as those mentioned in the foregoing. For example, on ballast unloaders and logging equipment, the ropes are sometimes stressed up to nearly one-half their breaking strength. Also on standing ropes and derrick guys, the heaviest load will sometimes reduce the factor of safety to about three, but since these extreme loads are only encountered occasionally, such a low safety factor is not considered dangerous.

Generally speaking, however, it is not good practice to go below a safety factor of four for any class of service. To do so will cause the rope to wear out rapidly even where the element of safety is not important.

Factors Tending to Destroy Wire Rope

Bending stresses have a very great effect upon the life of wire rope. When a wire rope is flexed over a sheave or drum, there is considerable movement between the strands and also between the wires composing the strands, and consequently there is much internal friction. Bending also causes fatigue in the wires, reducing their toughness and making them harder and more brittle. This causes them to fracture.

Speed is an important factor in connection with bending since, when a rope is bent around a sheave at high speed, the wires do not get time to slide past each other and adjust themselves to the changed contour of the rope. The result is that at very high speed bending stresses are much higher. It is not possible to state an exact rule for the effects of speed upon rope life but it is generally considered that rope life varies in-

versely as the square of the speed, other conditions remaining constant.

Corrosion and lack of lubrication are similar to high speed in this respect since here also, the wires do not get a chance to adjust themselves properly.

High speeds and sharp bending are to be avoided if satisfactory rope service is obtained.

Reverse bending is very detrimental to the life of rope, causing failure in about one-half the time that is caused by continuous bending.

Since a wire rope is a complex structure, the theoretical calculation of bending stresses is a very complicated matter. In a worn rope bending stresses are not susceptible to accurate mathematical analysis since too many variables are involved; corrosion effects, condition of lubrication, core condition, etc.

Abrasion

All ropes are subjected to more or less abrasion. Sliding frictional wear occurs when a rope drags over the ground, or across tracks, or through material of a gritty nature. For this type of abrasion a coarse strand construction is desirable.

To resist wear imposed by a sheave or drum a finer construction is desirable as such a construction has more wires per unit of length in contact with the sheave and this means a lower unit pressure between the rope and sheave and consequently slower wear. Mis-alignment of sheaves or drums causes undue abrasion to the equipment as well as the rope and where these conditions cannot be corrected coarser strand constructions are beneficial. Where sheave or drum wear is the governing factor and conditions of alignment are good, lang lay rope with its greater exposed surface is often successfully used but it is not recommended unless sheave grooves are of proper size.

Deeply scored or corrugated sheaves are also a source of rapid rope wear and contradictory as it may appear, a soft cast iron sheave that wears rapidly will also cause more wear on a wire rope than the harder materials such as carbon steel, manganese or other alloy steels.

One of the most serious abuses encountered in wire rope usage is overloading. While this abuse usually takes the form of

broken wires or strands, its effect is sometimes present without being seen. A rope may be loaded beyond the elastic limit of some of the individual wires without having them break. This destroys the ductility of the wire making the rope brittle and weak. Subsequent normal loadings may cause failure of the rope when this condition prevails.

The maximum load that can be applied to a rope without danger of overstressing some of its wires is approximately 60 per cent, and for the sake of safety and long rope life it is desirable to keep the load well below this value.

Overwinding

When more than one layer of rope is put on a drum the rope is subjected to much crushing, distortion, and abrasion that quickly reduces its life.

When overwinding cannot be avoided the succeeding layers should not criss-cross but should wind regularly in the groove formed by the preceding layer of rope.

Crushing

Ropes subjected to heavy loads on flat faced drums are apt to crush and flatten out of shape. This is especially true of eight strand rope which has a relatively large hemp center.

Even on U groove drums, ropes are subject to this crushing action when wound in more than one layer.

Wire centers often replace hemp centers where these conditions prevail, and as a coarse construction in the outer strands also helps to give the rope rigidity, the flexibility is sometimes sacrificed to prevent excessive crushing. It is for this reason that seal patent construction is so popular for logging and oil well rotary lines.

Corrosion

Corrosion results from adverse conditions or lack of proper attention and plays a very important part in the life of a rope.

Some types of corrosion cause a brittleness in the wires reducing their ability to withstand bending. Not only does corrosion eat away the material and reduce the tensile

strength, but when it is present on the inside it causes a rope to become "rust bound."

This means that when a rope is flexed or when a load is suddenly applied, the wires do not have a chance to slide freely upon one another and equalize the tension in the various units. The result is overloading some of the wires causing their failure with subsequent failure of the entire rope.

Tensile tests conducted on used ropes have demonstrated that ropes free from corrosion have a higher efficiency than those that have been allowed to rust.

No matter how well done the original job of lubrication put in by the rope manufacturer, it cannot be expected to last the life of the rope, especially where it is exposed to the elements. The application of an approved wire rope lubricant will do much to prevent the evils of corrosion and wear.

Discarding Worn Ropes

For ropes that can be used until one strand or the whole rope breaks, the time to remove them from service is not a problem. Where the safety of life or equipment is at stake, ropes must be retired while still amply strong to carry the load.

Visual inspection of wear and the number of broken wires are the only means for determining this, but to attempt to establish a rule or set of standards for this without due regard to conditions specific to the application would lead the rope user astray and do more harm than good. The human element alone would outweigh almost any other factor.

Tests for ultimate strength on a section of the rope under consideration have been proposed, but it is deceiving to judge by these tests, for it is a proved fact that in some cases used ropes have a higher strength than when they were new. Their ability to withstand bending, however, is very much less than when new, hence their remaining life is quite limited.

Experience coupled with an intimate knowledge of prevailing conditions on the particular rope installation under consideration is the best guide for proper time to discard a rope.

Slings form the connecting link between the crane and the load itself and are sub-

ject to more abuse, abrasion and indeterminate stresses than any other kind of lifting equipment. The matter of application is too often a "catch as catch can" proposition, since little or no provision is made in designing machinery, heavy castings, dies, etc., for sling attachment. The method of application must therefore be determined by the character of the load and experience of the operator. This again will vary widely on identical loads handled in different shops, or localities. Sometimes this variation is due to the experience of individuals, rather than demands of the place and the job.

For instance, the general use of manila rope for sling purposes in any shop is usually an indication that the man in charge of lifting operations was formerly a sailor. Where the use of wire rope predominates, there is reason to suspect someone in authority was formerly connected with bridge building or steel erection.

The maximum damage to slings, regardless of kind and type, is always inflicted at the moment the crane tightens up, preparatory to assuming the total load. This is due to the endwise movement of the sling, parallel to its axis, while under a considerable portion of the load. This applies, of course, where the slings encircle the load and is particularly severe on chains. The movement is often accompanied by a sudden snap, caused by a link catching on a projection, or to several links pulling off side. This would seem to account for the fact most chain failures occur just when the burden has been picked up only an inch or so. It is exceedingly rare to see a chain break with the load in mid-air.

Rope slings obviate this danger because the axis of the sling tends to follow in a straight line when assuming the full contour of the object being lifted. This is true of both manila and wire rope slings, each presenting a smooth surface with individual fibers or wires which parallel the sling axis.

Manila rope is ideal from a viewpoint of flexibility and protection of finished surfaces, but it is very easily damaged and subject to rapid deterioration from dampness, oils and dry-rot. The appearance of a brand new sling is no assurance of its strength, unless it was stored in a place free from dampness and high temperatures. The true condition of manila rope and chain slings is equally hard to judge.

Chain slings are highly flexible but cumbersome to handle and, it made from steel, the chance of faulty welds and early crystallization is a real menace. Iron has long been accepted as the best material for chain slings because it welds easily, rusts evenly and is slow to crystallize. It is hard, if not impossible, to determine when crystallization sets in, or to what extent it has affected the strength of the metal. There is no warning of impending failure until the break actually occurs.

The practice of annealing chain slings to remove metal fatigue and thereby restore them to their original efficiency, is a fallacy, according to some engineers. It is common knowledge that annealed chains lose much of their original stamina. It has been found, for instance, necessary to resort to a 1" chain to handle a given load which had been handled repeatedly with a ¾" chain before the annealing operation.

Alloy steel has recently been under consideration for chain purposes, but its general use presents a problem that would seem to defy solution. All of such steels, suitable for chain, have two or three elements which fuse at widely different temperatures. Hence, a good grade of iron will continue to be the most satisfactory material for chain, barring some revolutionary discovery.

The flexibility of a chain and the ease with which it can be shortened makes it susceptible to abuse and unsafe usage. It is no uncommon thing to see a two-way sling with one leg twisted several times, so as to shorten it to lift a load evenly. Where one leg must be considerably shorter than the other, the operator may even resort to the expediency of tying knots in the chain. Where such a sling is used with the legs hooked back into the main link, to provide two legs, basket hitch, the common method of lifting foundry flasks and castings is to twist one leg a number of times to shorten it. Nothing but a chain will lend itself to such brutal treatment and the application cannot be commended.

Wire rope has long been recognized as a safe material for slings because of its great strength and extreme lightness. There is no weakest link in wire rope and the approach of the critical point of fatigue is always plainly visible in surface condition long before the sling is actually unsafe to use. A casual inspection is sufficient to

determine its true condition and it is easy to decide when it should be retired from service.

When metal becomes fatigued, whether it be in wire rope, chain or sling fittings, there is only one way to restore it to its original efficiency. And that is to put it through the crucible and make it again. Hence, wire rope slings provide an additional safeguard in that they cannot be repaired. It is true that chain will outlive wire rope in many cases, but the positive safety, low cost and lightness of wire rope more than offsets this disadvantage.

Braided wire rope is a construction especially designed for sling purposes. The idea originated in the need for a sling body that would terminate naturally in eye ends and the result is a combination of the flexibility of manila rope, the strength of wire rope and the link principle of chain. For sling work, the use of multiple ropes insures greater contact with the load and the surface of the braid is just uneven enough to prevent slippage, without damaging the load.

The safe load for wire rope slings is 20 per cent of the breaking strength while the safe load for chains is 33⅓ per cent of the breaking strength. Manila rope slings are usually figured on the same basis as chain.

Where a sling is used for general purposes, the safety factor will, of course, vary with the loads lifted, but it can vary as much as 50 per cent on an identical load, depending upon the angle at which the sling is applied. For this reason, a safety factor of 5 to 1 is always recommended, since the safe load can be doubled and the sling still hold a good margin of safety.

However, many wire rope sling users, especially bridge builders and steel erectors, are satisfied with a safety factor as low as 2 or 2½, because of the well-known dependability of wire rope.

Discussion

Mr. Patterson: What size sheaves should be used for 1" rope?

Mr. Whyte: The proper size sheaves to use are set out in all rope catalogs.

Mr. Griffith: In open heart practice what is the danger of rope becoming crystallized?

Mr. Whyte: We claim that rope does not

become crystallized. Unless temperature of rope becomes higher than 950° F. the rope will not be injured. We do not recommend hemp center rope for that type of work.

Mr. Byram: Do you have a definite rule for changing ladle cranes?

Mr. Whyte: Most operators do have some definite measured step for this.

Planning Your Safety Program

By BURRELL T. DYE

Supervisor, Warren District, Republic Steel Corp., Warren, O.

Organized industrial safety efforts in our country are credited with saving the lives of 270,000 workers during the past 20 years; also with preventing the injury of millions of others. Only about half as many people are being killed today in our industries as were killed in 1917.

In 1917 industrial accident prevention as a science did not exist. It is true that guards—good, bad, and indifferent—were being applied to machines, but today approved guards are being built on our machines by manufacturers at the source of their origin, and our newer plants are being built on approved safety plans.

Twenty years ago the causes of accidents were not accurately known; today these causes are thoroughly analyzed, and in most cases the cause is definitely established and remedies are applied.

We know today that 98 per cent of all accidents are preventable; also, we know that injuries are caused by accidents which are preventable, caused by unsafe practices and unsafe conditions. We also know that after we have made our plants physically safe we have eliminated only about 15 per cent of our accidents. This being accepted as true, we must then attack the elimination of unsafe practices. This is where a planned safety program begins to play a most important part.

There are as many reasons for a planned program as there are accidents during the year. Reports are based on monthly experience, consolidated at the end of each calendar year, and you expect as good a record in June, October, or December as you experienced in January; in fact, you should expect a more satisfactory experience from month to month.

Assuming that you have safeguarded your plant properly, and that new machinery comes equipped with adequate guards, your

problems are more of a maintenance and educational type, and with the subsequent education of your organization, the maintenance problems should be few, especially those for discussion in safety meetings, as such problems should be handled through the medium of the "Unsafe Condition" and "Unsafe Practice" reports to the foreman as soon as they are observed. Of course, if the foreman is not safety-minded, you have another problem, which may need to be handled through the superintendent or the works manager.

You have heard the many responsibilities of the foreman discussed from every angle; yet few discussions arise as to how to help him become a better foreman. This, I believe, can best be accomplished through a well developed set of methods of handling all safety problems and reports, with a planned schedule of topics to be discussed at his meetings throughout the entire year.

This program should be arranged to cover all seasonal topics at the proper time, such as: winter hazards and their prevention; annual spring clean-up and paint-up programs; vacations of employees and their families; vacations of school children and the hazard of their presence on the streets and highways; heat hazards and the care of the person during hot weather, not forgetting the important use of salt in the campaign against heat cramps.

It is assumed that each of you has some form of general safety rules or orders. A planned safety program is the one sure way of covering these rules in their entirety. During the year, possibly several times over, I use a set of general rules with departmental rules, and see that a portion of every set is discussed at each and every monthly meeting, using a sufficient number of each to cover all of them annually. Foremen have had their burdens increased many times in

recent years; therefore, I have attempted to make their tasks easier, at the same time giving them some definite thoughts to put over to their men.

The ideal planned safety program should start with your executive safety meeting, and should be held at the beginning of each month, attended by works manager or general superintendent and all departmental superintendents. The place of these meetings may be the office of your district manager or general superintendent, or in an elective place. I prefer holding executive meetings in the department in which the most unsatisfactory safety experience has resulted in the previous month, with the superintendent of that department conducting the meeting as a penalty for his unsatisfactory work.

At a meeting of this type it is well to have the foremen who have had accidents to their men during the previous month. In this manner a real impression is made on the foremen present as to the serious manner in which management takes accident prevention work.

At these meetings problems which cannot be dealt with satisfactorily by departments should be handled. Minutes of these minutes should immediately be forwarded to all departmental superintendents, who in turn should use such general information as is valuable to their respective departments. Minutes of departmental superintendent's monthly meetings should be forwarded immediately to all foremen of the department involved, in order that they may use them in their group meetings.

After this point in your safety program your scheduled meetings become most effective and should be set up in such a manner as to cover all unfinished business, new business, special literature received from the safety department or superintendent relative to safety since last meeting, general safety orders, monthly safety bulletins, and other safety problems that have arisen since the last safety meeting.

I have prepared and used in the last two years such a program, with an outline of subjects for discussion including a monthly safety bulletin, all of which tend to create interest among foremen in safety and develop all workmen along the same prescribed safety lines.

The planned safety program for the Warren District of Republic Steel has created so much interest that when a new department is opened, or a man is promoted to a foremanship, those foremen involved will ask for a copy of the planned safety program for their personal files; frequently before they have been placed on the mailing list.

As evidence whether such a program is being followed, one has only to compare the foreman's minutes of the group meetings from one department with those of a foreman from some other department, which departments, relatively speaking, have no comparison in operation, but do have the same goal in eliminating accidents.

In building up my foremen's planned program, I prefer to attach to each program a set of 12 bulletins, each covering one or more safety problems to be contained in one 8½ inch x 11 inch sheet, and then augment the schedule from time to time with current topics and problems as they arise, together with all outstanding accidents and their prevention month by month.

After having followed this form of planned program for two years we have enjoyed a frequency rate well under the whole No. 4, and a severity rate well under the whole No. 1 in the Warren District.

I introduce each program with a letter addressed to all superintendents and foremen:

"In presenting the attached program it is not our desire or intention to eliminate any individuality from the departmental plans or programs, or to eliminate any of the responsibilities of the superintendent or foremen in the promotion of safety as an integral part of their duties. Rather, it is our desire to be of assistance to the foremen, and we have, therefore, accordingly prepared a brief outline of subjects systematically arranged to be used during the current year.

"You will notice many topics, such as clean-up, good housekeeping, hand tool inspection, etc., have been omitted from this schedule of items listed on the planned program. This has been done for the reason that these subjects are daily problems and should be dealt with accordingly.

"Please remember, in accepting this program, that you are not getting any more out of it than you yourself, as a foreman, put into the program."

THURSDAY AFTERNOON SESSION

October 14, 1937

Metals Section Safety Contest

Twelve of the 231 competing plants in the Metals Section Contest completed the contest period without a single disabling injury. More than 345,000 employees worked 760,295,248 man-hours for an average frequency rate of 9.240.

Contestants in the light machine shops division had the lowest rates, averaging 7.333. Foundries had the highest rates, with an average of 16.170.

Fifteen plaques were presented to first place winners and ten certificates to winners of second and third place.

Awards were presented by R. T. Solenstein, vice-president, Elliott Service Co., New York City, and vice-president for membership, National Safety Council. Winners of plaques were as follows:

Light Machine Shops Division—Four tied for first place—Republic Steel Corp., Berger Mfg. Co., Canton, O.; The Perfect Circle Co., Hagerstown, Ind.; The Koster Solder Co., Chicago, Ill.; Republic Steel Corp., Canton Culvert Div., Canton, O.

Steel Mills Division, Group A—Republic Steel Corp., South Chicago Works, Chicago, Ill.

Steel Mills Division, Group B—The

Youngstown Sheet and Tube Co., South Chicago Works, South Chicago, Ill.

Heavy Machine Shops Division, Group A—Henry Vogt Machine Co., Louisville, Ky.

Heavy Machine Shops Division, Group B—Two tied for first place—C. Hager & Sons Hinge Mfg. Co., St. Louis, Mo.; Emsco Derrick & Equipment Co., D & B Pump & Supply Co., Los Angeles, Calif.

Rolling, Fabricating and Finishing Division, Group A—Republic Steel Corp., Niles, O.

Rolling, Fabricating and Finishing Division, Group B—Three tied for first place—Republic Steel Corp., Moline, Ill.; Lehigh Structural Steel Co., Allentown, Pa.; Pullman-Standard Car Mfg. Co., Baltimore, Md.

Foundries Division—Two tied for first place—Haynes Stellite Co., Kokomo, Ind.; The American Rolling Mill Co., Sixth Street Foundry, Ashland, Ky.

A motion made by Robert L. Schmitt, chairman of the section's contest committee, proposed that the Metals Section sponsor a program of home safety during 1937-38. The motion was passed unanimously by the delegates.

How to Make Statistics Interesting and Useful

By W. T. FILMER

Supervisor of Safety, Youngstown Sheet and Tube Company, Youngstown, O.

It is not easy to present statistics in such a way that they will be interesting. Statistics are generally a very boring subject. Yet facts and figures are the most conclusive evidence we have to prove or disprove the efficacy of the practice involved and to act as the guide by which to steer our future course. Statistics, to be valuable, must be honest!

Statistics must also be presented intelligently. Variable conditions must be recognized to get a true picture. The mere fact

that one department shows a frequency of 2.6 while another shows 6.6 does not necessarily mean that the 2.6 department is doing a good job. What are the relative hazards of the two departments?

Superficially, it would appear that the 2.6 department was the better of the two, but comparing it with another department with a similar operation in another plant, it was found that at the other plant the frequency was 1.4. Also the frequency for all departments of this kind, as disclosed by the U. S.

Department of Labor figures, was 2.1, so that the 2.6 frequency was really bad for such an operation.

On the other hand, the 6.6 frequency of the other department, compared with 7.4 frequency for a similar department at another plant, and with a 9.7 frequency for all similar departments listed with the U. S. Department of Labor; so that the 6.6 frequency was relatively good.

The man to whom statistics are an essential part of his job can, if he is interested, find a great deal of interesting information in the intensive study of a tabulation of figures. But the man in the factory, the foreman and often the superintendent, do not have the time nor the inclination to wade through a mass of abstruse figures which, so often, carry very little meaning to the superficial reader. Yet, these are the very men for whom we must provide the full story in all its completeness, if progress is to be made and past experiences made the ladder upon which we are to climb to higher achievements.

There is a way by which a mere tabulation of figures can be made to tell the story quickly if, say, two columns can be shown which give the ranks of the various departments. Usually these departments are listed alphabetically and to find out how any one department stands, it is necessary to jump up and down the tabulation. But if the department having the best frequency rating could be shown as number one, and so on in order, it would be easy for a superintendent to determine how his department stood in the comparison. Similarly a column would show how he stood in his severity rating.

Dale Carnegie has said that we are all primarily interested in ourselves. Naturally, when we are confronted with statistics in which we are a factor, we look to see how we stand. If I find that I rank first in the tabulation, naturally I am elated; I proceed to pass the word around to my subordinates, and they too are enthused and an incentive is produced to plug hard to hold that place. If, on the other hand, I find myself in twelfth place, and that figure stands out like a sore thumb for all the world to see, I realize that it is essential to get the gang together to see what can be done to get away from such a discreditable showing in the future.

The question "How do we stand this

month?" is one in which superintendents and foremen are vitally interested and the more clearly this standing can be shown, the better. Tabulations should be prepared to satisfy that interest. The best tabulations, however, cannot present the story quickly. We must take time to go over them carefully and intensively. They are, therefore, of little account when it is desired to reach people who do not have time nor the inclination to look them over in that way.

You have all seen the pie chart, in which percentage figures are shown like various sizes of cuts of pie. There are charts in which the various proportions are shown by varying sizes of the same figure, such as the figure of a man, or of a number of men compared in groups. The handbook of "Accident Facts," published by the National Safety Council, is full of statistics splendidly and comprehensively presented by this pictorial method. Work of this kind requires the services of one, who, if not an artist, must at least be able to draw fairly well. Most of us, however, are not gifted in that way. How then can we get the benefit of this pictorial presentation of facts?

A very effective chart on frequency and severity can be made to show the standings of different departments by the use of a red line. It can be made variable by the use of a red and white ribbon running on spools at each end and around behind the back of the body of the chart, so permitting it to be changed from month to month. The same type of adjustable chart can be used to show the number of days since the last disabling injury in various departments. The same general form can be used on a smaller sheet for distribution to give department heads and men a quick picture of the various department standings.

Such a chart, for example, can be made on an ordinary letter size sheet. The purple lines can be printed with hectograph ink. The red lines can be put on with a ruling pen with hectograph ink, showing the record for the current month; and as many copies can be made on the duplicating machine as are necessary. Such a chart conveys a much better picture, depicted in a much more convincing manner, than any tabulation of figures could possibly convey. A chart of this type can very easily be adapted to show many other interesting statistics, such as causes of accidents, nature of injuries, age ranges of victims, time incidence, etc.

Now, what about progress charts to show how we are progressing from month to month? One chart, easily made, has a resemblance to a city skyline, and tells its story quickly and convincingly in a very interesting way. We made such a chart for 1936 showing eight similar operations. The different colors indicated the different units. The top row indicated frequency; the lower row indicated severity. Each horizontal space represented one month of the year, and the height of the line indicated the cumulative figure for the year to date. The

first space was for January alone; the second space for January and February combined; the third space for January, February and March; and so on.

The same type of chart can be used effectively in depicting other subjects. It makes an interesting and forceful picture of what progress is being made in dealing with various types of injuries. This type of chart can be taken out into the mill and shown to men at safety meetings and I have been a little surprised at the interest which was manifested by them.

Maintenance and Repair and Its Relation to Safety in the Metals Industry

By CLIFFORD J. SMITH

Superintendent of Maintenance, Gary Works, Carnegie-Illinois Steel Co., Gary, Ind.

The safety program of a steel mill maintenance department consists of two major divisions; the promotion of the safety of the maintenance crews in the performance of their work, and the safety of operating and production crews, insofar as proper maintenance of equipment and development of improvements, based on observation of operating difficulties, can contribute to the safety of such crews. The maintenance man is called upon to work around all types of equipment in his department; and if he is working out of the central shops, his duties will take him into all parts of the plant. For this reason he is subjected to a greater variety of hazards than the average employee, a fact which should be borne in mind in the selection of personnel.

The preferred type of man for this work should be alert, able to analyze a situation and arrive at a prompt decision as to the required action. He must be able to include in his analysis the probabilities of dangers to himself and crew and minimize these dangers by proper planning of the work. Men are naturally placed in an organization by their interest and capability in a given line of work. In maintenance work, for example, some men can climb at considerable heights, with no ill effects, and others cannot; and this and other limitations of individuals must be known and considered in the assignment of work.

The next consideration is that of proper

tools kept in good condition, and special clothing or equipment where required for safety. This, of course, includes goggles, foot guards or safety shoes, leggings, gloves, aprons and helmets for burners and welders, safety helmets for men exposed to falling material, respirators for dusty locations, and oxygen apparatus where noxious fumes or gases may be encountered.

Plants operating blast furnaces and utilizing their by-product gases, which are high in carbon-monoxide content, must pay particular attention to the safety of operating and maintenance personnel.

Gas detectors are available which are arranged to show gas concentration on the dial of a suitable meter, calibrated to read directly in per cent of carbon-monoxide. These devices may also be arranged to ring a bell or light a light or both, at a predetermined concentration of carbon-monoxide, giving a continuous check, or at suitable intervals. Such devices should be used whenever workmen need to enter any confined space where gas may be encountered, as in gas mains, blast furnace stoves, gas washers, engine room basements etc.

In areas where gas is expected, and where the presence of workmen is required for a short repair or operating job, some form of breathing apparatus must be employed.

House masks may be employed where there is an unquestionably pure air supply within reach of a reasonable length of hose,

and a hand-operated blower used to force a supply of pure air to the wearer of the mask. In atmospheres where there is sufficient oxygen to sustain life, another type of mask and breather equipment may be used, wherein the carbon-monoxide is removed by passing the air through a suitable chemical filter.

When the oxygen content of the air is at all questionable, a complete oxygen breathing apparatus must be used.

The foregoing apparatus is all of a preventive nature, and to be effective, must be applied in anticipation of a workman's exposure to harmful concentrations of carbon-monoxide. To guard against unexpected exposure definite and detailed procedures must be developed and strictly observed. For example, men must not work, or go alone into confined areas where gas might be encountered—as in engine room basements, gas washer enclosures etc. Notwithstanding careful planning, accidental exposure may occur and remedial procedures must be fully developed. These include the application of artificial resuscitation to persons overcome by gas, and the supplying of oxygen through the use of inhalators. Men must be available in all crews who can administer treatment correctly and promptly, and frequent drills in this procedure are essential.

The next step in safe maintenance is to insure the proper line-up of men and equipment on the job at hand. Proper clearance with operating departments insures the attention of those supervisors acquainted with details of operating conditions and attendant hazards, and whose advice on such matters is very important. Furthermore, this minimizes the likelihood of unexpected operation of equipment and calls the attention of operating men to the presence of outside men in the department, in locations where normally no one would be working.

On movable equipment, all sources of power and control must be safeguarded by locking out such power control apparatus by the use of safety locks. Proper line up of the use and removal of safety locks is of prime importance. If more than one group of maintenance men are working on the job, each group should attach a safety lock, to be removed by no one, except the man responsible for a particular group, and then only after careful check, which accounts for each man in his group. Facilities should be provided so that locks are attached directly to the

locking-out device and capable of removal individually—for example, snapping one lock into another lock, so that the removal of the first lock removes the protection of the other groups, should not be tolerated. If one supervisor is responsible for all groups employed on the job at hand, then one safety lock is sufficient, if not removed until every man assigned to the job is accounted for.

Working platforms, where required, must be constructed in accordance with accepted standards, with railings and approaches and other features required by the job, and makeshift or substandard construction must not be tolerated. The need for railings and warning signs is to be carefully analyzed, as well as the need for special watchers.

Before the work is started it is essential that all men are lined up not only as to their duties, but also as to special conditions requiring their attention to insure a safe conclusion to the work at hand. Here again the operating department can be of great assistance in calling attention to hazards which may be encountered by men getting away from the working area, where all possible precautions have been taken for their safety, and into a location where they are not expected to be, and where hazards may not be entirely obvious.

Changes from the agreed procedure should not be made by any individual or group until it is certain that all concerned are aware of the proposed change and that no unexpected hazard will be introduced.

Upon completion of the job, a complete clean up should be made, removing all scrap and unused material, and restoring the surroundings to an orderly condition. All guards and safety appliances must also be restored before turning the equipment over for operation. Furthermore, during the progress of the job strict attention to orderliness is required. All materials and tools should be kept in order, and no accumulation of scrap materials or tools under foot, or interfering with progress of the job can be tolerated, if accidents are to be minimized.

Good light is essential to the safety of maintenance work, and sufficient temporary lights should be used to insure adequate illumination, provided that the light intensity for normal operation is insufficient. Portable man cooling fans may often increase the comfort and efficiency of the workmen and minimize the hazards inherent in fatigue and discomfort.

On the basis of the human element being the major problem in the elimination of accidents and their attendant injuries, the safety program must be designed to emphasize to the supervision and workers the necessity of being safety-minded at all times. The most effective influence in selling any proposition is an appeal to the self-interest of the individual. If he becomes convinced that he can personally benefit by the elimination of accidents, he is apt to accept the safety program and become a safety booster.

The hazards incident to maintenance work can be minimized by methods which anticipate and reduce the number of breakdown jobs. This reduces the amount of work and corresponding man hour exposure, and allows most of the work to be done on a planned basis. The most essential practice in such a program is systematic, thorough and frequent inspection of all equipment, with a follow-up system which will insure that unsatisfactory conditions are corrected as promptly as production allows or economic considerations dictate.

If the maintenance foreman's territory is small this inspection can be made personally. However, the usual division of a steel mill maintenance foreman is too extensive and too many other demands are made upon his time to allow personal attention to all items of equipment. It is then necessary to delegate this important function to operators, oilers, engineers and electricians who are in a position to observe the condition of each piece of apparatus.

In power houses, boiler houses, pumping stations and similar station jobs the engineers, oilers, pump tenders and electrical operators are primarily occupied with operation of the equipment and close and continual observation is automatically obtained. Such close observation is accepted as necessary due to the importance to production and the fact that little spare capacity is provided. Likewise, the standard of maintenance is high, being kept as far as possible on a preventive basis. The jobs are usually well planned, the crews experienced and efficient, and all tools and special equipment at hand, resulting in efficient and safe performance.

The majority of mill auxiliary equipment does not get the same degree of attention and maintenance. Here the operator, in general, has no interest in the apparatus, except

that it respond to the controls, and little or no responsibility for keeping the unit in operating condition—hence the necessary, fully organized maintenance crew to take care of such equipment. The only exception to this is the crane man who may have limited responsibilities as to the inspection, lubrication and adjustment of his machine, and certain other machine operators.

Overhead traveling cranes, gantry cranes, repair trolleys and various types of hoists comprise a class of equipment which require special attention from the standpoint of inspection and preventive maintenance. Due to the hazards of falling material, whether casual material, broken parts of the equipment, or loads dropped due to failure of mechanisms, every precaution must be taken to keep this class of equipment in good repair. It has been found desirable to supplement the work of the foreman and repairmen charged with the proper maintenance of such equipment by the use of Crane Inspectors.

The crane inspector goes over all equipment in detail, recording all items of a mechanical or electrical nature which need adjustment or replacement. This survey provides a double check and does not lessen in any degree the responsibility of the above-mentioned foremen and repairmen. Copies of these reports are forwarded to the superintendent and foreman involved, as well as to the Plant Safety Department head. All recommended repairs or alterations must be disposed of, either by being carried to completion, or by being rejected for cause.

The inspection covers cleanliness and orderliness of the equipment in the interest of minimized fire hazard and increased safety of operators and repairmen. Safety equipment, such as sanders, fire extinguishers, hand lines, safety belts, gongs, warning lights, light extension cords, gear guards etc. is checked. Loose or scrap material on the cranes, approaches or runways is not tolerated. Loose, worn or broken parts are itemized and recommended for correction.

Inspections at intervals of one to two months have been found sufficient for average conditions, with more attention given to particularly hard-worked cranes. Unusual operating conditions, or failures of parts may make it desirable for the inspector to make special checks and reports when requested.

ADJOURNMENT

Mining Section

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 V. O. MURRAY, The Union Pacific Coal Co., Rock Springs, Wyo.
 R. B. PAUL, New Jersey Zinc Co., New York, N. Y.
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General Chairman—G. J. BARRETT, Oliver Iron Mining Co., Duluth, Minn.
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P. M. ARTHUR, American Zinc Co. of Tennessee, Mascot, Tenn.

FRED E. BEDALE, Consolidation Coal Co., Inc., Fairmont, W. Va.

JOHN L. BOARDMAN, Anaconda Copper Mining Co., Butte, Mont.

MAURICE COULTER, Clearfield Bituminous Coal Corp., Indiana, Pa.

C. W. GIBBS, Harwick Coal & Coke Co., Pittsburgh, Pa.

H. T. HARPER, Tennessee Copper Co., Copperhill, Tenn.

H. C. HENRIE, Phelps Dodge Corp., Bisbee, Ariz.

RUSH N. HOSLER, Coal Mine Section, Pennsylvania Compensation Rating & Inspection Bureau, Harrisburg, Pa.

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TUESDAY AFTERNOON SESSION

October 12, 1937

The session was called to order by General Chairman C. W. Gibbs, Harwick Coal and Coke Co., Pittsburgh, Pa., who introduced the speakers.

The Relationship of Safety to Efficiency in Mining

By JAMES K. RICHARDSON

Safety Director, Climax Molybdenum Company, Climax, Colorado

No person will deny that there can be but two ways of doing work—a right way and a wrong way. The whole scheme of mining methods is basically a question of safety and efficiency. If the ore cannot be extracted economically the system is abandoned. If the ore cannot be extracted without endangering

the lives of the employees the system is abandoned. Unquestionably the latter though has often been overlooked. We cannot, however, overlook the fact that anything that kills or maims men is morally wrong. Furthermore, if our process or method tears up machines it is surely not efficient.

Low cost production is the true basis of efficiency. The major item on any cost sheet is labor. A property that achieves a low unit cost due to a cheapness acquired by low wages with the consequent low type personnel will not long exist! The reason is obvious—although the daily labor cost is low the ultimate job cost is high. These poor workers are the men that efficient organizations refuse to tolerate—the "cream of the crop" are hired in their place.

When a mine gets a reputation for unsafe working conditions you will notice an influx of poor workers. The good men leave—the poor ones stay. The reason is that the poor worker realizes he cannot get work in an organization that demands efficiency and ability. Each of us has talked to various employees coming from other properties. You hear that "such and such" a company kills men daily, or that someone is always getting hurt. These reports may or may not be exaggerated—but where there is smoke there is fire! If your property gets such a reputation among the laboring men LOOK OUT.

The basic principles of accident prevention are: Supervision, education, and discipline. It is not necessary to discuss these principles. However, it is true that too much of each day's work is lost by the working men, due to unsafe conditions. If the workman must spend half his day remedying faulty conditions, replacing staging left by a previous shift, "blowing out" his working place, or any one of a thousand similar circumstances, you know production costs are rising.

The efficient mining organization is today standardizing every task. These standards are built up from the study of the task and are adopted if efficient and safe. Such jobs are easily supervised and it is easy to educate the employee in the manner of working. When an employee knows how to do a job he seldom is injured!

From my personal standpoint I believe that the standardizing of jobs is the biggest step an organization can make toward improving underground or surface efficiency. I also believe that on the standard tasks the accident risk has been lessened 50 per cent. Every task is done the same way yet there is enough variation of conditions in mining practice so that it does not tolerate a man becoming mechanical. When a workman knows he must keep a definite standard regardless of the work being done, he attempts

to meet those requirements. He knows that the preceding shifts must meet the same requirements and therefore he is able to take up his work safely, exactly where it was left by his predecessor. He can thus devote his full time to work without fear of slipshod methods applied previous to his arrival.

I believe that a task well done, regardless of the job, is more easily maintained than a haphazard piece of construction. When a job is safe, all components of that job are in first class condition. We can, then, surely count on lower maintenance costs on first class jobs and when the operator looks over his cost sheets, repair costs are the major items. All of us have seen timbermen tearing out old timber and replacing with new. Had this timber been properly placed and properly considered at first, the new job would not have been necessary.

Unquestionably we have all had experience with faulty ventilation. I recall certain underground fires that could have been controlled and loss of life averted had ventilation been considered a major problem in the original layout. The major portion of our small metal mines are notoriously poorly ventilated. Many men are "gassed," causing them to fall from high raises to death or certain injury; others contract pulmonary diseases more readily and are disabled. Some are injured because of their inability to see their work clearly. These things are all due to a faulty ventilating condition, and any injury causes certain losses in production regardless of its seriousness; nor can it be denied that unless breathable air is available the normal efficiency of employees is decreased.

In one particular property I recall certain additional work obtained merely by establishing proper ventilation. A total of 150 machine shifts was being put in each day in a stoping area and prior to correct ventilation the average amount of hole drilled per machine was 86 feet. After the ventilation was improved the average was increased to 118 feet. Loaders who had originally pulled approximately 76 cars consistently passed the 100 mark. Footages in development work rose from 2.6 per machine to 3.8 feet. Loss of time from pulmonary disorders dropped to a negligible figure, and the accident frequency fell 28 per cent.

Another important factor in accident prevention is correct illumination. Those mines which have done away with the old carbide

lamps have found not only increased efficiency but increased safety. The average length of time spent per day working on carbide lamps by the underground workman has been found to be approximately 25 minutes. This alone makes a sizable amount on the cost sheet. When we consider the thousands of underground men still so equipped, the amount is truly appalling. The argument so often heard to this point is that regardless of the 25 minutes thus wasted, the average worker would waste it some other way. Regardless of such argument, the amount is still chargeable against carbide lights.

J. J. Carrigan, general superintendent of mines, Anaconda Copper Mining Company, has said of mine lighting in the Butte District:

"The salient advantages of the use of the electric cap lamp in the Butte District are:

1. Elimination of the fire hazard of the open flame lamp.
2. Reduction of fire hazard due to lighting circuits.
3. More uniform light during the entire shift, which is a good safety factor.
4. More efficient sorting of ore, made possible by better and more uniform illumination."

The advantages outlined are those normal to most metal mines.

Entirely neglecting the compensation or medical costs incurred by an injury there are numerous other costs which arise each time an accident occurs. Some of these costs are

hidden and not easily tabulated—others are very definite and are always present. Regardless of whether "hidden" or not; after a serious accident look at your cost per unit. We are safe in saying that it has materially risen.

For example let us take a wreck on a main haulage line in which a motor ran into the rear of an ore train. No one was injured and the delay caused was only five and one-half hours. It was, however, impossible for other trains to proceed with their ore, so that production stopped during that period. That accident in actual loss of production cost \$12,000; labor to rerail and repair motor and cars amounted to \$450; labor idle underground \$350. A total for an accident which caused no real injury to personnel of \$12,800. When persons are injured underground there are production losses in their immediate area; transportation costs which contribute to production loss; lowered morale of employees with a decreased individual production which often extends over several days; repair of equipment; and other items not easily tabulated. All of these are "dollars and cents" items to the producing company. Our company has figured that we have saved during 1936, by our safety program, approximately one-half million if we consider the year we undertook a definite program as a base.

Our company is no exception, and our management definitely believes that there is no compromise with safety, and there is no lessening of efficiency by strictly adhering to a successful accident prevention policy.

Safety Program for the Reduction of Accidents In Coal Mines in Colorado

By THOMAS ALLEN

Chief Coal Mine Inspector, State of Colorado

The safety program in Colorado involves many separate and distinct efforts; it will be necessary to describe each activity individually, and the coordination of the different units into one general plan.

Some three years ago I took the office of Chief Coal Mine Inspector for the State of Colorado. This was the time just following the general depression. For several years mines had worked very irregularly, and all

lines of safety work had fallen practically into nonexistence. At that time there were funds, and had been funds for several years before, in other state departments which might have been applied to work along educational and safety lines, but for some reason this was not done, and consequently there had been a long period of inactivity in safety programs with the State Coal Mine Inspection Department.

The activity of the Coal Mine Inspection Department at this time, in contacting other organizations engaged in welfare, safety and similar work in coal mines, is described here.

The State Coal Mine Inspection Department is now the hub around which all this work revolves.

Colorado Coal Mining Laws

The Coal Mine Inspection Department, being the base of operation for Safety efforts, is built upon a very good code of mining laws.

Colorado has had effective coal mining laws since 1913. Previous to that time laws were suggested and recommended, but with very little power for enforcement.

No real changes in the coal mining laws were made from 1913 until the Colorado Legislature convened this year. With so many changes in coal mining methods during the last twenty-four years, it was necessary to reframe different sections of the law to meet the new conditions.

The major rearrangements were made for the control of mechanical mining, which in most cases requires some blasting on shift. The important changes in the law regarding mechanical loading are as follows:

1. Where mechanical loading devices are installed they shall be operated under rules and regulations as prescribed by the State Coal Mine Inspection Department.
2. No blasting on shift shall be permitted in any coal mine without the written permission of the Chief Inspector of Coal Mines.
3. No other powder than permissible powder fired by electric battery, Cardox or approved mechanical or chemical devices shall be used where blasting on shift is permitted, and only certified shot firers shall be allowed to fire such shots.
4. Small power or hand blower fans for face ventilation may be used with the written permission of the Chief Inspector of Coal Mines.
5. In all mines the installation of underground fans shall be permitted only by the written approval of the Chief Inspector of Coal Mines.

The temporary rules governing the installation of mechanical loaders are here quoted. These rules are subject to change, with every possibility of more detail in regulation.

1. That each area where mechanical units are operating be under the constant supervision of a properly certified shot firer or other official, other than the regular employed foreman or assistant foreman.

2. That shot firing be done by a properly certified shot firer or other official.

3. That all places shot be examined as soon as possible and before operating men are allowed to return to work.

4. That the use of dynamite, black or pellet powder be prohibited in the coal face.

5. That only electric shooting by battery be permitted and rubbed covered or properly insulated lead wires be used.

6. That burster shots be fired alone and that no dependent shots be allowed and delay caps used when more than one shot is fired at a time.

7. That a sufficient supply of non-combustible, dirt or clay cartridges be kept on hand at all times.

8. That all places where mechanical devices are used be protected from dust hazard in a manner agreed upon with the Chief Inspector of Coal Mines.

9. That ventilation arrangements in mechanical districts and throughout the mine meet with the approval of the Chief Inspector.

10. That all ventilating fans be on the intake side of the workings and so set as to prevent return air from reaching it.

11. That all workmen wear goggles, hard or safety hats and hard toe shoes. Men operating cutting machines, electric drills and other such devices, wear only high-press rubber shoes with hard toes.

12. That no light, other than the approved flame safety lamps and electric safety lamps be used by crews on these units.

13. That first aid kits be kept close to operating units and all men be trained in first aid.

14. That telephones be kept up to within a reasonable distance of the working face.

15. That systematic timbering, meeting with the approval of the department, be strictly enforced.

16. That no conveyor or parts of machinery be suspended from the roof by hooks or bolts inserted in holes drilled for that purpose, excepting with the permission of the Coal Mine Inspection Department.

No regulations have been drawn as yet for

control of blasting on shift, but such rules will be ready for publication soon.

Mechanical loading devices, blasting on shift shooting, and underground fans, are under the direct control of the Coal Mine Inspection Department. This gives the department full power to stipulate any regulations they may see fit for the purpose of advancing safety in this work.

To carry out the proper supervision, the Colorado State Coal Mine Inspection Department is allowed one Chief Inspector and six Deputy Inspectors as a maximum force. The law states, "That every mine employing more than three men underground shall be inspected at least twice annually, and all mines employing three men or less shall be inspected once every six months."

Maintenance of Inspection Department

The revenue for the maintenance of the Colorado Coal Mine Inspection Department is derived from a special levy of four mills per ton of coal mined at each mine. In addition to this there is a license requirement as follows: Every coal mine producing less than 500 tons annually pays a license of \$10; 500 to 1,000 tons maximum, a license of \$25; over 1,000 tons annually, a license of \$50. This classifies the mines in a general way as large, medium and small.

Coal production in Colorado is approximately seven million tons annually; this nets an annual income of about \$28,000. Licenses produce approximately \$10,000 annually from 358 mines listed.

The law gives a further advantage in that registration of licenses gives us a complete list of all coal mines operating in the state. Previously, smaller mines would open and close without notification to the department, although the law provided that such openings and closings should be recorded in the office.

The law provides that in the event that we should accumulate more than \$20,000 in excess of the expenditures of the department, operators shall be notified that they are exempt from payment of the current quarterly installment of the four mill levy per ton.

The Coal Mine Inspection Department personnel is selected from the classified lists of the Colorado State Civil Service Commission, after competitive examinations are held governing the subjects pertaining to each individual job.

In addition to the field force of six Deputy Inspectors and one Chief Inspector, the office force consists of a Chief Clerk and two Assistant Clerks. One of the assistant clerks is classified as a Safety Director, whose work consists chiefly of accident and safety statistics.

Mine officials in the State of Colorado are certified after an examination is conducted by the Board of Examiners; this Board consists of one engineer, two coal miners and one coal mine operator. The Chief Inspector makes the fifth member and is Chairman of the Board.

Certificates of competency, granted by the State, are required for Mine Foreman, Assistant Mine Foreman, and Fireboss or Gas Watchman. Shot firers are certified by the Chief Coal Mine Inspector, who examines the candidate personally at the place where he is employed.

Certification of machine runners is not in the law yet. However, the reliable coal companies are beginning to request this. In the shot firer's examination the candidate must prove that he is able to detect dangerous gases by the use of an approved safety lamp. The Coal Mining law provides that before any shots are fired or any electric devices operated in a working place, the place must be examined for explosive gas. This means that every machine runner should be familiar with a safety lamp and have some knowledge of explosive gases.

In the 1937 session of the legislature a bill was proposed requiring certification for all underground employees.

In addition to the forces of the State Inspection Department, the larger coal operators of Colorado have formed an insurance company which has two inspectors in the field.

Most of the smaller mines are insured under the Colorado State Compensation Insurance plan, and this department carries at least one inspector on its payroll for coal mines exclusively. Only one company in Colorado carries its own safety inspector.

Accident Reports

Monthly accident statistics are published by the State Coal Mine Inspection Department.

A list showing the number of accidents for each mine is sent to every operator and every

local union of the United Mine Workers of America.

At the end of each six months the total number of accidents for each mine is sent to the same people. This is in the form of a competition for the reduction of accidents. The winner is presented with a silver plaque known as the State of Colorado Trophy, for the best record over the preceding six months' period. To obtain permanent possession, a mine must win it four successive times.

The State Board for Vocational Training has very materially assisted in the development of safety programs.

In 1935 it obtained about \$4,000 for instructors' salaries, to train 60 mine rescue men, and trained 300 applicants for certificates in the examinations held for mine officials; also, various groups were trained in first aid. The Board has cooperated with the Coal Mine Inspection Department and the United States Bureau of Mines to train an additional 1,200 men and 100 women in first aid.

During the last legislature the Vocational Department secured sufficient funds so that \$16,000 was allotted to train miners in mine rescue work, first aid, and the technical phases of coal mining this year.

Mine Rescue Work

Through lack of funds the training in mine rescue work had been inactive since 1935.

Now we have enough funds to reopen the educational campaign. It will be carried on until at least 1,000 well trained helmet men are in the mines of the state.

A complete file of these trained men will be kept in the inspection office, so that in time of accident they can be called out for duty. The intention is to select a key man in every district, who, upon notification, can assemble the required crews.

Some time ago a meeting was held to organize a State Council of the Holmes Safety Association. The organization of a State Council did not get under way, but the United States Bureau of Mines, and the Coal Mine Inspection Department are furthering the program.

Routt County, one of the largest coal producing areas, is 100 per cent organized. Other districts are organizing local Chapters with the expectancy that in possibly one year the

entire state will be functioning in this safety work.

The Holmes Safety Association of Routt County was possibly the first group of men in the country to take it upon themselves to further the use of goggles by all coal mine employees.

The Coal Mine Inspection Department maintains a very close contact with the United States Bureau of Mines through the regional office and field force in Denver.

First Aid Work

The system of First Aid Work was built up as follows:

A representative of the United States Bureau of Mines trained a group of men from each district to be instructors. The instructors trained workers at individual mines and were paid through the Vocational Board, assisted by the Coal Mine Inspection Department.

This may or may not be an entirely new method of approaching safety in coal mines. In furthering this program, the gospel has been preached among the women in mining communities that they are the real sufferers in accidents.

Women's auxiliaries are formed with the Holmes Safety Association, and other groups of women here have organized into independent units. These women are trained in first aid by a representative from the State Coal Mine Inspection Department and by any other available instructors. At present there are four active organizations in the northern field of Colorado, and six active organizations in Routt County. We expect to expand the program throughout the state.

These women, in addition to giving first aid, will help take care of the families where a mining disaster has occurred, and help maintain proper quarters and food for rescue workers.

The value of women being trained was shown at a recent meeting of the Haybro chapter of the Holmes Safety Association in Routt County. A miner's loose clothing caught in moving machinery. Women were present when the accident was discussed. In the future they will see that the men have tight fitting clothing, also leggings as a protective device.

W. P. A. to date has given the State Coal Mine Inspection Department the following assistance:

It has assembled and filed all the coal mine maps in the possession of the Inspection Department. It is now possible to secure a map of any mine in the state in a very few minutes.

The women's section of the W. P. A. made 500 compresses and possibly 2,000 triangular bandages for use in first aid instruction. The material was purchased by the Coal Mine Inspection Department. Splints for first aid practice were made by the men's group of the W. P. A.

At present some W. P. A. workers are making mine models for use in teaching coal mining in the different districts.

Exhibits of models and materials have been secured from powder firms and machinery houses; safety lamps have been collected and are available for instruction.

We have an agreement with the Public Service Company of Colorado whereby we may use any of their equipment on emergency.

The Mountain States Telephone and Telegraph Company will also respond with equipment or supplies.

We have an agreement with the Colorado National Guard, that in serious situations, necessitating the use of large crews of men, they will transport and place at the scene of the accident bed and bedding and cooking equipment, so that the excess crews may be handled.

National Guard airplanes will be placed at the disposal of the department for emergency work.

The Colorado State Highway Department will provide trucks and automobiles.

Included in safety activity is a continual pressure for the use of protective clothing, replacement of open flame lamps by electric head lamps, rock dusting, etc.

WEDNESDAY AFTERNOON SESSION

October 13, 1937

Specific Accidents and Hazards and Their Elimination In Bituminous Coal Mining

By JOHN LYONS

Safety Engineer, Bell & Zoller Coal & Mining Co., Zeigler, Ill.

For the last nine years I have been in charge of safety at two mines which have a combined daily tonnage around 14,000 tons. During this period we have made a complete transition at both mines from hand loading to 100 per cent mechanical loading. Some hazards have eliminated themselves with the change and new ones have originated.

Very few of our serious accidents have been repeaters that could have been eliminated by the same recommendation. Each accident had its own peculiar circumstance and needed a different remedy. Let me illustrate—two men were fatally injured in separate accidents by falls of roof rock. "A" was cleaning and timbering an entry; an old

prop supporting some rock was still standing. "A" knocked the prop out with a hammer and when he did, rock fell, fatally injuring him. Safe practice would have been to pull the prop out with a long rope pulled by a motor, or by use of a regular post puller. In the second case "B" had a rock roll across an entry which he was instructed to make safe. He set one prop under it on one rib and was standing under the roll cutting off the shoulder on the other rib when the rock fell and killed him. Safe practice in this case would require several safety props set under the roll and then cross-barred it.

However, there were some accidents which might be termed repeaters such as cutting

machine men riding cutter bars when the machines were in transit from place to place. Usually the helper would ride the cutter bar and upon seeing a switch ahead lined against him would jump off the moving machine to reline the switch and would slip under the truck wheels. This we have eliminated by enforcing a safety rule which allows no one to ride cutter bars.

In two separate fatal accidents the basic cause was the breaking of an electric locomotive axle underground. Early in 1931 we began changing our axles and used a heat treated alloy steel having a tensile strength of 125,000 pounds per square inch and a Brinell hardness with a 225 rating. Prior to this change we averaged breaking one axle per month; with the alloy steel we have never had a broken axle.

We have reduced our eye, toe and head injuries considerably by the use of goggles, safety shoes, and safety hats.

The majority of our other accidents have been reduced through removing the cause, such as the elimination of close ribs and timbers and requiring a minimum clearance of 30 inches, from the outside of the rail. The same applies to unloading timbers along the side of any track, they must clear 30 inches. Roof supports of junctions or curves must be put up so that in case of a derailment the timbering will not be knocked out. This is done by either hitching the legs or putting in concrete piers.

In face loading, we require that props be set not farther than 20 feet from the face and during the loading out of a room not less than three safety props must be set where coal has been loaded out, and no props must be removed while machinery is in

motion. At all times our foremen carry steel rods for roof testing and flame safety lamps for gas testing.

To prevent wrecks and accidents at switches, through the failure of the bridle bar on the latches for any reason, we have installed double or extra bridle bars on all main line haulage switches or any place where the motor may make a drop.

Safety rules require that the ground for 15 feet on each side of a switch throw be kept clean. Track is now laid on treated ties. This is especially important in development work where track laid on untreated wood becomes rotten and is responsible for a lot of bad track and derailments. Furthermore, track should be laid on ties not too far apart on account of breaking rails. We find 20 inch centers suits our rolling stock.

We avoided several finger and thumb amputations by providing all car sprags with guards. We use a steel pipe sprag on which is welded a steel washer 4 3/4 inches outside diameter and 6 inches from the end held in the hand. The pipe used is ordinary 2 inch double strength pipe. The use of wedge cap pieces for timbering increases efficiency and avoids the need of using an axe which has been responsible for the loss of many thumbs.

We enforce safety rules which require men to unload and load into mantrips only when trips are stopped, and only at regular stations where the trolley wire is guarded. We also require motors to keep at least 200 feet apart in transit with only two men on each motor.

Our greatest problem has been to eliminate the type of accident which may be attributed to man failure similar to that described in the case of timberman "B."

Specific Accidents and Hazards and Their Elimination In Anthracite Mining

By JOHN D. COONER

Safety Inspector, Hudson Coal Co., Scranton, Pa.

My company operates 17 mines in north-eastern Pennsylvania; employs 8,000 men, and in 1936 produced 4,500,000 tons. Eight years ago, our vice-president and general manager, Cadwallader Evans, started to drill into us the belief that most of our

injuries were not due to accidents, because an accident is "an event that takes place without one's foresight." This obviously leads to the belief that there would be fewer accidental injuries if dangerous conditions were properly guarded against, and

if the person likely to be injured took proper care to guard himself and his neighbors.

Our endeavor, therefore, has been to convince our men that what is commonly called an accident is generally caused by something that takes place due to lack of foresight of some person, and we now refer to such occasions not as accidents but as injuries.

Our inside men are 100 per cent equipped with safety hats. The majority of them wear safety shoes, with the number increasing; but our progress in getting our men to actually wear goggles has been slow. Men have received eye injuries, and in some cases lost their eyes due to flying material, etc. In many of such cases, investigation of these injuries has shown that the injured men owned goggles which were either in their tool box, their coat, or at home at the time they were injured. We have, after much thought and designing, had the manufacturer of our safety hats attach safety goggles to the hat by means of two aluminum discs on the under side of the visor and an elastic around the back of the hat. The goggles are thus immediately available when needed and easily put away when not needed.

To stimulate their sale, the men at our two largest collieries were given the following incentives to secure this combination:

- If a man has a hat without goggles, the new goggles will be placed on his hat free, if he presents his hat and any kind of goggles.
- If he has no safety hat, he will receive the combination at the cost of the hat if he presents any kind of goggles.

It is customary to use small auxiliary fans in some caved ground places and short tunnels, the faces of which are difficult to ventilate. These fans are installed so that the air is not recirculated or a non-permissible type is not installed in a gaseous area. The colliery people, before they install an auxiliary fan, must make a formal application to the assistant general manager on a special form used for this purpose. This form gives all the facts of the particular working place and vicinity. Should the conditions be satisfactory, the assistant general manager approves the form, which gives authority to install the fan. A copy of this approved form advises the ventilation inspector of the authority and intention to install a certain fan in a certain place. When this fan is installed the colliery people im-

mediately notify the ventilation inspector, who inspects the installation and—if satisfactory—approves same. Such a procedure must be followed each time a fan is moved or installed. Our ventilation inspector, therefore, knows where each auxiliary fan is installed and under what conditions.

In 1932, we started to use steel props on the three retreating longwall operations at our Birdseye mine, because we had learned that it was practically impossible to control the breaking of the roof with wooden props. These steel props are made up in three pieces, the middle piece being the shape of a wedge which is held in place by a key and a bolt which runs through the key and the wedge. All three parts are tied together by a chain.

It was not long after these steel props were put into use that men began to be seriously injured by parts of the props breaking under the terrific pressure and flying about. The 1 inch bolts through the wedges would break, allowing both the ends of the bolts and the heavy wedges to fly, even though the wedges were tied to the other two parts of the props with the $\frac{3}{4}$ inch chains, which would also break. In one particular case one of these 40-lb. wedges flew 23 feet and struck a man in the back. He was idle $1\frac{1}{4}$ years. To eliminate these hazards the following changes have been made:

- The 1 inch bolt through the key and wedge was increased to $1\frac{1}{4}$ inches, made of special high grade steel instead of ordinary steel as before.
- The $\frac{3}{4}$ inch chain tying the three parts of each prop together was increased to $\frac{7}{8}$ inch.
- The size of the wedge was increased to make it stronger.
- The props were stood with the wider portion of the wedge toward the cave so that if it did fly it would go into the caved area.

These changes have caused the injuries to decrease as follows:

	Per Mine Start	
	Injuries	Man Days Lost
1932	0.2	10.0
1936	0.015	0.13

	Total	Man Days Lost
	Injuries	
1932	26	1,382
1936	3	28

We design, and have made up, our own safety posters for our mine bulletin boards. The posters in each case attempt to show our men the mistakes of others and otherwise teach safety lessons. As an example—our No. 29 poster or Safety News shows the right and wrong way for a machine runner's helper to hold and hitch the main rope jack for an undercutter. This poster was made up after one of our men chose the wrong way, i.e., he stood between the jack and the moving picks as the undercutter was being pumped in, and stepped or slipped into the moving picks. His shoe—a new one—was torn from his foot and thrown out of the back end of the undercutter. Fortunately he lost only his small toe. Copies of each poster are kept on the bulletin boards two weeks.

Four years ago, four men were very seriously burned with gas in a chamber at the beginning of the shift. The cause of the gas accumulation was never definitely determined but the source of the ignition was. The brattice carried a good current of air to the face and the fire boss' marks were found there by the mine foreman, who arrived on the scene before the fire boss, i.e., after the men were burned.

The investigation brought out among other facts that this fire boss carried, in addition to his flame safety lamp, an electric cap lamp to give him better light for traveling. Although this fire boss claimed he always put the headpiece of the electric cap lamp in his coat pocket as he approached each working place, it was concluded that due to the presence of the high candle power light,

a short time before he would test for gas his eyes were not in proper condition to detect in his flame safety lamp as small a percentage of methane as he would if he had not been carrying such a high power light.

After these injuries occurred all fire bosses were forbidden to carry these high power lights, and each one was issued an approved flash light to be used in traveling over falls, down pitch workings and similar difficult places. The mine foremen keep tabs on the use of the flash lights by keeping records how often the fire bosses ask for new flash light batteries.

As roof falls cause approximately 50 per cent of the fatalities in our industry, special stress is placed on the care of the roof and the facts in connection with roof fall injuries. Each sectional foreman must personally write a report to the assistant general manager, forwarded through the mine foreman and superintendent, covering each injury resulting from the fall of roof or rib, even though the injury may be only slight. In this report the sectional foreman tells how the injury occurred, makes a sketch of the place the injury occurred, reviews the injured man's past record, and states how a similar injury may be prevented. The assistant general manager scrutinizes these reports very carefully and they are not filed until he is satisfied that all the facts have been given and that all concerned have learned the lesson of each injury.

It is sometimes necessary to send back some of these reports to the colliery a couple of times with the request for more or clearer information, or pointing out the responsibility of individual officials in connection with the injury. The result of this report system has been to spur the sectional foremen and mine foremen to put forth special efforts to eliminate roof fall injuries.

Iron Ore Mining

By G. J. BARRETT

Secretary, General Safety Committee, Oliver Iron Mining Co., Duluth, Minn.

In diminishing numbers, we still have accidents involving the head, eyes and feet, but we have practically eliminated resulting injury by the use of hard hats, goggles and steel-toed shoes.

We saw the goggle enter the field of accident prevention for use principally in surface operations—particularly shops. We all remember the ensuing struggle and the ultimate victory. However, it has been a

far greater problem to introduce the goggle into underground work.

We know our records indicated a serious eye hazard while drilling bore holes and breaking chunks. But the miners said that glass goggles fogged—that they could not keep them clean in wet places—that they were uncomfortable. How could we get eye protection just for the starting of the bore hole, and while breaking chunks by hand? We pioneered home-made, shop-made, and finally a factory-made screen for insertion into the goggle frame. We did not ask that they be worn constantly, but we did insist that they be worn while starting holes and breaking chunks. We made progress and convinced the workman that eyesight could be saved with screen goggles.

We then waived side protection to promote goggles with glass lenses, and again we did not make rules about their being continuously worn. We publicized broken goggles by circulating them to all of our properties, with a story of the happening. The men saw glass lenses broken by flying objects, but with the resulting saving of eyesight. Our supervisory forces followed up these cases with extreme care, always preaching the proven value of the goggle. The men finally made their own mines 100 per cent goggle from check-in to check-out, whenever atmospheric conditions could be surmounted. Several of our mines are 100 per cent goggles for the full period of the shift, and we know it is only a matter of time until the men increase their use of goggles, but not without daily pressure from the local mine management and the publicity which we send out to convince them that eyesight can be saved by goggles.

The hard hat came next as a matter of personal equipment. We sent trial hats to the mines soon after they were put on the market, but no enthusiasm was aroused in the management or the men. They said they were too heavy—that the brim interfered with the carrying of timber—that they were otherwise uncomfortable, and too expensive. This sort of thing went on for quite a time, but we were convinced that a hard hat could be worn with comfort, because our private investigations confirmed this. How could we get the men going on hard hats?

We finally offered hats to the men at a price of one dollar, the company paying the balance—here they had something for al-

most nothing. Again we made no rules to enforce their use and waited for several months to see what would happen. Our supervisory forces in the meantime followed up all hats broken in accidents, and we publicized the crippled hats by routing them to all of our properties and telling the story of another life saved.

We then made an investigation to determine the number of hats in use, and we were gratified to find that about 95 per cent of the men had equipped themselves. It was not a difficult matter to make hard hats compulsory for the unprotected 5 per cent. We still publicize broken hats in the manner described, just to keep the men constantly reminded as to the importance of their being worn at all times.

Safety Shoe Salesmanship

Hard-toed footwear was our next experience with personal equipment. Composition toes caused a great deal of sales argument, and probably much valuable time was lost. Then the steel toe came into being. The workman complained just as he had always done whenever something new was suggested. He said the shoes hurt his feet, because the fitting was not properly done—that we could not make delivery promptly. He had never anticipated his shoe needs in advance, and it was apparent that it would be necessary to bridge this gap.

Our purchasing department began a special study of shoes. They investigated quality, price, comfort and delivery. We studied the problems of the manufacturers and the manufacturers investigated our problems. The result was—better fitting and immediate delivery of a good shoe at cost from our stock in local warehouses, with deductions from the payroll to cover cost. Again we publicized all shoes crippled in service, sending them on tour of all of our properties, with a complete story of the accident.

I am gratified to report that our underground, open pit, and shops are 100 per cent equipped and using steel-toed shoes. At some of our properties we are using a small number of safety-toed rubber boots. We are now studying the problem of better insulation of shoes to meet the needs of men working outdoors in the winter climate of Minnesota.

Specific Accidents and Hazards and Their Elimination in Copper Mining

By RICHARD S. NEWLIN

Mining Engineer, Inspiration Consolidated Copper Co., Inspiration, Ariz.

Most copper mines of the world may be classified as "big mines," handling large tonnages of relatively low-grade ore. As in other big industries, their problem calls for organization and standardization. Accidents have no place in such a set-up. Every copper mine I know of has an accident prevention program which aims to educate the individual miner to work safely as well as to eliminate the hazards which surround him. In carrying out this program effective supervision is of the utmost importance. The bosses in direct charge of men should be responsible for the enforcement of safety instructions. They should be teachers as well as leaders. Every accident that occurs should be thoroughly investigated and violators of safety rules disciplined.

Probably more than one-third of the serious accidents in copper mines are caused by falling rock. In most copper mines the nature of the ground requires timbering in all permanent openings. Where slabs are likely to fall on men working at the face, timber should be kept as close to the face as possible. In many mines the practice is to use booms of steel or timber, hung under the caps by boom hangers. After the round is blasted, the booms are moved ahead and the next cap is laid in place on the booms, lagged and collar braced, before the muck is removed. This forms a protection for the muckers, or the mucklifting-machine operator.

One southwestern operator uses the same method successfully in advancing timbers in square-set stopes, with booms hung under the cap. The same mine reports that in driving two-compartment cribbed raises in ground requiring close timbering, they install not less than two stulls on top of the last round of cribbing, with headboards arranged to allow drilling between the lagging.

In mines using shrinkage, caving, or similar systems, the hazard of falling ground is particularly present in the stopes, where a minimum of timber support is desirable. There should be very definite rules as to picking down loose rocks. Slabs too large to let down must be stulled. Bosses should be required to inspect all stopes and guard against loose ground.

The use of hard-boiled hats and hard-toed shoes is nearly universal in copper mines. These prevent many minor cuts and bruises as well as more serious injuries. But at the same time the miner should keep his mind alert to the damage which falls of rock may cause him.

In a large mine, where a big tonnage is handled daily, there are likely to be many hazards connected with haulage. Most copper companies have planned their haulage levels so that the ore may be handled not only cheaply but with a maximum of safety as well. Sections where collisions might occur are usually equipped with red and green signal lights, operated by double-throw switches which may be thrown by the motorman at either end of the circuit. Haulage ways should be well lighted, and the clearance between cars and sides of drifts maintained, sufficient for men to pass trains safely.

Many mines have provided refuge stations at regular intervals along main lines, where men may stand while trains are passing. It is most important that the sides of haulage drifts be kept clear of muck piles, timber, or other obstructions, so that the danger of men tripping and falling under or between cars may be lessened. Cleanliness and safety are closely related.

Many haulage accidents are caused by derailments of cars or motors. The danger of derailments may be reduced by maintaining the tracks and rolling stock in good repair. Definite slow speed areas cut down derailments on curves and switches. Brakemen should be prohibited from adjusting couplers with hands or feet, and when coupling or rerailing cars, should be particularly cautioned to stand in the clear.

In copper mining we have our share of blasting accidents. Less frequent than other types of accidents, they are nearly always more severe. Improper spitting of fuses, the use of too short a fuse, or trouble with a faulty lamp, may cause men to delay too long while spitting a round and be caught at or near the face when the holes start to go.

A number of methods have been devised to make fuse spitting a shorter and surer operation. Some mines recommend the use of bunch blasting, others, the hot-wire spitter.

The first method calls for a special tool and a technique of preparation that is rather complicated for the average miner. The second method, the hot-wire spitter, is gaining favor. The hot-wire spitter burns with a hot, smokeless flame, and has the advantage of burning at a definite rate. However, if carelessly dropped before it is consumed, it may add to the fire hazard. Many copper mines are going over to electric blasting, which eliminates the danger of men staying too long at the face, simplifies the guarding of blasts, and reduces the danger of missed holes. Most of the southwestern copper mines use electric caps and hand-operated batteries in chute blasting. Electric blasting in chutes, storage, or transfer raises prevents the chute blaster from being injured by a bomb placed by himself, either because he remained too long at the raise after the fuse was spit, trying to place the bomb in an effective position, or because he returned to the place after hearing a shot in some other part of the mine and thinking it was his own.

Electric blasting has its hazards, however, if not properly done. Electric detonators are just as likely to explode as ordinary caps through dropping, striking, or other mishandling. Lead wires, if not carefully protected, may come in contact with pipes, rails, or other conductors which often carry stray current. Whatever method of blasting is used, the important point in eliminating accidents is that the man handling explosives must be impressed with the destructive violence in them. Explosives should never be handled carelessly. In loading explosives into holes time must be taken for thorough preparation, so that the chance of premature explosion is entirely removed.

In underground copper mines there are many vertical and inclined openings for passage of men, material, and ore. The hazard of falling in such openings is always present. Protection is provided by grizzlies over ore raises or chutes, by equipping the tops of manways with screen doors, shaft stations with gates or bars. All open raises and inactive chutes must be covered with lagging. In open stopes, pockets, and shafts where the nature of the work entails the

danger of falling, most operators require their men to use safety belts. The importance of secure staging, especially in square set stopes, cannot be overemphasized.

There is always danger connected with the hoisting and lowering of men. Modern hoisting equipment, however, has almost entirely eliminated this hazard. Hoists are protected with devices which prevent overspeed and overwind, and mechanically operated brakes are applied in case of power failure. Cages are equipped with safety dogs which grip the guides in case of rope breakage. In most large copper mines the care and periodic inspection of all hoisting equipment are among the duties of a competent mechanical force. A fixed code of hoisting signals and a separate call-bell or telephone system aid in eliminating the human element from the operation of handling men in shafts.

The increasing use of electricity in copper mines has introduced an added danger. Besides the additional fire hazard there is always danger of men coming in contact with trolley wires or poorly protected power conductors. All trolley wires should be kept above a minimum clearance and evenly and securely hung. Where timbering or other work is to be done near a trolley wire, the line should either first be killed or, if this is not possible, should be covered with a line hose or other insulation.

Men should be prohibited from carrying pipe, drill steel, or other metallic material on their shoulders through drifts where there is a trolley. Above all, electrical apparatus should only be handled by those whose duties require them to do so, and power cable insulations and supports should be subject to periodic inspection.

In many copper mines the danger of fire is a great hazard. While flammable gases are rarely present, there is always danger of fire in timbered areas. Most mines have so arranged their ventilation systems that air currents may be completely controlled, both to safeguard human lives and to aid in extinguishing the fire. In areas where fires are likely to occur fresh air currents may be separated from exhaust-air currents by fireproof doors. The principal entrances and exits to the mine are often fireproofed by some means, either by lining them with concrete or, if timber is used, by treating it with some fireproofing preparation. Many main working shafts are concreted, and sta-

tion floors concreted and station timbers gunited.

Many mines have prepared fireproof rescue stations, located centrally in each mining area, of sufficient size to accommodate all of the men likely to be in the area at any one time. These refuges are usually provided with air and water lines, and often a telephone as well. Some mines have high pressure water lines underground as well as on surface, with strategically located fire hoses: one mine has large fire lines at the collars of all shafts, which can be discharged down the shaft in case of fire. The valves for these lines are located at a considerable distance from the shaft.

Some mines provide means of injecting a warning stench into their compressed air lines, to notify the men in all parts of the mine in case of fire. In mines where fires are likely to occur, fire drills, conspicuously posted fire regulations, and, of course, the check-in and check-out system of tallying the men, are important. Open lights and smoking are prohibited at all shaft stations and in cages. Old timber, powder boxes, paper, and other flammable debris should be kept cleaned up. Men working in areas where a fire hazard exists must be impressed with the precautions necessary to prevent the outbreak of a fire, and should be thor-

oughly drilled in the steps to take in case of fire.

Since the copper of the United States is produced in about equal proportions by underground and surface mines, it might be well to mention a few of the hazards peculiar to the surface mining of copper ore. Most surface copper mines are a railroading problem, and the rules and safety devices of modern railroading are scrupulously observed. Accident peculiar to the use of heavy machinery, such as the cranes in electric shovel operation, are avoided by careful design and periodic inspection of equipment. Falls of men from bank ropes while drilling pot holes, due to caving of the bank, are eliminated by the use of safety belts. Great care in the handling and storage of explosives is common practice.

Whether on surface or underground, copper miners are adopting a new attitude toward safety problems. By exerting pressure through officials and bosses, they are making the individual miner safety minded.

The man who handles the pick and shovel, who runs the haulage motor, or operates the drill: he is the one to be sold on Safety. Teach the miner the correct, safe, and efficient manner of doing his work, and you'll go a long way towards solving the safety problem.

Specific Accidents and Hazards and Their Elimination In Lead and Zinc Mining.

By H. W. GIESSENG

Safety Engineer, Commerce Mining and Royalty Co., Picher, Okla.

Our mines produce principally zinc and some lead concentrates. The proportion is around eighty-five per cent zinc and fifteen per cent lead.

Specific accident hazards on the surface, in shops, and in concentrating plants consist of:

- Contact with moving machinery.
- Contact with electricity and electrical installations.
- Falls of persons.
- Handling objects.
- Handling chemical reagents used in flotation plants.
- Using grinding wheels.

Moving heavy machinery.
Tailing pile slides.
Drowning in mill ponds.
Pouring hot metal.

Steps have been taken to guard machinery and floor openings properly. Each employee is accounted for when starting the plant. Putting on belts while machinery is running is prohibited. Men are requested to wear close fitting clothing. Electrical equipment when exposed is guarded and grounded; and repair work is required to be done by competent electrical men.

Heavy objects, consisting principally of roll shells, are handled with crabs and hoists.

Men are cautioned and not permitted to stand or pass under heavy loads regardless of the safety factor of the hoisting equipment.

To eliminate falls of persons, excess grease and oils must be kept off floors and walkways. Steps are guarded with proper hand rails, and overhead walkways are equipped with hand rails and toe boards. Men are cautioned to eliminate short cuts to avoid accidental injury.

In flotation plants men are required to handle copper sulphate, both in crystal and liquid form, Nanthate, Cresylic Acid, Aero Float and Pine Oil. Care must be exercised in opening steel drums and handling contents. Rubber gloves and goggles or face masks are used to prevent burns. All grinding wheels are guarded and checked for speed. Men are required to wear non-shatter glass goggles while grinding.

All heavy machinery is moved by the reclamation department, which has proper equipment and experienced men.

Employees are required to wear goggles or face masks while pouring hot metal to guard against burns from contact, or from explosions. In reclaiming old tailing piles for retreatment in tailing mills we have a tailing slide hazard. These piles are from 25 to 100 feet high. When walls are left too nearly perpendicular, we encounter slides of great volume.

To eliminate this hazard, blasting must be started on low side and cautiously continued to keep the pile benched back at top. This protects men and equipment from being covered.

Our mill ponds, deep in some instances, are a constant temptation to swimmers, young and old. We post danger warnings, remove any diving boards that might be constructed and as much as possible prevent swimming in mill ponds. Mine shafts are fenced and prospect drill holes filled to prevent anyone from falling into them.

Specific underground mine hazards consist of:

- Fall of rock.
- Premature explosions.
- Rocks rolling down stope.
- Loading ore.
- Animal and rope haulage.
- Eye injuries.
- Shaft accidents.
- Foot injuries.

Strained backs.
Bad air.

Fall of rock is an ever present hazard. One or more roof trimmers are employed at each mine.

Trimmers are equipped with bars, ladders, flash lights and use electric spot lights when doing very high work, to light entire workings. These men inspect the workings and correct hazards before men work in such places. Inspection is a part of the mine foreman's job and all corrections under his supervision.

The trimmer works off a ladder when necessary and often as high as 60 feet. High ladders require proper roping and guying and often three or four additional men are required in the work.

All underground employees are required to wear skull guard protection. Skull guards have saved many lives and prevented numerous otherwise serious injuries. We keep skull guards on exhibition in the employment office which have seen service to demonstrate their value to new employees.

In blasting we use fuse and detonator. Electric blasting is employed under certain conditions. Premature explosions with resultant injury and death were formerly not uncommon.

In the spring of 1926 two of our employees, McLaughlin and Anderson, patented a safety shell. Safety shells are now used in all blasting. These shells are made of cardboard, 10 1/4 inches long, 1 1/8 inches diameter. A wooden core is bored to permit passing of the fuse. This wooden core is inserted and glued 2 1/4 inches on the end of the shell. A second hole, not completely through, permits insertion of spike on the end of the tamping pole for threading the shot into the bore hole. This shell prevents rupture or destruction of the shot and exposure of the detonator, which previously was the cause of most premature explosions.

We have used more than a millions shells in the past 10 years and have no record of premature explosion or injury when the shells were being used. The detonator is placed in the shell at the cap rack and need never be exposed in transportation or loading. Detonators and dynamite are stored separately. We have daily delivery of dynamite and approximately only one day's needs stored in any mine. This also insures fresh powder at all times.

Rocks rolling down steep high stopes are a constant menace. Men are instructed to keep these combed down to avoid injury. Shovelers at the foot of stopes are continuously exposed to this hazard. We constantly caution against over-lifting or lifting while in awkward positions, to prevent falls and strains.

Animal and rope haulage presents many hazards. Keeping a safe distance from the mules' heels is essential. Care in replacing wrecked cars, wider haulage drifts, heavy rail and better lighting are necessary to safe haulage. Track gauges widened from 14 and 16 inches to 18 and 24 inches will prevent many wrecks. Our recently-introduced rope haulage requires better equipment, better lighting, and warning signs, since the speed of the trips is materially increased.

Employees are furnished screen goggles for mine use. Drillers and helpers are required to wear these while starting and blowing hules, and when using jack hammers. Shovelers are required to use goggles when sledging boulders, to prevent injury from flying objects.

Shaft accidents result from men riding up or down, from falling objects, and from failure of equipment. At three properties we use safety cars for handling men on and off shift. Proper signals are required when handling men. We require not more than 500 feet per minute rope speed. Men are not

permitted to ride from collar of shaft into derrick. Tub hookers at shaft bottom are required to wear army type steel helmets for head protection against falling objects.

Hoisting equipment is regularly inspected, and tonnage hoisted per rope limited to 50,000 tons. Any unusual occurrence or abuse requires immediate inspection of the rope which is usually removed regardless of the tonnage hoisted. We use 3/4 Tru-Lay cable, hoist from 1,400 to 1,600 pound tubs an average of 350 feet, and up to 800 tubs in one eight-hour shift.

Foot and toe injuries are reduced by wearing safety shoes. This is not compulsory. A recent check revealed that about 60 per cent of men were wearing safety shoes. They are sold to men at cost.

The hazard of back strain is constant. Some are real and many falsely alleged. Education in proper methods of lifting is the best remedy.

Old workings are inspected for foul air.

Air samples to determine gas and oxygen content are frequently made. When a deficiency of oxygen content exists, added forced ventilative is furnished. Samples to determine dust content are made in each working face. Ventilation down shafts and drill holes, and thorough wetting of mine and muck piles, are employed to keep dust count below permissible limit.

Specific Accidents and Hazards and Their Elimination In Mining from the Viewpoint of the United States Bureau of Mines*

By J. J. FORBES

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Control of accidents can be accomplished best by intelligent and impartial investigation and by study of statistics relating thereto. First, the operating head must be imbued with an earnest desire to prevent accidents whether from a purely humanitarian point of view or from the more urgent one of operating cost; otherwise, any safety program is bound to fail.

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As the result of greater interest in the prevention of accidents shown by both men and management, there has been a substantial reduction in accident frequency and severity during the past decade. During the 5 years, 1906 to 1910, inclusive, on an average 2,568 persons were killed annually in the coal mines of the United States. In 1936 there were 1,275 coal mine fatalities, a reduction of about 50 per cent. In other words, there has been a saving during the past 26 years of

approximately 1,000 lives annually in coal mining.

Somewhat similar results in saving of life have been attained in metal mining. During the 15 years, 1911 to 1925, inclusive, on an average 531 persons were killed annually in our metal mines, compared with 164 fatalities during 1935, a reduction of about 68 per cent.

The most prolific source of accidents in both coal and metal mining is falls of roof and side material. Approximately 35 to 50 or more per cent of all mine fatalities and about 25 per cent of all non-fatal injuries are from this cause.

Accidents by mine cars and locomotives are the next greatest sources of fatal and nonfatal injuries, representing 10 to 20 per cent of the total. Explosions, electricity, explosives, mine fires, and accidents of a miscellaneous character, together with machinery, are also responsible for a large number of fatal and nonfatal injuries annually.

Falls of Roof and Side Material

There has been an encouraging decline in accidents from falls of roof and sides during the past five years, as shown in the reduction made in bituminous coal mines. During the period 1926 to 1930, inclusive, the average annual toll from roof-fall accidents was 902 deaths, but during the following five years (1931 to 1935, inclusive) this toll was reduced to an average of 517 annually, a reduction of nearly 43 per cent within five years.

The solution of the problem of roof falls is very largely a matter of enlisting the cooperation of both the mine operator and the mine employee. It required many years of intensive education of the part of the Bureau of Mines to convince the mining public that coal dust in the absence of combustible gas is explosive, and even now far too many mining people are more or less skeptical.

It required even a longer period to obtain general recognition of the fact that rock dust properly applied would prevent the propagation of coal-dust explosions. In consideration of the critical problem of deaths from falls of roof and sides, the question naturally arises, "How long will be required to effect a substantial reduction in fatalities and injuries from this cause?" The 43 per cent reduction in fatalities from falls that

has been effected during the past five years is indicative that progress is now being made to prevent this type of accident.

Falls-of-roof accidents are due largely to the failure of the individual miner to exercise full precautions necessary for his own protection. Therefore, any successful campaign against such accidents must be directed largely toward the awakening of the miner to the necessity of guarding himself unceasingly against this peril.

Very frequently, in discussions of falls of material in mines, the causes have been assigned to more immediate or readily apparent conditions rather than to the underlying basic conditions. Analyses of roof-fall accidents usually reveal lack of carefulness either by officials, miners, or other underground employees. Far too frequently the victim is blamed for carelessness and at the same time the responsibility of management itself is overlooked or neglected completely.

The United States Bureau of Mines studies reveal that the principal factors in preventing accidents from falls of roof and sides, or rock and ore are (1) proper layout of mines; (2) education of officials and employees; (3) systematic support of roof and sides; (4) testing and inspection of roof and sides; and (5) adequate supervision and discipline.

The first step in preventing falls of roof and sides should be taken on the drafting board by preparing the proper layout of mines. Shaft and haulageway should be protected amply by adequate barrier pillars. Working places, such as rooms or stopes, likewise should be protected by pillars of adequate size.

Mine officials should be educated in the proper development of the mine so the plans may be followed carefully and accurately; the supervisory staff then should be instructed in definite methods of protecting the men at the working faces and along passageways.

Officials, in turn, should instruct employees in the system adopted for preventing falls of roof and sides. A systematic plan of timbering should be adopted and all employees should be instructed in the maintenance of this system, as well as in the necessity of adopting additional timbers for support where necessary.

Specially trained employees should be designated to make careful inspections of all

working places and passageways and to test adequately for loose material before the shift of men enters the mine, as well as throughout the working shift. Miners should be instructed to test and observe frequently the condition of the roof during the working shift and before starting to work, and if the roof or sides are unsafe they should be secured by posting or timbers.

The effectiveness of this system depends on having competent supervisors who will carefully instruct the workers in the proper procedure and who will discipline any employee failing to follow the system which has been chosen and taught.

Education should include publicity regarding falls-of-roof-and-side accidents. To insure accuracy in this publicity, adequate inspection and investigation of roof-fall accidents, whether fatal or nonfatal, should be made and definite conclusions drawn as to the causes of the accidents and methods proposed for preventing recurrence.

One of the newer hazards which tends to increase accidents from falls of roof and sides is the introduction of mechanized mining. Some machines require relatively large open spaces in which to operate, thus requiring large areas of unsupported roof. Also, because of the noise made by the various kinds of machinery, workers are unable to hear the preliminary clipping and cracking that usually precede the fall of larger masses of overlying material.

Mining companies utilizing the newer mechanical methods owe it to their employees, as well as to their own material interests, to make definite studies as to possible accidents involving the use of machinery, and extra precautions should be taken against them, otherwise, the newer systems will come into disrepute and be barred by state officials, as has already been done in some instances.

Haulage Accidents

Coal mine haulage accidents annually cause about one-sixth of the fatal and about one-fifth of the nonfatal injuries. In metal mines haulage is responsible for about 6 per cent of the fatal and about 8 per cent of the nonfatal injuries. Although haulage ranks second as a cause of coal mine injuries, it ranks fourth as a cause of fatalities and

second as a cause of nonfatal injuries in metal mines.

Haulage accidents, like roof-fall accidents, have shown a steady decrease during the past five years—this in the face of longer hauls, increased speed, and heavier equipment. During the five years, 1926 to 1930, inclusive, the average annual death toll from haulage accidents in bituminous coal mines was 328, and during the past five years (1931 to 1935, inclusive) the average annual death toll from haulage has been decreased to 170, a reduction of 48 per cent. In both coal and metal mines, the outstanding causes of haulage accidents are:

Struck, run over, or squeezed between cars or locomotives; and squeezed between car and rib, timber, or roof. Nonfatal-injury rates are higher proportionately than fatality rates. Coupling cars or locomotives is the outstanding single cause of injuries received from haulage accidents.

The prevention of haulage accidents depends largely on proper equipment, proper maintenance of equipment, proper maintenance of haulageways, suitable layout of haulage for safe as well as efficient transportation of coal, and the adoption and enforcement of practices that will minimize haulage hazards.

Haulage accidents generally entail a greater economic loss than other types of mine accidents, excepting explosions and fires. In a great many haulage accidents, an interruption of production occurs and there is financial loss from damage to property. The economic loss involved in haulage accidents justifies special efforts on the part of mine management to reduce such accidents.

Explosions

Explosions of gas and coal dust are limited mostly to coal mines, although some gas explosions have occurred in metal mines. A most gratifying reduction has been made during the past six years in both frequency and severity of accidents from explosions; this is believed to be due primarily to (1) increased activities of the various state mine inspection departments, especially in educational work, and demand for more rigid adherence to state laws; (2) growing realization of the economic waste of accidents, and more or less general acceptance by mine operators of responsibility for accident oc-

currence; and (3) widespread dissemination of safety data by the United States Bureau of Mines and other safety organizations.

The record of fatalities from mine explosions in the United States during the past four years has been the best in the history of the mining industry. During these four years, mine explosions have resulted in an average of 45.5 deaths per year, compared with an average of 153 deaths per year for the preceding five years. Because explosions generally are a menace to the lives of all the men in the mine, precautions to prevent them are a primary requirement and demand consideration even beyond that given other accident causes which kill far more men.

The three outstanding ignition causes of explosions in coal mines are electricity, open lights, and explosives. One of the major activities of the Bureau of Mines has been research on causes and prevention of coal-mine explosions. The causes of explosions have been given so often by Bureau of Mines employees that time will not be taken to discuss them here. It is desired to emphasize, however, that in spite of the recognition of the hazards of open lights in coal mines, large numbers of open flame lamps are still in use, and many explosions continue to result from open lights chiefly in so-called non-gassy mines.

The Bureau of Mines recommends that explosions be prevented by adequate ventilation properly coursed; by the exclusive use of permissible electric cap lamps for illumination in mines with accompanying use of permissible flame safety lamps or other suitable equipment to test for explosive gas; by the use of permissible explosives; by rock-dusting all coal mines excepting anthracite mines; by supplementing rock dust with water applied at the face regions; and by the use of permissible electrical equipment underground.

Explosions are not unknown in metal mines. Some explosions in metal mines have resulted probably from decomposition of organic matter under water in old stopes where a large amount of timber had been used. Where beds of carbonaceous material are intersected, gas is sometimes given off from these strata, causing explosions. Under such conditions, as a rule, little attention has been paid to ventilation, and when gas is encountered there is insufficient air to dilute or carry away the explosive gases. Those in

charge are rarely able to cope with the situation effectively, because such occurrences are too rare in non-coal mines to give the operating personnel experience with them.

Explosives Accidents

Explosives, with about 3 per cent of the fatalities and less than 1 per cent of the nonfatal injuries, rank fourth as a cause of coal mine injuries. In metal mines, explosives cause more than 7 per cent of the fatalities and approximately 1 per cent of the nonfatal injuries.

Accidents from explosives are due largely to premature shots when charging and tamping, shots breaking through rib or pillar, flying particles of coal or rock, drilling into unexplored holes, delayed shots, and suffocation from explosives fumes. These causes are more or less general in both coal and metal mines.

The Bureau of Mines recommends the use of permissible explosives that will not ignite gas and will give off a minimum of poisonous gases. Explosives should be used in a safe and permissible manner. Permissible explosives are rarely used in metal mines, due to lack of explosive-gas hazards in most metal mines. The Bureau of Mines believes that in metal mines electric blasting should be used to reduce the hazard of misfired shots and accidents resulting from persons returning too soon after blasting and being injured by delayed blasts.

The Bureau has published information on the proper use of explosives and the prevention of accidents from explosives.

Briefly stated, the essential recommendations to prevent accidents are (1) select the proper explosive for the class of work to be performed and use the minimum quantity per shot which the conditions will allow; (2) store explosives under proper, safe conditions and handle explosives and blasting supplies under proper conditions; and (3) blast with proper electrical equipment, being careful to prevent premature ignition of explosives and to protect nearby workers or oncomers from flying material.

Explosives accidents in bituminous coal mines have been reduced about 45 per cent during the past five years, compared with 1926 to 1930, inclusive.

Electricity

Electricity causes more than 4½ per cent of the fatalities and more than 1 per cent of the nonfatal injuries in coal mines and more than 1 per cent of the fatalities in metal mines. There have been few nonfatal injuries from electricity in metal mines. The figures cited do not include explosions or fire originated by electricity. It should be noted, however, that all five of the major explosion disasters with 37 fatalities in 1936 were suspected of having been initiated by electricity.

The increased use of electricity in mines greatly extends mine hazards, not only in the haulageways but also at or near the working faces, and only by the most careful planning by the mine management, use of permissible equipment, proper installation, and rigid inspection system can the extended use of electricity be made safe.

The responsibility for the prevention of electrical accidents rests more with the employer than with the employee; the employee should exercise care in avoiding such accidents, but the employer is responsible for the safe installation, maintenance, and guarding of electrical equipment as well as in choosing safe types of equipment and safe methods of using it.

Electrical accidents generally are from contact; shock accidents are most numerous from contact with unguarded trolley wires, machine feed wires, and junction boxes or switches. Protective hats are now being used extensively in both metal and coal mines, and are an additional precaution against contact with electricity by the workman.

By far the largest number of deaths by electric shock in mines occur from contact with live wires that can be safeguarded with relative ease. Live wires, such as trolley and power wires, should be guarded adequately throughout their entire length unless they are more than 6½ feet above the rail.

The development of electric mining equipment has reached the stage where safe permissible equipment may be purchased and installed at small additional cost; the installation of such equipment, together with adequate supervision, strict discipline, and continually guarding against carelessness, will go far toward preventing electrical accidents in mines.

Mine fires constitute a hazard in both coal and metal mines. Fortunately the fire hazard is relatively unimportant, causing less than 1 per cent of the total fatalities and less than one-tenth of a per cent of the nonfatal injuries; however, fires in coal mines constitute an ever present menace of developing into an explosion.

Methods of preventing and controlling mine fires have been discussed frequently and precautions and methods to use in fighting fires will not be restated here. There is an outstanding hazard, however, in fighting mines fires that should be given careful attention. Mine fires cause the formation of gases one of which is carbon monoxide, whose deadly qualities are well known to all those in the mining industry.

In spite of this fact, in many instances in both coal and metal mines, in the effort to control fires, employees enter mines or are taken into the mines without any or with inadequate respiratory protection or with relatively little appreciation of the possible hazards from fire fumes. Consequently, a number of men have been killed by asphyxiation in the last several years, due either to carelessness or to lack of knowledge or appreciation of the properties of mine-fire gases and of combating them. In one mine the rescue crew fighting a fire had adequate respiratory protection, but workmen bringing in supplies and working on the haulage road that was on the return air from the fire area were left unprotected; about 15 of them were overcome, nine of whom died before assistance could be obtained from the rescue men.

In another mine where the return also was on the main haulage road, five or six men were overcome while working on a haulage road without gas masks or other respiratory devices. It cannot be emphasized too much that wherever a fire occurs all men fighting or helping to fight the flames should be equipped with adequate respiratory protection; those who cannot be protected should be kept out of the mine or at any rate should not be allowed to remain in return air or other place where the air may be contaminated by fumes from the fire region.

Consideration of causes of accidents usually centers on the outstanding causes of fatalities as listed above. A large number of nonfatal and a certain number of fatal accidents from other causes are generally

disregarded and given little emphasis. Hand tools, machinery, falls of persons, handling of material, and run of ore from chutes and pockets annually cause a large number of injuries. In 1934, hand tools caused nearly 7 per cent of the nonfatal injuries and falls of persons down chutes, winzes, raises, and stopes caused nearly 8 per cent of the fatal and over 4½ per cent of the nonfatal injuries in metal mines. Run of ore from chutes and pockets caused nearly 3 per cent of fatalities and more than 2 per cent of the nonfatal injuries.

Machinery, on the other hand, caused less than 1½ per cent of the nonfatal injuries in metal mines and nearly 5 per cent of the nonfatal coal-mine injuries. Handling material, other than rock or ore, caused virtually 7 per cent of the nonfatal injuries in metal mines.

Hand tools causing injuries were principally picks, axes, or hatchets. Engineers in safety work in the Bureau of Mines recommend that wherever possible saws be used and that in general axes and hatchets should not be used underground. In metal mines it may be necessary to use axes and hatchets

for certain kinds of work; however, even in metal mines use of axes and hatchets should be restricted to a few persons, selected for their carefulness, where timbering forms a major part of the operation in the mine.

The safety workers of the United States Bureau of Mines believe that virtually all accidents can be prevented and eliminated in both coal and metal mines. The method used by the Bureau is to study carefully statistics, observations, and data collected on specific hazards or accidents; make a thorough, comprehensive, and impartial investigation of all similar accidents; then carefully analyze all data that have been obtained.

Analysis should reveal not only the direct cause of the accident, but indirect or probable causes. Recommendations of measures for preventing recurrence of similar accidents are then formulated and made public through publications, addresses, motion pictures, and instruction courses.

Similar methods can and should be employed by industry to help to prevent and eliminate accidents.

Coal Mine Injuries from a Doctor's Viewpoint

By JOHN M. GRIFFIN, M.D.

Des Moines, Iowa

From 1919 to 1932 Iowa recorded more than 25,000 mine injuries, of which 143 were fatal. 75 per cent of all fatalities were at the face from falls of coal or slate, due to carelessness. In fact, 75 per cent of all injuries occur under conditions controlled by the workman.

During this period there were more than 8,000 eye injuries, or more than one eye injury to each employee. 25 per cent of all mine injuries were to the eye. 90 per cent of these were due to flying objects from pick or sledge at the face. Suitable goggles would have prevented these injuries. The other 10 per cent were due to hand tools, falling objects from the tippie, etc.

The number of injuries per million dollars pay roll averages about 300. 60 per cent of all injuries occur at the face, of which 13 per cent are serious back injuries, due to falling slate or coal "jack-knifing" the work-

men, resulting in various types of broken backs. In the past 25 years, I have seen and assisted in operating on more than 300 broken backs, where there was complete paralysis below the waist, due to a displaced fractured fragment of the vertebra pressing upon the spinal cord. I refer only to the type where the vertebra is broken in two, with a displacement sufficient to produce paralysis below the point of fracture.

All these cases would be total permanent disability without surgery. From my observation, it is my opinion that any man with a broken back who survives the shock of the first four days, even though all the deep reflexes are gone, is entitled to the chance of relief from the permanent paralysis, due to pressure on the cord, by surgery. The operation is not dangerous after the period of shock has passed, and he has everything to gain and nothing to lose. A fracture of a

spinal vertebra that is maintained in apposition by fixation will heal just the same as the shaft of a long bone anywhere in the body.

There are two methods of fixation of the spinal vertebra without a cast. One is a bony inlay in a groove through the broken vertebra, back in proper position, extending into the well vertebra above and the well vertebra below, which acts as a splint and prevents the displacement of the fractured fragment on breathing or moving in bed. This method is not as satisfactory in view of the fact that the bone inlay does not always take, and requires a secondary operation.

The operation of my choice for the past twenty years has been fixation of the fractured fragments by drilling a hole through the posterior spinous process of the fractured vertebra, also the well one above and the well one below; then lacing the three together with Kangaroo tendon, which holds the fractured vertebra together until the callous forms. Kangaroo tendon does not absorb for 6 to 8 weeks.

We have many cases of broken backs that would have been total permanent, who are now back at work.

I will cite briefly two cases that looked hopeless and were operated against our judgment as to any relief. First a man had sustained a fractured 12th dorsal vertebra with complete paralysis from the waist down. He had lain in the hospital at the State University of Michigan at Ann Arbor for 14 months, completely paralyzed from the waist down, large bed sores on each buttox, and he had had two operations without relief. An X-ray showed the displaced fractured fragment was pressing on the cord, which we felt in the 14 months period must have degenerated beyond recovery, and discouraged an operation. But they insisted. The fixation operation was done and to our surprise sensation returned, and the bed sores healed, and the man again learned to walk, and gets about without crutches today, and works as a farmer. This has been nine years.

Another case had a fractured first lumbar vertebra with a lateral displacement, one-half inch greater than the diameter of the spinal canal through which the spinal cord passes. We all felt that this displacement would

surely sever the cord, and discouraged operation; but being a compensation case, the insurance company, in order to satisfy the relatives, insisted upon operation. Fixation was done, and the patient recovered sensation. These two cases are outstanding. They should be convincing that any man who has a fractured vertebra with paralysis below the injury, is entitled to a chance, as the spinal cord can stand lots of abuse, and can regenerate after more than one year's lack of functioning; and that even though the displacement is sufficient to sever the cord, we have no way of determining whether the cord is severed or dragged over with the displaced fractured fragment.

In these 300 broken back cases which would all have been total permanent, about 60 per cent recovered sufficiently to return to work within 12 to 18 months. About 20 per cent were able to get about and have the return of sensation. The other 20 per cent which may or may not have had severing or destruction of the cord, remained total permanent disability.

The return of 60 per cent of these cases to industry and their families was worth the effort. From a financial standpoint under the compensation carriers, there was a savings of thousands of dollars, which in turn cut down the insurance premium, and finally the cost of production.

There is also a form of back injury known as compression fracture, due to "jack-knifing" or bending of the spinal column forcibly forward, which crushes the anterior body of a vertebra, usually the 12th dorsal, or the first lumbar, which is in the greatest curvature of the arc produced by forcible flexion forward. This type of injury without complications does not produce paralysis, and often goes unnoticed without a lateral X-ray picture, which will show the gradual hunch back, known as Koomal's disease, which becomes progressively disabling. These cases treated immediately or within the course of a few days (the sooner the better) can be relieved by hyper-extension, and maintained by a cast to maintain this curve. We also take a lateral or side view X-ray picture through the cast after the hyper-extension is done, which shows the wedge shaped vertebra has filled out to its normal width on the anterior body, and the cast holds the patient in this position until the vertebra becomes normal again.

THURSDAY AFTERNOON SESSION

October 14, 1937

New Safety Kinks in Mining

By W. D. HASELTON

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The sinking of shafts by boring is a rather recent application of an old principle. It can no longer be classed as experimental, as one rather deep shaft has been drilled as well as several shallower ones, in the course of which work the routine was well developed. Further improvements in this method of sinking will be along the lines of better and heavier equipment, rather than in any changes of basic principles.

The sinking is accomplished by means of a cutting sleeve riding on chilled cast iron shot, the sleeve being the lower extremity of a core barrel. Rather closely coupled to the core barrel is a cylindrical cab containing the driving mechanism and operator's compartment, which is prevented from rotating by means of jack crews set into the walls of the bore hole. The rest of the equipment consists of a head frame, hoists and cables, cage, power line, bailers and numerous miscellaneous items found necessary or convenient in the work.

I will limit myself to discussing the safety features of this method of shaft sinking.

To show that the method is practical, I refer to the successful drilling of a shaft 1,125 feet deep and 60 inches in diameter through rock that was sometimes solid, sometimes faulted and sometimes very treacherous. This shaft is now in service for ventilation and the handling of men at the Idaho Maryland Mine, Grass Valley, Calif., and was completed late in 1935.

In spite of the experimental nature of both routine and equipment on this job there was only one disabling accident, a simple leg fracture, caused by failure of a metal hook and therefore not of a nature peculiar to this particular operation.

Incidentally within the next month, a 1,200 foot shaft 5 feet 6 inches in diameter is to be started at a mine in the Lake Superior Iron Ore District, the selection of this

method of sinking having been based on probability of reducing accident hazard as well as of lower cost per foot than would obtain by the conventional method.

The hazards are less with this type of sinking operation than with conventional methods for the following reasons:

1. The crew is small, consisting of a runner and a helper for each of the three shifts, supervised by one foreman. With this crew of workmen there is less exposure than would exist with a normal crew of perhaps 20 men per shift. Due to the unique nature of this job, it has been found advisable to have an apprentice in training through observation and helping as needed.

2. Very close supervision of the work is possible, and the crew is so small that individual attention can be given both to their training and to their work.

3. There is no crowd of workmen swinging shovels at close quarters and no congested use of drills, the latter being used only for drilling plug holes, etc. The core is generally solid and is lifted out bodily by means of a harness, with no one below it. In case of broken ground there is only one man at a time doing the mucking, using a bucket rigidly supported below a bonnet, so the latter could not be lowered onto him by mistake. The man rides out above the bucket but under a bonnet and with his safety belt fastened to a ring just below the bonnet.

4. Only one man is in the shaft at one time, except when the foreman is inspecting. Only one man at a time rides the small rectangular and pointed cage, which is fully enclosed except for the entrance, the latter having drop bars across it.

5. The operator sits in an enclosure protecting him from all sides, with a manhole through the roof as a means of getting in and out.

6. He is further protected by a strongly built bonnet above the operating cab, except during the few seconds required to step through the trap door in this bonnet while getting into the cage. The manholes in the roof of the cab and the bonnet are staggered. The bonnet is equipped with guide wheels riding on the sides of the hole to prevent spinning.

7. Drilling is submerged, so dust is at a minimum.

8. Blasting is so light there is no shattering of the wall.

9. Powder can be dispensed with by using wedges to break off the core, but when powder is used only about one quarter of a stick is required. This is placed at the bottom of the cut, where it is buried in sludge. Shots are fired by electric detonator set off from the surface. Missed holes are not in the picture, but if one should occur the powder could be easily withdrawn from the sludge covering it.

10. The operation does not involve the hoisting of rock or materials over the head of the man at the shaft bottom.

11. In bad ground no serious difficulty occurs, as would be the case in a large rectangular shaft. Reinforced concrete rings or patches are put in, using a steel form expanded into place. By use of hot water and CaCl₂, very fast setting can be secured, so that little time if any is lost through waiting for the concrete to set.

12. There are no heavy steel shaft sets or lath to be installed. The most important item, of the small amount of steel required, consists of the guide runners for the permanent cage, these being welded to short plates supported by bolts which are leaded into plug holes drilled into the side of the shaft. All of this work is done by template to assure proper alignment. Most of the electric cables are placed behind these plates where they are protected from damage and away from likelihood of accidental contact with anyone working in the shaft. The other items consist of brackets, extending from the runner plates, holding the 32 volt cage signal trolley and clamps leaded into specially drilled plug holes, used to support water and air lines and such cables as are too large to put behind the runner.

13. The air in the shaft is violently agitated by a trip of the circular drill unit or core, which has a piston-like effect in the

round hole, but just what improvement to the air results is as yet an unknown factor. Fresh air is easily supplied to the single workman at the shaft bottom through a ½ inch rubber hose, handled by reel on the surface.

14. The shaft opening at the surface can easily be protected by fencing and toe boards.

15. In severe climates the headframe, etc., can be enclosed to permit working in a comfortable temperature and with no hazard of ice and snow or numbness of feet or fingers during work around the collar.

It is only fair to call attention to the fact that the system is not fool proof and that it has some hazards not found in the old methods. Among these points consideration should be given to the following:

1. If anything does happen to the operator down in the shaft it may be very serious or fatal, as he has no one to assist him.

2. He is in the shaft alone with a 100 HP motor. In case of short circuit smoke might quickly knock him out, due to the small size of the opening; therefore, a tetrachloride extinguisher and a self rescuer should probably be provided, but this is a questionable means of protection, as the use of tetrachloride in such a confined space might be open to debate.

3. Any heavy falling object might damage the bonnets, making it difficult for the man to get out on top of them to gain access to the cage. Incidentally, he is unprotected while doing this, although only a few seconds are involved.

4. The sinking cage operates without safety catches or runners. There is a swivel between the top of the cage and the cable, and the cage is prevented from spinning by the rider guiding it from either the other hoisting cables or the wall.

5. In handling the core a weight of some 15 tons is involved.

6. In handling the core after it has reached surface there is danger of it splitting along a plane of weakness when the lifting harness is released upon setting the core down on the transfer car.

7. The core frequently breaks off with an irregular or angle bottom face requiring use of blocking when placing it on the transfer car in order properly to balance its 10 or 12 feet of height.

Handling Safety in a Large Mexican Mine

By ARTURO C. FERNÁNDEZ

General Superintendent of Safety and Hygiene, The Fresnillo Company, Fresnillo, Zacatecas, Mexico

In our mining operations our most difficult problems have been: (a) To plan ahead of actual execution all details of mining operation in order to render them inherently safe. (b) The relatively high percentage of workmen not reached effectively by means of printed information or propaganda. (c) The stubborn opposition of the local labor organization to the application of disciplinary measures; and (d) The adverse character of our ore bodies, mostly narrow veins scattered over considerable territory, rendering the high type of supervision required extremely difficult.

Notwithstanding these unfavorable circumstances the company has succeeded in maintaining large scale operations during the last 18 years without interruption, our greatest achievement in the prevention of accidents being the mining of 674,446 metric tons of ore during the last fiscal year in 4,500,000 man-hours of exposure without a fatal mishap.

Needless to say, these results have been made possible by the application of well known principles of safety: organization, engineering, education, supervision, discipline, and above all, by the cooperation of the human element.

On November 1, 1928, in a small mining town of the State of Zacatecas, a meeting of all the local operating executives and technicians of the company was held to discuss problems related with the prevention of accidents and occupational diseases. A unanimous decision was reached to intensify by all possible means the campaign of safety and hygiene initiated in previous years, and for this purpose, a general safety committee responsible for the health, safety and welfare of the workmen was appointed.

The first act of the general safety committee, under the permanent chairmanship of the assistant general manager, was to appoint departmental safety committees, preference being given at the start to the mining department, on account of its greater importance. The departmental safety committee for the mine, in order to obtain the cooperation of the existing labor organizations, in turn appointed safety subcommit-

tees with syndical representation to cover not only all the sections of the mine, but all the various phases of mine operation as well.

The preparation of the members of the various safety committees for the efficient discharge of the respective duties, the delimitation of their fields of activity, their degree of authority and responsibility and their subordination to the safety department were of extreme importance, but once this was accomplished the whole organization began to function as a unit, the immediate steps being: (a) Intensification of the educational campaign by means of posters, safety contests, meetings and conferences. (b) Complete revision of the company's safety regulations. (c) Intensification of the training given to the workmen on health practices, hygiene, first-aid, fire prevention and fighting and mine rescue work, and (d) The publication of a monthly safety bulletin entitled "El Centinela."

At a meeting of the general safety committee on November 23 the safety engineer presented his report giving an account of the activities up to that date, pointing out the accidents that had occurred in the mining department during the previous month, as follows: 2 fatal accidents; 2 serious accidents; 68 minor or disabling accidents and 230 slight accidents without loss of time, in a total of 47,679 man-shifts worked.

For a quick comprehension of the progress made in the prevention of accidents as a result of the procedure outlined before, it will suffice to say that, three years after the initiation of the safety campaign, the accident record of the mining department for the month of October 1931 was: no fatal accidents; 2 serious accidents; 19 minor or disabling accidents; and 57 slight accidents, in 32,131 man-shifts worked.

In addition to the progress made in the prevention of accidents since 1924, the company has built a fine hospital, providing the best medical treatment and care. The yearly records of accidents and occupational diseases have improved progressively, culminating this year with the following statistics:

Mining Department

Disabling Injuries per 1,000 man-shifts worked

Fiscal years	Minor	Serious	Fatal
1927-1928	1.309	0.018	0.027
1928-1929	1.257	0.064	0.029
1929-1930	0.860	0.036	0.006
1930-1931	0.623	0.027	0.027
1931-1932	0.335	0.021	0.016
1932-1933	0.266	0.026	0.015
1933-1934	0.255	0.018	0.010
1934-1935	0.217	0.019	0.012
1935-1936	0.112	0.024	0.003
1936-1937	0.176	0.014	0.000

N.B. The Mexican mining law defines a minor injury as one requiring from 2 to 15 days to heal; a serious injury, one requiring more than 15 days to heal.

All Departments—Fresnillo Unit Fiscal Year 1936-1937

Total amount paid for non-professional diseases on the basis of 50% of daily wages.....	P58,088.47
Total amount paid for all classes of compensation, indemnities, and special expenses on account of injured employees, including cases that correspond to previous years, not settled before	P25,066.09
Total amount paid for all classes of compensation for occupational diseases, including retirements in non-professional cases	P49,805.51
Total health and accident indemnities	P74,871.60
Total amount of wages paid during the year.....	P4,360,357.81
Percentage of wages paid for health indemnities in cases of occupational diseases	P1.142
Percentages of wages paid for accident indemnities	P0.575
Total percentage of wages paid for health and accident indemnities	P1.72

These figures are eloquent proof of the progress obtained in the prevention of accidents and occupational diseases. However, an explanation is necessary concerning the relatively high cost of non-professional diseases noted. These costs are due, primarily:

(a) To a concession made to the workers in the collective contract that became effective in April 1936, whereby they are allowed 50 per cent of their daily wages up to two months' illness per year, while they are under treatment and rest. (b) To mild ailments of the respiratory organs such as bronchitis, colds, coughs, gripes, etc., generally brought about by sudden changes of temperatures, due to the obstinacy of many miners who work in their bare thorax while in warm places of the mine. (c) To various afflictions of the skin such as itches, rashes, dermatitis, furuncles, etc., brought about by insufficient cleanliness of the clothing or bodies of workmen.

Accident Reporting

The importance of this feature of accident prevention was soon realized by the organization and since the inception of the safety campaign, a written record of the causes, circumstances and consequences of all accidental injuries arising out of and in the course of employment, has been kept.

Every workman receiving an injury on the premises of the company, regardless of its severity, is immediately sent to the hospital for treatment, and a report is made by the boss or foreman is sent to the medical and safety departments. Each morning all the accident reports received by the safety department are studied, and then referred for further investigation to the sectional safety committees, who report their findings, conclusions and recommendations.

In all cases of disabling injuries an independent investigation is made by the safety engineer and foreman in charge, and a detailed report is sent to the management and officials of the mine. Infringements of the safety rules are punished with layoffs of from 1 to 5 days or even immediate discharge, in very serious cases. All cases requiring the application of discipline are the subject of a thorough investigation by a safety committee, final action resting with the company.

The hospital keeps a permanent record of all the injuries reported, with complete information on each case and treatments. On each new injury a complete description of the case is entered in the hospital books, and copies of the medical report are sent to

the mine superintendent and heads of the employment and safety departments.

Each accident is analyzed and entered on the workman's safety record which shows at a glance, not only the accidents that he has sustained and the action taken, but also the educational training he has received and the protective equipment with which he has been provided such as goggles, gloves, safety hats, lamps, safety belts and other similar articles which are furnished by the company free of charge, and exchanged without cost to the workmen when rendered unfit by normal wear.

The safety work of the mining department is under the direction of a safety engineer, who has under him a corps of trained inspectors who make an inspection of all working places on each shift, and supervise general blasting operations. Dangerous conditions are reported immediately to the boss in charge of the work, and in urgent situations the inspectors have authority to stop the work until the place has been inspected by the boss, who then assumes all further responsibility. Typewritten reports are distributed daily by the safety department to all the bosses concerned, and at the weekly meetings of supervisors a check is made on the action taken on the recommendations that have been submitted.

As a stimulus to greater interest and co-operation in the prevention of accidents, a scale of monthly safety bonuses, payable to all bosses and inspectors has been established. This scale is based on the total rate of accidents per thousand shifts supervised, and takes into account the interest displayed during the month by each supervisor in the elimination of hazards, enforcement of safety rules, and good housekeeping.

Once each month all the working places of the mine are inspected by sectional safety committees, who make a detailed report of the conditions and equipment considered to be unsafe. Typewritten copies of these reports are distributed to all the foremen and bosses concerned for their investigation and written comments, and the discussion of questionable recommendations is taken up at a monthly meeting of the committees, bosses, foremen and mine officials.

Separate meetings of the contractors working in the two main divisions of the mine are held once each month, and the accident record of the preceding month is discussed with them in detail, adopting all possible measures for the prevention of similar recurrences.

Two meetings of the general safety committee comprising the management, operating executives, technicians and principal assistants: one for the surface departments and the other to cover mining operations, are held once each month for a review of the record of the previous month, and for the discussion of matters of general nature.

Fire Prevention

Every possible effort is made to minimize the danger of a fire underground. In preparation for such a contingency a large number of carefully selected men have been trained in the use of oxygen breathing apparatus, and five crews of five men each are kept in continued training. A smoke room has been provided to make the training more effective, and fire-drills are held underground in various sections of the mine once a month. An up-to-date first-aid and mine-rescue station is maintained on the main patio of the mine, completely equipped with 12 McCaa oxygen breathing apparatuses; 10 all-service gas masks; 50 self-rescuers; oxygen pump; carbon monoxide detector; safety lamps; stretchers of various types; life line, and other miscellaneous equipment.

A fire-car fully equipped with hoses, axes, pipe fittings, fire extinguishers, first-aid supplies, and other tools and material is also available on the main mine patio at a moment's notice. Provisions for an abundant supply of water in all parts of the mine through both air and water lines have been made, and water connections, hydrants, and fire extinguishers have been placed in convenient parts of the mine. An injector installed on the main air line at the portal of the mine is available to spread, by means of a stench signal, the warning of a fire underground.

ADJOURNMENT

Paper and Pulp Section

Officers 1936-37

General Chairman—GEORGE J. ADAMS, International Paper Co., Glens Falls, N. Y.
Vice-Chairman in Charge of Membership—ARTHUR E. WINNLOW, Hollingsworth & Whitney Co., Waterville, Me.
Secretary and Program Committee Chairman—F. A. ROBINSON, Kimberly-Clark Corp., Neenah, Wis.
News Letter Editor and Publicity Committee Chairman—CLAYTON BRAATZ, Marathon Paper Mills, Rothschild, Wis.
Contest Committee Chairman—A. SCOTT DOWN, The Paper Industry, Chicago, Ill.
Engineering Committee Chairman—D. B. CHANT, The Ontario Pulp & Paper Makers' Safety Assn., Toronto, Ont., Canada.
Health Committee Chairman—DR. EDWARD W. PAINE, Hollingsworth & Whitney Co., Waterville, Me.
Poster Committee Chairman—J. H. TURNER, Consolidated Paper Corp., Ltd., Grand'Mere, P. Q., Canada.
Statistics Committee Chairman—FRED W. BRAUN, Employers Mutuals, Wausau, Wis.

Members at Large—

ERNEST AUGUSTUS, The Mead Corporation, Chillicothe, O.
 W. J. BRENNAN, Maine Department of Labor and Industry, Augusta, Me.
 M. W. DUNDORF, Beloit Iron Works, Beloit, Wis.
 K. L. FAIST, The Champion Paper and Fibre Co., Hamilton, O.
 W. A. GLEASON, Hammermill Paper Co., Erie, Pa.
 E. E. GRANT, The Crystal Tissue Co., Middletown, O.
 J. J. HASTINGS, Port Huron Sulphite & Paper Co., Port Huron, Mich.
 C. O. HOLMER, Minnesota and Ontario Paper Co., Minneapolis, Minn.
 F. L. IRVIN, St. Croix Paper Co., Woodland, Me.
 D. A. McALARY, Fraser Companies, Ltd., Edmundston, N. B., Canada.
 DON E. McDOWELL, Kalamazoo Vegetable Parchment Co., Kalamazoo, Mich.
 ARTHUR MURRAY, Container Corporation of America, Chicago, Ill.
 H. G. NOYES, Oxford Paper Company, Rumford, Me.
 J. J. PLZAK, Consolidated Water Power & Paper Co., Wisconsin Rapids, Wis.
 SAMUEL PRUYN, Finch-Pruyn Co., Inc., Glens Falls, N. Y.
 B. D. ROGERS, Bird & Son, Inc., East Walpole, Mass.
 F. H. ROSEBUSH, Nekoosa-Edwards Paper Co., Port Edwards, Wis.
 S. F. SHATTUCK, Kimberly-Clark Corp., Neenah, Wis., Representative, The American Paper and Pulp Association.
 L. R. SIMPSON, The Brown Paper Mill Co., Inc., West Monroe, La.

Officers Elected for 1937-38

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H. G. NOYES, Oxford Paper Company, Rumford, Me.

E. W. PATTON, The Lawrence Paper Co., Lawrence, Kansas.

J. J. PLZAK, Consolidated Water Power & Paper Co., Wisconsin Rapids, Wis.

SAMUEL PRUYN, Finch-Pruyn Co., Inc., Glens Falls, N. Y.

B. D. ROGERS, Bird & Son, Inc., East Walpole, Mass.

F. H. ROSENUSH, Nekoosa-Edwards Paper Co., Port Edwards, Wis.

S. F. SHATTUCK, Kimberly-Clark Corp., Neenah, Wis., Representative, The American Paper and Pulp Association.

L. R. SIMPSON, The Brown Paper Mill Co., Inc., West Monroe, La.

MONDAY AFTERNOON SESSION

October 11, 1937

The opening session of the Paper and Pulp Section was called to order by George J. Adams, International Paper Company, Glens Falls, New York, who presided.

CHAIRMAN ADAMS: Following the usual practice, it is my duty as General Chairman to review briefly the activities and progress of the Paper and Pulp Section during this past year.

There were two meetings of the executive committee during the year, the first at Chicago on January 19 and the second in New York City on April 15.

At the Chicago meeting, the principal topic of discussion was the program for this Kansas City Convention.

The New York meeting was concerned with a discussion relative to the correlation

of efforts of this Section with other agencies or associations of the industry in their aims to promote accident prevention in pulp and paper mills. Also included in the New York meeting was an extensive discussion on accident statistics. It was proposed that the Section take some means of perfecting and continuing these statistics because of the very pronounced interest being shown by a number of mills. Accordingly, a committee was appointed at the New York meeting consisting of Fred Braun, Chairman, Ernest Augustus, Arthur Winslow, George Burns and myself to act as a sub-committee to the regular statistics committee, of which Mr. Braun is also our Chairman, to consider the following:

1. Improvement of the present form of report of accident.
2. Perfecting a plan for future tabulation.
3. Perfecting a plan for the presentation of the statistics to the Section.

I have asked Mr. Braun to include in his statistical report also the report of this committee.

There has been quite an increase in the membership of our Section the past year. About 25 per cent of the industry as a whole are now members of the National Safety Council.

Through the good will of Fred Robinson and the Kimberly-Clark Corporation we have the services of a stenotypist to take discussion notes at our meetings here. We certainly are all appreciative to Fred and his corporation for this.

J. J. PLZAK (Consolidated Water Power & Paper Co., Wisconsin Rapids, Wis.): I would like to ask that the membership give the Secretary permission to record a unanimous vote of appreciation for the splendid leadership that this Section has had under our Chairman, George Adams.

(The motion was carried.)

Report of Accident Experience Exchange

By FRED W. BRAUN

Manager, Safety Engineering, Employers Mutuals, Wausau, Wis.

Statistics should be used in your accident prevention work for fact-finding interest on your program. These can be shifted in any manner. Some very interesting things are brought out in this year's report.

Members of the Section are to be complimented on their response in sending in their reports. We received 678 reports this year as compared to 108 last year.

This year August, with 77 accidents, was the high accident month; July, with 29, low.

In Tabulation 2, which indicates the day of the week in which these accidents were caused, you will find that Wednesday was high, with 119, and Sunday was low. In '36 Sunday was low and Thursday was high. There is apparently an indication there that the middle of the week is high.

You should check with your own plant experience and see whether the accidents as they are reported to your plant check with this. Do you have the high recording in the middle of the week?

Tabulation 3 shows the day or shift. The day worker is low and the shift worker high. Does that mean that the day worker, working eight hours a day, during the day, every day in the year, has more natural rest, and that the shift worker who goes on at eleven to three or from three to eleven and so on, one week, and next week some other hours, has his rest broken up? When a man comes home at seven o'clock in the morning from a night shift, or three o'clock, does he go to bed and get his rest? If so, does he get natural rest? Those are some of the things you should check with your own plant.

Tabulation 4, time of accidents, is very close. There is very little difference between afternoon and morning accidents in recording.

Tabulation 5 shows that for the three years, '35, '36 and '37, the highest peak in the morning occurred anywhere from eight to twelve o'clock. Here is your first somewhat consistent fact. In the afternoon you

find practically the same thing. From two to four is your high period. Why do we have accidents? Why do they apparently come at the same hour? Is there a drop in enthusiasm? Is there drowsiness? Is it increased production? Is there tenseness? These are some of the causes that you might study, because they are quite consistent in their time.

If this is an indication, and it is going to run this way for years, why do we have safety meetings in the evening? Why not have five-minute safety meetings at ten o'clock in the morning and somewhere between two and four in the afternoon? If that is the time that you have accidents, that is the time that you should concentrate on them.

According to tabulation 6, which shows the time worked preceding the accident, accidents are caused after men have worked several hours. This year we had 121 accidents reported after men had worked five to six hours, which indicates, again, that that probably is the time to inject some safety program into the picture.

Now the age bracket—note the 25 to 35 group. Tabulation 7 shows how close these indications run for four years. Is it due to the fact that you have more men employed at the age of 25 or 30, or are they more prone to accidents? In '34 you had 45 accidents occur to those between the ages of 25 and 30; in '35 you had 43; in '36 you had 21 from 30 to 35. This year you had 117 between the ages of 25 and 30.

It will be interesting to figure out in your own plant what your average age of employment is. See if it checks with this.

Tabulation 8 shows a higher frequency for married men. I really cannot see the value of this. Probably most men who work are married. That is the reason for that; they probably have to work, and that is why you have a high frequency.

Tabulation 9 shows the years in employ of company. Note again how close they run as to new men. In '34, 44 worked from one month to six months; in '35 you had 36 accidents of men that worked from one year to two years; in '36 you had 19 that worked from two to three years, and then this year you had 74 accidents, from three to four years.

Is this to lead us to believe that young

employees, in point of service, show the high accident tendency? Certainly all of us should work on the new men.

Tabulation 10 shows a steady increase and a steady hold on machines for the number of accidents. This should lead us to make a study of paper machine accidents by departments. Is the nip hazard responsible? I call to your attention the finishing room—8 accidents in '36 and 73 this year. Shipping went up from 6 accidents last year to 26 this year.

However, we had a tremendous increase in number of accidents reported, which may account for that.

But you see the importance of sending in reports. If you could hold to a certain figure, the number of accidents reported over a period of years, you would have some very accurate statistics.

Tabulation 11 shows a tremendous increase in days lost—110,000 compared to 10,000 last year. It shows the trend of the departments that are having these accidents. Several more years of reporting of this kind would prove definitely that machines are probably your greatest time-lost hazard.

Tabulation 12 shows the job-distribution of accidents. The four years that are represented show a consistency on laborers, wood handlers; machine tenders and finishers show quite an increase.

The next tabulation, on the cause of injury, is probably the most important tabulation for all safety men. Note that "slipping, stumbling and tripping" shows a remarkable increase. It was first in 1936; it is first again this year, with 1,169 days lost and 75 accidents.

Tabulation 14 is on the nature of the injury. Fractures and bruises take first and second place. Last year it was just reversed. That shows you, again, how consistent statistics can be. You have "slipping, stumbling and falling" and machine accidents as your high causes and you get, as a result, bruises and fractures.

Tabulation 15 is on parts of body that were injured. For the fourth consecutive year, hands, fingers and feet suffer most.

I want to make a few comments, now, that are very pertinent to this job.

It is a mistake to change your statistical chairman year after year because it is quite a job to pick up where the other fellow

left off, and a great many people do not have the equipment to tabulate.

I mentioned that at the Executive Committee meeting of this Section the early part of last year and urged that a uniform report be adopted, and that you clear all your records through the National Safety Council,

allow the National Safety Council to be your statistician. Then year after year you can have the same type of report, the same agency tabulating it. They have the facilities; they have the means; and I know that they will do it, provided you adopt a report that will fit their cards. That should be worked out by the committee.

CHAIRMAN ADAMS: I would like to explain a little further. Our present form of report is quite complicated in that it requests a good deal of information relative to the accident.

Our members are asked to file a report for each accident that occurs and send it through to the chairman of the Statistics Committee. Some fault has been found with that at the mills because it entails a good deal of work. In many instances the questions are not answered. To me that is an indication that the fellow who is making out the report thinks it is a silly thing to answer this question or that. Do you get that impression?

MR. BRAUN: Yes.

CHAIRMAN ADAMS: We conferred with the National Safety Council headquarters. They looked over our form and said they couldn't do a thing with it in its present form, but that if we would simplify it they would take over the compiling of our statistics.

Does anybody want to discuss this question?

J. H. TURNER (Consolidated Paper Corp., Montreal, Canada): Has the National Safety Council submitted a form they would like us to adopt?

MR. BRAUN: This isn't as complicated as it sounds or looks. Mr. Forney, the statistician of the Council, will submit a report form to the officers of this Section. If that form meets with the approval of your officers, they will adopt it and send it on and use it this year. Then the Council will automatically take care of your statistics and publish the report each year.

CHAIRMAN ADAMS: Fred, can you give us any idea of that report—what the questions are?

MR. BRAUN: They have a great deal of information that we call for now. The

causes and the departments are practically the same.

CHAIRMAN ADAMS: Is there anything left out in your estimation, that would be of value to us?

MR. BRAUN: I think it can be used. Some additions could be made, and they would be willing to make them. You see, they get reports from other sections, and that is why their report is somewhat uniform. If you want a separate report, of course you would have to get their o. k. But as the report form stands now, I think it could be used and would give you valuable information every year.

ERNEST AUGUSTUS (The Mead Corporation, Chillicothe, Ohio): Could Mr. Braun, as retiring chairman of this committee, get that form and submit it before the end of our sessions this week for consideration, and if o. k. could we adopt it and go ahead?

ARTHUR E. WINNLOW (Hollingsworth and Whitney Co., Waterville, Maine): Will we lose records that have already been compiled if we adopt the new form? Will they simply start with the new form and go on, or will these be incorporated?

MR. BRAUN: You could incorporate these and just add your 1938.

CHAIRMAN ADAMS: You will get your year-to-year comparisons?

MR. TURNER: What is the statistical period?

MR. BRAUN: From October until the time the chairman feels he has to stop to make up his tabulation.

D. C. HUNTER (Oxford Miami Paper Co., West Carrollton, Ohio): Why couldn't that period be the same as our contest?

CHAIRMAN ADAMS: I think we discussed that before, and we decided we didn't want to hook up our statistical report with the contest.

DR. THOMAS DOWNES (Serval, Inc., Evansville, Ind.): What do you class as accidents, lost-time, just an injury, or what?

MR. BRAUN: They are all injuries. You have a question in there as to the time lost, if there is any lost time.

DR. DOWNES: What do you compare that with, your man hours of exposure, number of men? What do you class in these injuries? Do they have to have lost-time or involve compensation or expense?

MR. BRAUN: They are just injuries.

DR. DOWNES: Around a mill a lot of fellows get hurt and they are never reported. One firm may be conscientious in reporting injuries, and another doesn't report them. They just wrap them up and the men go back to work.

CHAIRMAN ADAMS: That is true. But the purpose of the report is to classify, according to the different tabulations, such reports as are sent in to the chairman or to the national headquarters, as to cause, age, and so forth, without any relation to the man hours. Hooking this thing up with a contest isn't our purpose. You are probably familiar with our Paper Industry Contest. It is based on exposure. Maybe I am wrong in this, but I can't see the value of hooking man hours into this kind of tabulation.

MR. BRAUN: We are not interested here in man hours. We are interested only in one thing—frequency of causes. If a man scratches his finger and goes to the first aid room and is back in fifteen minutes, you might think that is a very trivial cause, but all of you know men have died from a cause like that. If you have in a year 500 accidents like that, there is something wrong in your plant. If you have five, it makes no difference. It is an indication of the trend of cause of accidents. That is what you want to get out of this report. If you want a contest, that is another matter. You want the frequency and the cause. Of course, the severity is interesting. You have it here because you must tie up severity with your accident program.

It is brought out that hands and feet are the parts of the body that receive the most severe blows in your industry, naturally, when you have all these nip hazards, and your severity is based on that.

CHAIRMAN ADAMS: We are getting back into a discussion we have had for three or

four years in the past, as to what our statistics shall consist of. I believe we started this with lost-time accidents only. It may have got to the basis where we are including no-lost-time accidents. There is just as much value in the data on a minor injury that doesn't cause lost time as there is on a fatal accident. There is very little difference so far as cause is concerned. The circumstance of the accident is going to determine whether or not a fellow will go back to work or be taken out in a coffin.

At the same time, if it is the consensus that you want to stick to lost-time accidents, we can settle that now. If we want to include both, we can still do that and make some separation in the tabulation.

MR. BRAUN: It is difficult when you get these reports. Some aren't lost time and some are. You must have a standard form and stick to it. Some mills—whether they misunderstand or not, I don't know—will send information and you can't tabulate it.

It all goes back to what I originally started to say; that if you have a standard form that is used by all the other sections and add to that possibly some of the questions you want answered, you will have better information.

CHAIRMAN ADAMS: Will the meeting consent to this? Let me appoint a committee to consult with the National.

MR. BRAUN: I move that the Chair appoint a committee to consult with the National Safety Council, to adopt a uniform report form and uniform practice of reporting for this Section.

(The motion was seconded by J. J. Hastings, put to a vote and carried.)

CHAIRMAN ADAMS: I will appoint Mr. Winslow and Mr. Augustus. Will you serve with them?

MR. BRAUN: I will be glad to help.

MR. PLZAK: I want to inject this into the matter of recording these statistics. I wonder, Fred, if you are familiar with the Heinrich Cause Committee committee reports. It is a federal report. The committee might look into it. It is a type of form for reporting both lost-time and minor injuries. It might help in your report.

CHAIRMAN ADAMS: Is there anything else on that question?

STAFFORD A. BENEDICT (Southern Advance

Bag and Paper Co., Hodge, La.): I would like to bring out one point that I believe has been overlooked in this discussion here. Very often an employee will neglect to report a minor injury, although we realize they may be severe cases some time in the future. If we included every injury in this statistical report, we would not get quite the precise report that I think we want. If you made that strictly lost-time accidents, it is more than natural that the employee would report an accident or that you would get a check on an accident that involved lost time. If you make this strictly lost-time accidents, I believe you would arrive at more definite conclusions.

CHAIRMAN ADAMS: The committee will take that into consideration. We will try to do the best job we can.

G. J. BIENVENU (Corrugated Box Co., Inc., Bogalusa, La.): I am in a converting plant. When drawing up new reports, I would like the committee to consider analyzing accidents that may take place in a box factory. Most of the reports leave them out. I am wondering how many representatives we have in this group from box plants.

CHAIRMAN ADAMS: We can easily find out.

MR. BIENVENU: Corrugated fiber boxes, cartons. (Eight.) Have you gentlemen found it true that the paper and pulp reports do not bring out the type of accidents we are likely to have in our plant?

CHAIRMAN ADAMS: You will be given all the cooperation in the world if you will file your own reports with the committee.

MR. BIENVENU: We have been doing that.

CHAIRMAN ADAMS: They must be included then. They may not have been classified.

MR. BIENVENU: That is what I mean. They are not classified, and the report doesn't ask for enough information that we could classify them well enough. In other words, it seems to be devoted almost entirely to pulp and paper mills and not to box factories and refabricating plants.

C. A. WRIGHT (American Box Board Co., Grand Rapids, Mich.): Maybe he is in the same position that we are. We have a paper mill and converting plant. We are all in one plant. We either have to break them down and send just the paper and pulp to get them classified, or send them both, and they are not classified.

MR. WINSLOW: The tabulation is based upon the reports that came in the first year—Isn't it, Ernie?

MR. AUGUSTUS: Yes.

MR. WINSLOW: That first year apparently the box industry was not represented. That was in '34, I think. Certainly the Section doesn't want to freeze out any part of the industry. I think the committee could talk with some of you boxboard people and find out what points should be covered.

CHAIRMAN ADAMS: I will ask the committee to take your suggestion into consideration when they meet with the headquarters staff.

Our next speaker is Mr. Thomas G. Henderson, Superintendent of Bird and Son, Inc., Phillipsdale, R. I.

Methods of Obtaining Employee Interest and Cooperation in Safety

By THOMAS G. HENDERSON

Superintendent, Bird & Son, Inc., Phillipsdale, R. I.

I shall describe the methods we use to get our employees to help us in our safety program.

We believe the first thing necessary is that the management show the employees that it is enthusiastically willing to do its part in the safety program. All machinery and all dangers should be thoroughly guarded, and

all work should be laid out so as to be done in the least dangerous manner. While it is generally conceded that more accidents are caused by carelessness or thoughtlessness than by the lack of machinery guards, the responsibility of management in this direction is perfectly clear if employee cooperation is to be deserved.

Existing machinery should be periodically inspected to see that the necessary guards are in place and all new machinery should be gone over to see that guards, not supplied by the manufacturer, are made and put on before the machine is put in operation. Extra precaution should be taken to see that after repairs or alterations no guards have been left off, even temporarily. In consideration of the proper methods of doing various operations, it is realized that the safe way is not always the quickest way; but since employees are quick to detect any lukewarmness on the part of management toward safety, it is especially important that in prescribing certain methods for doing routine jobs the management should take as broad a view as possible.

Perhaps equally important is the safety committee organization. We have first the department safety committee, made up of the foreman, as chairman, with a few of his men, and second the central safety committee, headed by the vice-president in charge of manufacturing, and made up of all the plant superintendents.

The department safety committees are headed by the foreman. He is given to understand that he is directly responsible for accidents in his department and that this safety committee is a means for him to combat accidents. On this committee he will have what men he thinks necessary and will meet with them informally at least once a week to talk over dangerous or unsafe practices which they have observed, review the peculiar hazards of their department, do what they think necessary to keep their department safe, and consider recommendations made by the men.

It is part of the duty of these members to talk to any men working in an unsafe manner, and they, as well as the foremen, have the right to stop what they consider any unsafe practice. It is the custom of the company to change the makeup of these department committees at least once a month on the theory that by so doing all men, particularly the newer employees, will have a better opportunity to become versed in the safety idea.

Since all superintendents have some latitude in the running of their safety committees, we have made it a practice in our plant to keep the same men on the safety committees for longer periods on the theory that

safety work is important enough to warrant the time of the best men in each department and that their position on these safety committees would be respected more if everyone realized that their appointment was probably more or less of a permanent nature.

Regardless of which plan is followed it is important to bring in the men on the job. No matter how good a foreman is, he can frequently learn safety improvements from his men, and their having some say in the safety program cannot but increase their interest. These committees occasionally make inspections in other departments and are sometimes able to call attention to conditions or practices to which men have become accustomed but which should be corrected. Recommendations of these department committees are passed along to the superintendent, who sees that they are carried out when practical. Some recommendations are passed to the central safety committee.

A foremen's meeting, held twice a month in each plant, offers the opportunity for safety matters to be brought up if a foreman wishes certain items discussed. Here, after discussion, changes may be ordered or recommendations made to the central safety committee.

In emphasizing the foreman's responsibility for the success of the safety program in his department, he is required to come each morning to the superintendent's office and mark on a chart the accident record for his department during the previous day. This is something we insist upon every morning, and the foreman is not allowed to forget it.

The central safety committee, made up of the superintendents and presided over by the vice-president in charge of manufacturing, meets once a month. It receives reports of the safety inspector, passes on recommendations of the various superintendents, and decides the general policy of the safety program.

Since it is never too early to get the employee's interest in safety, we start before he is hired. The employment department explains to the new man the company's policy in regard to safety work; and the fact that he must work safely is impressed upon him before he starts to work. In addition to this each foreman must see that the new man is thoroughly instructed in the hazards of the work he is to do, and the necessity for working safely is further impressed upon

him by the signing of an examination card before he starts to work, signifying that he has been instructed in the hazards of his department and that he promises to do his work in accordance with the safe methods outlined. A further check is made on the new man by the safety inspector. He makes it a practice to talk with each new man before he has been working a month, and he satisfies himself that the new man has been properly instructed concerning safety matters.

This same procedure is carried out when an employee is transferred to a new department, so that he may be fully instructed in the hazards of the new job before starting.

The cooperation of the employee is dependent to a great extent on the attitude of his foreman and his superintendent toward safety work. Frequent talks with the men, either by the superintendent or foreman, about safety matters will go a long way toward the desired cooperation.

The foreman or superintendent must know when he sees a man working unsafely and must be willing to take the time to stop the man right there and then to explain the danger of what he is doing. He should be made to understand that he is actually playing with perhaps life-long misery not only for himself but for his family as well and that the safe way to do his work is the only way approved by the company.

The management feels that a detailed check and careful investigation of all accidents emphasizes the importance of safety work to the men in addition to providing means for the prevention of future accidents. All accidents requiring medical attention are reported immediately to the vice-president in charge of manufacturing, and a very detailed report is sent along later. This includes first the accident report made out by the foreman giving a description of the man, the accident and the time and place, what the foreman thinks was the cause of the accident, and what he can do and has done to prevent its recurrence. Second, a report of the investigation by the plant safety inspector. Third, a report of the nurse who sets down the employee's reason why the accident occurred and what precautions have been taken. These are all sent through the superintendent who, of course, keeps himself well informed concerning the safety conditions of his plant.

A safety inspector visits all plants at least once a month and not only constantly checks

the hazards which the management can correct but also does a lot of missionary work in talking with both new and old workers. His recommendations are made to the superintendent and to the chairman of the general safety committee and are subject to followups of this committee.

Two shields have been provided by the company as an incentive and an acknowledgment of good safety work. One shield is held by that plant which has run the largest number of days since the last lost-time accident and the other is held by the plant which has run the largest number of man hours without a lost-time accident.

Items on bulletin boards play a part in stimulating employee interest. Statistics are posted monthly showing the standings of the individual plants in the company's own contest and also in the other safety contests in which the various plants have been entered. Details of lost-time accidents are given when there is noticed a tendency toward any general unsafe practice (such as fast driving around the plant), and in case of a particularly bad infraction of the safety rules a little publicity is given with very desirable results.

National Safety Council posters are used and changed frequently. We consider that these posters, to be effective, must be changed at least once a week. There is a question as to just how important bulletin boards are in a safety program. It certainly is necessary to keep what information there is on the boards up to date and to change them frequently. Probably the fewer boards there are the more they are looked at and, of course, they should be placed near a time clock or some similar place where the men must see them every day.

In the employee magazine publicity is given to all accidents and to all safety achievements. The contest standings of the various plants are given.

Safety calendars are distributed to all workers each Christmas. These serve not only to show the company's interest in safety work but also to create an interest on the part of the employee's family in the company's safety program.

In any industry where heavy materials are handled we believe safety shoes to be very much worthwhile. We, therefore, carry in our storerooms a stock of a good brand of safety shoes and advertise, recommend and

otherwise encourage their use by permitting them to be bought at cost and paid for in installments from the weekly pay check. These shoes are constantly proving themselves to be good injury preventives.

Time cards and pay envelopes are an opportunity for the presentation of short and attention-getting safety slogans. The use of time cards especially offers good possibilities for this purpose, as they are seen by all employees at least twice a day, and good slogans will have a chance to sink in.

A very good and direct method of creating employees' interest is by the encouragement of American Red Cross courses in first aid. We have had very good success in sponsoring courses the last three winters. A large group has been interested not only in the regular course but in the advanced course as well. These advanced students have also formed a First Aid Club which meets regularly during the winter. A few of the advanced students are taking the examiner's course. We think these first aid courses are

very effective, as they make the men conscious of what terrible things can happen when safety is not practiced.

One more thing which should be brought out is the need for variety in certain items of the safety program. Take, for instance, the organization of the safety committees. There are probably nearly as many different kinds of safety committees as there are companies, and under certain conditions they may all be best; but probably no organization in safety work should remain unchanged year after year, as there is just as much danger of getting into a rut here as in any other work. Too many times a program is set in motion and then forgotten until the company experiences a flood of accidents which awaken it to the need of changing the whole program. A new program may not be any better than the old, but in offering something different it will restore a good accident record. Probably every safety program should be thoroughly overhauled at least once in five years to be sure that interest is maintained.

CHAIRMAN ADAMS: Does anyone want to ask Mr. Henderson any questions?

CLAYTON BRAATZ (Marathon Paper Mills Co., Rothschild, Wis.): I would like to ask Mr. Henderson in what form this publicity is that you use in safety work.

MR. HENDERSON: We put out organization books once a month. In them, if there are any accidents, we describe them and tell what corrective steps have been taken and any other information we can get. We also show safety standings of the companies.

MR. BRAATZ: When you describe these accidents, do you give the name of the man?

MR. HENDERSON: Yes.

W. R. OWENS (West Virginia Pulp and Paper Co., Covington, Va.): I would like to ask Mr. Henderson if he has any method of punishment for carelessness or lack of interest on the part of the employees? That is, if one fellow is found to be a repeater or anything like that.

MR. HENDERSON: We have talked that all over and threatened to lay men off, but we have never had to do it. We find when a foreman tells the safety committee about a

man who is careless and can't be trusted, he generally brings him up; and the superintendent will talk with the man and tell him that if he continues to be careless, he is likely to be laid off for a few weeks. In almost every case that has been enough punishment—just the idea of the superintendent talking to the man, with his foreman, just showing him what it means to get hurt, making him feel that you are working for his interest more than for the company's interest.

It would be far better to lay that man off for two or three weeks rather than to take him into the hospital. We have never really had to lay a man off.

CHAIRMAN ADAMS: That is a question we have scheduled on our program for Wednesday. I think we can iron it out at that time. Is there anything else?

E. H. RUTTER (Kimberly-Clark Corp., Kimberly, Wis.): In making out this report on accidents I would like to ask whether he gives the employee's viewpoint of the accident or puts down what he thinks about it.

MR. HENDERSON: That is on the nurse's

report. She asks the man certain questions, and she puts down his very words.

MR. BIENVENU: Is that given publicity?

MR. HENDERSON: No, it isn't, but it comes up before the central safety committee and it is all talked over. The safety inspector generally knows about it, and he checks on it.

MR. AUGUSTUS: I think I understood Mr. Henderson to say that the members of his safety committee are given the same authority as the foreman to put a stop to any unsafe practice. Have you ever had any difficulty with that, any resentment on the part of the men?

MR. HENDERSON: No. It has worked out very well. If a man from one department is passing through another, and he is a member of the safety committee in his own department, and he sees a man doing something that is likely to endanger him, just stopping and talking to him has done a lot of good. I believe that is a good thing.

CHAIRMAN ADAMS: That might depend somewhat on the size of the plant. Do you agree with that, Mr. Henderson? That is, that might not work, I can see, in a large ten-machine mill, for instance, where it might work in a smaller mill where everybody knows everybody else. Is that true?

MR. HENDERSON: That might be, but I can't see why it wouldn't. If on that department safety committee, even though there are ten machines, you have one or two men who have been there for a number of years, who can take the younger men or the newer employees and show them that they are wrong, I believe it will work all right.

CHAIRMAN ADAMS: Do the safety committeemen wear any identification?

MR. HENDERSON: No. We have posted in the department a card showing who are members of that committee. These department committee meetings are very informal. The foreman will take his three or four men who are generally just working on the committee, and they will sit down on a roll of paper and talk things over, and he sends a little written report right in to the superintendent. That is just to show the superintendent he has had a meeting with his men.

M. D. KOSSORIS (U. S. Bureau of Labor Statistics, Washington, D. C.): In investigating accidents I have come across a belief or an attitude on the part of the men who

have had accidents, to the effect that the investigation and reporting of minor injuries results in diminution of cooperation of the employee towards the safety program because of the effects of such publicity.

MR. HENDERSON: We haven't had any trouble in that way. You mean minor injuries, some that have to go to the doctor?

MR. KOSSORIS: No, just first aid cases.

MR. HENDERSON: The foreman's reports come to the central committee meeting. They talk them over. "Well, here is a man who stuck a wire in his hand" or "a truck ran over and jammed a foot" or something; none of them required medical attention. They are just talked over in that way. We have never had any trouble.

The man isn't brought up and bawled out. If he has been careless, the foreman will go back and talk to him in a nice manner. Then the safety inspector will later talk to the man, ask him if he is getting along all right and is he careful. We just have to use judgment when we talk to the man, make him feel that we are working for his interest more than the company's.

SECRETARY ROBINSON: We have had very strong resentment on that point. In investigating, we found it was because the employees did not understand our objective in recording the information and making the investigation. They even objected to having the nurse write their name down and put down the cause of the accident, to say nothing of a formal investigation.

I think we have difficulty with a lot of these things because we don't get together with the group affected and explain to them what it is all about. These people had the feeling that we were using it for a black list, and after two or three occurrences of their names on the first aid report, it was going to be too bad for them, which, of course, wasn't the intention. It is a matter of trying to correct a wrong procedure or method or practice and using the actual experience to help us to do that.

MR. AUGUSTUS: Do I understand, Mr. Henderson, that every little, minor first aid case is brought to the attention of your committee and discussed? That is, every cut or scratch or bruise? We have quite a large plant. An average of 100 men a day come into the first aid room, maybe only for a scratch, hung up on a nail, a bruise, a boil

or something else. Is every one of those discussed by your safety committee?

MR. HENDERSON: In our first aid room we have a book, and the name of every man who is treated is put down there, showing what he was treated for. When we have our monthly meetings, that book is brought in. We just look them over.

We handle a lot of hales of rags. We might have a dozen cases where men got wire stuck through their fingers, and things like that. We don't take each case, but it is outstanding there that perhaps a dozen cases might turn to blood poisoning.

What are we going to do about it? Let's say a dozen cases happen every month, and every one of them might have been a bad case. It might develop that we would make men wear gloves in handling the hales. That is the reason for the report, to catch the little ones and not wait for a lost-time one or a doctor's treatment.

MR. AUGUSTUS: In that connection, this might help somebody else: Each morning our nurse makes out a report, mimeographs it, sending out the name and department and the nature of injury, very briefly described, of every man treated by her during the preceding 24 hours. That goes to each foreman so that he has a check on his own men. If he looks at that report each morning, he will see how many of his men were in the plant hospital the day before.

W. A. GLEASON (Hammermill Paper Co., Erie, Pa.): I was going to ask Mr. Henderson when they had time for this safety committee to function. Do they shut down the machines and do it? He said that some time during the day they sit down and make a little informal meeting of it.

MR. HENDERSON: That is right, just whenever everything is running all right. It is only a small committee in departments, perhaps three or four men.

CHAIRMAN ADAMS: I think what you have stressed all through your paper is the development of attitude, as I understood you, from the top down.

MR. HENDERSON: Yes, make the men in the plant feel that it is to their advantage for us to help them, that we are not helping the company. We never talk about what an accident costs, or anything like that. We just talk about how to save the man from being hurt. When a man is hurt, sometimes

it is a good thing to talk to him and give him a little sympathy, and he will feel pretty good. Foremen meetings are held twice a month, usually about one-third in the afternoon. Foremen can generally get away then. That takes in foremen in all production departments. It doesn't necessitate shutting down the departments, however. You take the foreman of the paper machines, the foreman of the beater room, the foreman of the cutter room, yard and all the other departments—they all go right along even though the foreman is out for a week.

JAY E. FARR (Employers Liability Assurance Corp., Chicago, Ill.): With reference to making public the names of men who have been injured in plants—one company with whom we have had dealings has a system that I think is interesting. They have had some of their safety men equipped with cameras, that will take pictures in the natural light in the plant. Pictures have been taken of men in unsafe acts and later published on bulletin boards. It has a very amusing reaction on the men.

One time a man was photographed standing under a heavy load hanging on a crane. Of course, he didn't think it was possible, but there was his picture. In the same way, another man was going up a ladder with some tools in his hands, climbing over a point where some other men were standing.

MR. HENDERSON: We have done that, too. Frank Fisher, our safety inspector, has taken a number of those pictures. Some have been printed in our monthly bulletin that goes to the employees.

MR. PLZAK: At Kimberly-Clark Fred Robinson took some movies of actual safe and unsafe practices in the paper and pulp industry that are very, very interesting, very educational.

CHAIRMAN ADAMS: Were they posted? Do you want to explain that?

SECRETARY ROBINSON: Yes. We went through our accident reports for a certain period of time and picked out some of the accidents that we figured could have been easily avoided and were probably the result of wrong practice. We had those re-enacted and took movies of them. Then we had movies taken of the job being done in the correct way so that you had the wrong and the right way. We had several reels of those and showed them on our annual safety day

at Kimberly. We had a better turnout, I believe, at that event than we had ever had at a like event. The wives and children were anxious to see the husbands in the pictures, and, of course, they took a safety message away with them. We used the pictures at various plants.

We discovered something else that has helped us maintain employee interest in safety.

I found that we were making up our safety program behind the desk and solely on the part of management. We felt that we could get better cooperation if we would give the hourly paid worker an opportunity to cooperate with us in the development of that program from the bottom up.

We went to our labor organization and sold the idea to them, told them what we wanted and asked them to appoint a committee of hourly paid workers to work with a number of management representatives. That committee is the steering committee. They have the power to appoint other committees, subcommittees, to make special investigations or to work on certain phases of the safety program that is developed. We go over our safety program every year with that committee.

I noticed, and I have the same word from the personnel department superintendents of our various mills, that as the result of that method, we have received greater cooperation and have been able to see an improvement in the interest shown by the employees, hourly paid workers, in the program. They have an actual part in building it.

Another thing—in the purchase of materials and equipment for our plants we have a system we call materials standards. For instance, we need belting. All right, why buy it here, there and all over? We buy certain types of belting and investigate, analyze and try it out, and finally come to the conclusion that we want this particular type because it has given the best results. We do the same thing with safety clothing and equipment.

There is a full-vision mask out on the market. When the material came out on that, we had a request from one of our plants to make an investigation. We bought one and sent it to the plant. We will try that out alongside the old equipment we are now using, and the employees will be given

an opportunity to express their own views on it.

The same thing is done with goggles, gloves and what-have-you. They have a part in deciding on the clothing they are going to wear. They have their own ideas, and if they have something to say about them, and you can help them analyze the situation, you are going to come out a whole lot better in the end.

MR. AUGUSTUS: Do you have motion picture equipment, or do you get an outside concern to take the pictures?

SECRETARY ROBINSON: I got an amateur who was making a hobby of it, and he did a very good job, although I found in looking at those motion pictures some things that I hadn't noticed in going through the plant. They divulged a few things that needed correction.

I will tell you one thing we found. We installed a deluge shower in our acid room. It was a brand new shower and in a very convenient place so if one should get splashed with acid, he could run in, pull the chain and get soaked and washed off with this water.

We were going to show that in these movies. We had a fellow all prepared to give the demonstration. He ran under, pulled the chain and nothing happened. He yanked it again, and nothing happened. We looked all over to find out what happened. Somebody during the night had got up on the piping and shut off the main valve, and we haven't yet been able to find out who did it.

From this we learned that we must look important valves so that when we want to use them, they will be all right.

CHAIRMAN ADAMS: Are there any other questions on Mr. Henderson's paper?

MR. AUGUSTUS: One thing I would like to mention that is very important in maintaining interest in safety is the manner in which your nurse handles the employees. She probably has a greater opportunity to contact your employees than any other individual in your plant, and, depending upon her personality and tact, she can get the good will of your employees and get them interested more quickly than anybody else.

DR. THOMAS DOBBINS: We have another stimulant for safety interest. We pay for suggestions and have suggestion boxes up near all the time clocks. We pay anywhere

from \$2 to \$500. Several of the men have won these high prizes. That is either on safety or production or anything that will improve conditions about the plant.

CHAIRMAN ADAMS: Our next speaker represents the boxboard industry—Mr. E. W. Patton, Safety Director, The Lawrence Paper Company, Lawrence, Kansas.

Major Hazards and Their Elimination in Boxboard Mills

By E. W. PATTON

Safety Director, The Lawrence Paper Co., Lawrence, Kan.

Many accidents are due to some little thing or group of little things which cause the normal operating conditions to become abnormal. In boxboard mills, where the dominant thought has always been production and more production, little things have not been given the recognition they deserve.

We are inclined to be lax in storing raw materials. They will be used sooner or later, so why bother placing them to insure safety? The same is true of materials used in repair work. They are put down in the manner that requires the least amount of effort, whether the material is well arranged or not. Safety men know that a poor arrangement of material is a formal invitation to an accident. The responsibility is squarely up to us to see that the neglect of these little things is corrected.

How many accidents are caused by poor illumination? It is true that few accidents are attributed to this cause, but the actual number would probably be amazing. Unshaded lamps are widely prevalent hazards. To work near an unshaded lamp is not only injurious to the eyes, but there are areas nearby where the vision cannot be depended upon because of the difficult adjustment required. Good light is important to plant safety.

Injuries caused by burns are common. The most frequent cause is uninsulated steam pipes or pipes where the insulation has been worn down. Electric switches, connections and extension cords, especially when used near water or wet objects, present serious dangers.

Maintenance work around boxboard mills has always been subject to a high accident frequency. The repairman may be called to work in any spot in the mill, no matter how small, dirty or poorly lighted. He handles all types of material. Sometimes no special

provision is made for handling heavy material, and men are required to lift weights beyond their physical capacity. There is a tendency when several men lift an object for some to permit most of the burden to rest on the others. Strained backs and hernias are likely to result. After a man strains his back several times he acquires a "trick back," and anytime that man lifts a heavy object he may have a lost time accident. This type of injury occurs when the supervisor is not doing his job correctly.

Waste paper is the principal raw material used in boxboard mills. It is handled in bales ranging in weight from less than a hundred pounds to nearly a ton. It is not unusual for one man to truck a bale of paper weighing 1,600 pounds on an ordinary two wheeled truck. Three unskilled men would have a difficult time doing this job without the knowledge of how it should be done. The weight is in itself no small hazard. When truck wheels bump over a rough spot in the floor it can shift a tremendous amount of force to the truck handles. This hazard cannot be completely eliminated unless mechanical means of handling the paper is substituted for man power, and in many cases this is not practical. However, careful training of the men, smooth trucking surfaces, and trucks kept in good working condition will eliminate most of the injuries from this source.

Waste paper is bound with stiff baling wire. No particular care is used to separate other forms of waste. Anything might be found in the bales from old razor blades to beer bottles. These foreign objects are responsible for a high minor accident frequency. Injuries of this nature may be reduced materially by an inspection of each bale for loose ends of wire and other sharp or pointed objects.

Another type of injury occurred when two men were stacking bales of paper. One man, in attempting to hook a bale, missed the bale but dug the point of the hook in his partner's elbow. An investigation disclosed that the men were hired temporarily and were not given adequate instructions in the use of hand hooks. Sometimes also the hook may slip because it is defective. The heavy materials handled by the yard crew make it extremely important that their hand tools be in good condition at all times. A daily inspection by each man of the equipment he uses should keep the tools in good repair.

Waste paper is also handled in the beater room but the hazard is changed. The wires binding the bales are clipped here. When the tightly drawn wire is cut, the ends fly out. Cuts, scratches and punctures on hands and face have been caused by this operation. Eyes have been put out by it. A satisfactory method of clipping wires is to hold the wire firmly beneath one hand on a side of the bale and clip the wire near a corner. The loose end is then short and will fly around the corner away from the operator. Gloves offer effective protection for the hands. Wire taken off in the beater room should not be scattered about indiscriminately.

In working around large piles of cooked stock there is a cave-in hazard. An accident of this kind wrecked a good safety record. A beater man's helper was shoveling stock onto a conveyor and dug so far into the base of the pile that it caved in on him. In working around material of this type close supervision is absolutely necessary.

Continuous beaters are generally located near the floor level. The operators stand close to the edge of the beaters. The guard is generally a substantial railing around the exposed section of the beater, leaving adequate space to permit feeding with the least possible interference. Handles are sometimes put along the interior sides, and sometimes chains are attached so that they will be within easy reach if a man should fall into the beater. Chains are more of a safeguard in large or long beaters than in short ones. The design of the most effective safety devices is determined in all cases by existing conditions in individual mills.

In mills where the labor turnover is small the paper machine hazards are materially reduced. The slip hazard around the wet end of the paper machine depends upon

the particular arrangement in each mill. Ample gutters and drains should be provided along both sides of the machine so that water is carried away and does not accumulate over the floors. All footing surfaces should be kept free of oil and grease.

Along the press section small portable ladders are less dangerous than poorly shaped toe holds on the framework. However, the ladders must be of firm and dependable construction.

In repairing felts there is danger of infection from needle punctures. The puncture hazard is also present in working around the screens. The dirt and filth to which these objects are exposed make infection inevitable when the skin is penetrated. These wounds do not always bleed and there is no way of being certain that they will not cause trouble, except by prompt medical attention.

Weight levers and rods both on the press section and at the calenders present a possibility of weights dropping on feet. When the weights are tied on by ropes or wires, the constant vibration of the machine may free them. Bolts of sufficient size to hold the weights may be put in the end of the levers. Or reciprocating notches may be put in both lever and weight so that no slip can occur.

Rubber nips have tremendous pulling power. A man might have a chance to escape with the loss of a few fingers or an arm if caught between steel rolls but rubber rolls would certainly pull him through. Nip hazards around the felts are therefore very dangerous in box board mills. Accidents from this hazard occur most frequently when wrinkles in the felts are being pulled out and when the felt is being straightened by pulling the edge of the felt. When this is done in front of an inrunning nip the risk of being caught in the nip is tremendous. Automatic felt straighteners eliminate this hazard. Where they are not in use the risk can be diminished by proper instructions and rigid adherence to them. Nothing should be left undone to impress upon all men working around this type of hazard that they are risking their lives when they touch a felt moving into a roll.

Rope carriers that thread the paper around the dryers eliminate most of the dryer hazards. The heavy grade of paper and the production speed of box board mills make it extremely difficult to guard nip hazards on the calender stack without interfering

with its operation. The fact that it is recognized should help in preventing accidents from such a hazard. The propensity toward excitement when a bad run of breaks in paper occurs should be overcome as much as possible. Naturally, the men are eager to get the paper started again, but loud talk only adds to the nervous tension and contributes generally to the confusion.

The hazards encountered in handling the finished product depend entirely upon the method used in individual mills. The use of cranes and hoists in conveying paper rolls to storage or to the shipping department is the safest method. The hazards here depend on the equipment. The test is whether the equipment is kept in proper condition and designed to do the work for which it is used.

In some mills handling the finished rolls is done entirely by trucks and tiering machines or stackers. The size and weight of the material is in itself a definite hazard if handled by man power. Trucking requires special knowledge when done with a two wheel truck. It requires a sense of balance and good coordination for one man to truck a heavy roll. A substantial truck in good working condition and a smooth trucking surface are needed to do the job safely. The stacker or tiering machine has many danger points on and around it that the operators must constantly bear in mind. It is extremely important that strict rules be made concerning the starting and stopping of this machine so that the operators are aware at all times of what the machine is doing.

CHAIRMAN ADAMS: We are now open to discuss Mr. Patton's paper. I hope there is a good representation from the boxboard industry. He has brought up a number of very vital questions.

MR. BIKKENVU: Mr. Chairman, this gentleman spoke about a boxboard mill. We are in a refabricating plant. After he gets through with the paper, we get it; then we make it into boxes. The hazards are altogether different.

When you called on the speaker you said you were mighty glad you had some boxboard people here. I just wanted to get my position straight.

In our plant we have a rule forbidding the operators from riding on the stackers, and all men are warned not to be under the machine when it is being loaded or unloaded. One man had his arm severely mangled when it was caught between the moving platform and the frame of the stacker although this space was comparatively small. A wire mesh guard was designed that eliminated the hazard.

One big problem in the use of stackers is how to keep the floors in good condition when these heavy machines are continually chipping and grinding holes in them. In this method of stacking the rolls are chocked at the base of each roll. Heavy boards are laid on top of the roll and each succeeding layer is built up in the same manner. Special boxes provided for keeping the chocks off the floors will prevent many sprained ankles if the men are taught to put chocks in the box. The yard man's skill in handling large bales of waste paper is comparable to the skill required by men who handle rolls of paper on the stacker. With an iron bar the roll is controlled and balanced while it is being guided into place. But it is a life and death matter with the operator because a single slip might cause him to be crushed to death by a roll falling on him. Instruction and supervision play a very important part in preventing accidents.

No safety program is complete without adequate provision for taking care of injured employees. I suggest that in addition to a regular first aid attendant that courses be given to men throughout the plant in first aid.

CHAIRMAN ADAMS: I thank you, but I still think we have some people here who are connected with the manufacture of boxboard. I realize that probably we as a section have neglected what we call the conversion part of our industry. We haven't done it deliberately, but because we haven't in the past had enough representation from conversion to carry on a discussion. I will be very glad to devote some time during the week to problems of conversion in the paper industry.

D. B. CHANT (Ontario Pulp & Paper Makers' Safety Assn., Toronto, Canada): In addition to the offer you have just made,

to provide for a discussion of boxboard problems, I suggest that a memo be given to the incoming executive suggesting a paper on the hazards of the box plant as distinct from the boxboard mill, to be put on next year's program.

Among my members there are thirteen or fourteen box fabricating plants, most of them branch factories of the Gair Company of Canada or Heinendorff of Canada, both of which are represented here today. I think, certainly, there would be room for such a paper and such a discussion on hazards which are no doubt considerably different from those of the paper manufacturing mill.

CHAIRMAN ADAMS: Your suggestion is in the notes of the meeting, and I am sure whoever is the program chairman next year will be glad to do that.

MR. PIZAK: As a matter of information, the National Safety Council has available a pamphlet on hazards in the boxboard industry from a converting standpoint.

CHAIRMAN ADAMS: Of course, in the paper industry we have a lot of conversion. For instance, our company has bag plants where we make cellophane bags, and regular grocery bags, and so forth, but your suggestion has to do with boxboard boxes. Is that right?

MR. CHANT: Box factories.

C. A. WRIGHT (American Box Board Co., Grand Rapids, Mich.): I think we are all interested in box factory operation, regardless of whether we have a converting plant with our mill or not. As I say, we do have a converting plant with our mill. It is all in one building. We are very vitally interested in that.

When you get down to it, we are working for the elimination of accidents, regardless of whether it is in our own mill or whether it is in a box plant. We can all probably give suggestions, even on the product going to the box plants.

MR. REITER: Mr. Patton was speaking about weights on the calender level. We have had some accidents through weights falling on toes and so on, so we developed a lever with a sock in it, and we have a set screw going through all our calender weights, that permit the weights to be slid back and forth for different levers at the same time, prohibiting the weight from fall-

ing off the lever. Then there is a chain on the end of the lever so it can't slide off.

CHAIRMAN ADAMS: I wonder if you would be willing to make a drawing of it.

MR. REITER (Drawing sketch): In the center of the lever we have a slot of about three-eighths of an inch, and through the calender weights we have a set screw that comes right up into the slot of the lever, but not tightly—just enough so you can lift it up and still permit the weight to be slid back and forth. If the back tender on the end wants to hold that lever stationary, he tightens it up. We put a ring screw on some of the weights so that the back tender wouldn't have to use a wrench. He can tighten it up by hand. We haven't had a weight accident on the calender since we did that.

CHAIRMAN ADAMS: Are there any other questions of Mr. Patton?

MR. WRIGHT: Mr. Patton spoke about nip hazards on the calender. I wonder how his men feed the paper into the calender, on starting the calender.

MR. PATTON: They do it with the finger. We have tried a stick shaped in the form of a triangle, but our paper is too heavy and we haven't had much success with it. I believe we run paper possibly heavier than they do in most boxboard mills, because some of it is 30 point. It is pretty hard to handle with a stick. We run up to 50 point and use a stick.

MR. HENDERSON: We use the sticks on our box machines, and we haven't had an accident.

MR. PATTON: I took up the suggestion with our superintendent, and he said it wouldn't work, that it would cut our production speed.

MR. HENDERSON: You haven't the right shaped stick.

CHAIRMAN ADAMS: How fast do your machines run?

MR. PATTON: We have a small machine, about 40 tons a day.

CHAIRMAN ADAMS: How does that compare with yours, Mr. Henderson?

MR. HENDERSON: We make about 150 to 200.

MR. WRIGHT: That is about the average. That is what we run. We run from 12 point up to 50, 55, sometimes 60. We use

plugs. We haven't had a nip accident since we started using them.

MR. PATTON: The nip accident I mentioned in my paper is the only one that we have had since I have been there, or that I know anything about. Since we haven't had many accidents due to that hazard, nothing has been done about feeding with the fingers. I did take the subject up with the superintendent, and he said it would interfere with our production, seriously, if we used the sticks.

D. S. GAMER (Hummel and Downing Co., Milwaukee, Wis.): We have a board machine running up to 40 point board, about 2.5 feet a minute. We eliminate nip hazards by having the first and second back tenders work on the calendar stacks, but they are all instructed to put the paper through the rolls with their hands palm forward. We never have any nip accidents.

CHAIRMAN ADAMS: That is a live subject. We could talk all day on feeding paper of all weights and kinds through calendar stacks. I do know this, that Mr. Patton says you have to take into consideration the attitude of the production man.

MR. WRIGHT: I wonder how many here are interested in the trend of legislation on occupational diseases. We are very vitally interested in it because the first of next month we start a new law in our state.

I know some of the states represented here already have it. I wonder if it would be interesting later on to get into that.

DR. DOBBINS: I would like to answer that by saying, "Who's afraid of the big, bad wolf?"

About eight years ago Wisconsin inaugurated the Industrial Disease Act, and we were fearful of it. I was at that time with the Nash Motors Company, employing about 22,000 men. We had shops in Milwaukee, Racine and Kenosha.

When you speak about occupational diseases, what is foremost in almost everybody's mind is silicosis or pneumoconiosis caused by inhaling dust. That dust is so fine it is below six microns by microscopical measurement. You can't see it with the naked eye. The big chunks of dust you get in your nose and throat and spit up the next morning, hurt very few people.

In six years with this law, we had two cases of siderosis. One man inhaled iron

dust and the other inhaled a little foundry dust. In the iron case the diagnosis was made by a physician out in Missouri who had no laboratory facilities, and the judge of the court later reported back to our attorney that this poor doctor was non compos mentis; in plain language that means "nuts." The other case has never been decided. It was purely a case of tuberculosis. The man left our employ and painted houses around Wisconsin for six months and went on out into the country and developed a typical case of tuberculosis.

I will tell you one thing: There are many unscrupulous doctors and shyster lawyers who think they are going to profit on this. Thousands of cases were brought up in Illinois and Wisconsin.

I said, "We have an issue to face. It is like the war. We may as well get on with it." So we had a joint hearing with the Illinois Commission and with the Wisconsin Commission in Chicago and actually heard a case. We brought in Gardner, we brought in a doctor from Saranac Lake, from the U. S. Public Health Service, the best type of men who were qualified to speak and render testimony on this subject. We found that this particular case did not have silicosis.

There is nothing to fear. There is ample personal protective equipment available to guard against silicosis. We spray porcelain, and that contains six per cent of silica. We used a sand-blasted but we are now using steel.

I went through the Kohler plant at Kohler, Wisconsin. They do a great deal of sand-blasting. A couple of weeks ago I went through A. O. Smith's in Milwaukee. They do a world of sand-blasting, but their men are amply protected, with air-fed masks. They work right inside these great, big vats—the beer vats, and the great big tanks where they crack gasoline, 100 feet or more long. They are in there for hours and hours at a time.

They have had a few cases. Kohler had three up to that time.

Find out what protection you need. Some salesman will come around with a commodity with a trade name and will not divulge the formula of it. You don't necessarily have to have it exactly, but you should know what is in it. Is it alkali or acid? Is it something that is going to injure the lungs or the skin or the tissue of this individual that

is going to have to work with it? Is it toxic? If they won't tell you, don't do business with them. If you are dealing with Dupont, they will tell you, "There is no silica in this, no lead in it."

The insurance salesmen have been scaring the manufacturers on occupational diseases. You can find out from the National Safety Council, you can find out from the American Medical Association, what is the necessary protection, and whether or not these substances are toxic; or have the chemist in your plant do it.

Don't be afraid of it. Don't try to economize on protection for your workmen, and you will have nothing to fear.

MR. WRIGHT: I had something different in mind. We run into hernia. We run into dermatitis and several other things which come in the wastepaper that Mr. Patton was speaking about. With those things in mind, we have a lot of work to do to protect our men.

DR. DOBBINS: Hernia is not an occupational disease. It is an injury.

MR. WRIGHT: It is in our law in Michigan.

DR. DOBBINS: There never was a hernia caused in an industrial plant by trauma. Hernia, if caused at all, is called trauma. It is not a diseased condition. It comes on a man gradually, so you couldn't call it a disease. It is an affliction.

DR. DOBBINS: Dermatitis is inflammation of the skin. You may put a man to work on paper pulp that contains a little acid. He might be much more susceptible than the next man. The only thing to do is to watch that man and see whether he can do that type of work. If he can't, the sooner you take him off, the better. If you put him in a damp place, he may develop pneumonia. If you give him boots or a raincoat and rainhat—if he is out in the weather—and protect him, you have done everything that is physically possible.

The law is practically the same in all the states, except that they say "occupational disease," which has scared so many of us. The occupational disease that almost everybody is afraid of is lung disease—pneumoconiosis.

MR. WRIGHT: Ours is a scheduled type, and hernia is one of the scheduled types.

DR. DOBBINS: The laymen made the rules. They probably don't have a doctor on their commission.

MR. WRIGHT: That is true, but from the statements you made there, there is work to be done in the paper mills to protect the men, regardless of the law.

DR. DOBBINS: Haven't they been doing that for years? In Indiana there was no law to buy safety equipment for the men. I went down there and started buying protective equipment. They said, "You are starting a precedent." They didn't have safety shoes.

MR. WRIGHT: You are arguing the prevention of the law. I am arguing the prevention of sickness and accidents to the man.

DR. DOBBINS: We use all kinds of chemicals. We say, "What is this, and what is it going to do to the workmen? How are we going to protect them?" If it won't do the job, we find something else. We have about fifty engineers sitting over there, and they can find something else.

MR. WRIGHT: In that case, what you do is protect your men by investigating all this stuff. How many of the plants do that? That is what I am trying to bring out.

DR. DOBBINS: The majority of them. I went through every big plant in the North. They have awakened. I think Ford did it twenty years ago.

CHAIRMAN ADAMS: This is a ripe question. Maybe we have found our speaker for next year.

MR. WRIGHT: Maybe we should leave out the occupational disease phase of it and say "the prevention of sickness and accidents."

MR. BIENVENU: We have about \$80,000 worth of suits pending against our plant for silicosis.

CHAIRMAN ADAMS: I can see your angle, and I can see yours, too, Doctor. In New York State we have an all-inclusive occupational disease law, and we don't know what it means. It might mean a common cold. I think that is what you are driving at, isn't it?

MR. WRIGHT: Yes. In other words, the paper mills have some definite job here which they can do not only to protect themselves but also their employees. How should we do it to the best interests of all?

CHAIRMAN ADAMS: We will use that for one of our subjects at the Wednesday afternoon session and try to get something on our program next year in connection with it. I agree with you, Doctor, that the thing can be controlled. Your solution is controlling it at the source. We are probably lax in the paper mills in not trying to control some of the conditions that exist.

As an example, I had a case in one of our mills recently in a state that does not have any occupational disease law, where a fellow was completely covered with sores and boils, a dermatitic condition that he claimed he got from handling color. I went to two different color people who supply the same color to this mill. One said, "Yes, there is the odd case where the color will cause this condition, but it is very rare, and the thing

to do is to transfer him to some other type of job."

The other company, with exactly the same formula, said, "Under no circumstances will this color affect anybody." They said it must have been due to something else. But those are the things we are up against.

MR. CHANT: For general information on the subject of occupational or industrial diseases, dermatitis has been a compensable industrial disease in Ontario for seven years or possibly a little longer. So far, in the pulp and paper industry, which includes the box manufacturing plants in Ontario, we have had only two claims of dermatitis under the act, and both of these were rejected by our board. So I don't think we need to be greatly alarmed about the danger of dermatitis in the pulp and paper industry.

TUESDAY AFTERNOON SESSION

October 12, 1937

CHAIRMAN ADAMS: We are fortunate to have as our first speaker a gentleman who was instrumental in organizing this Pulp and Paper group under the National Safety

Council and who served as the first general chairman: Mr. S. F. Shattuck, Vice President in Charge of Industrial Relations of the Kimberly-Clark Corporation, Neenah, Wis.

Safety's Place in an Industrial Relations Program

By S. F. SHATTUCK

Vice-President in Charge of Industrial Relations, Kimberly-Clark Corp., Neenah, Wis.

In many institutions, the safety movement as it took shape in the early years of this century, blazed the trail for present day industrial relations programs.

Let us look at the industrial relations program itself. What are its objectives? By what is its soundness measured?

The more obvious tests of industrial relations would be in terms of tangible factors such as wages, hours, working conditions, supervision, and the like. But wages, hours, and working conditions are effects, not causes. They demonstrate the

sincerity of the program but do not necessarily reflect its motivation. An industrial relations program that touches people where they live deals primarily with motives, attitudes, habits, and loyalties. Above all, our policies and techniques must take into account the significance of the individual.

The desire for individual recognition is as basic as is the desire for money. Thus the test or measuring stick of our industrial relations program is found in the realm of intangible, rather than of tangible factors—in spiritual rather than material values. I

appreciate that this word "spiritual" is not readily accepted by the practical supervisor whose pay and progress are measured by his ability to produce marketable goods at low costs. Yet we are dealing with spiritual factors, and the most efficient managers and supervisors demonstrate the most skill in dealing with these intangible elements.

Industrial relations programs these days must be geared to something more fundamental than production demands. There is abroad a social awareness unlike that of any former post depression era. The survival of the enterprise order, or capitalistic system, depends more than we may realize on the quality and level of relations and programs which take shape within industry during the years just ahead.

Typical criticisms leveled against the enterprise order are:

1. The system operating as it does, with self interest and the profit motive at its core, sets definite limits to the operation of active good will between men. Class conflict becomes inevitable. Capitalism is based on strife.

2. In setting limits to the operation of active good will, the system creates a destructive conflict in the lives of individuals sensitive to spiritual values. In other words, the so-called Golden Rule cannot operate in modern industry because the economic framework of the enterprise order is alien to it.

3. Our economic life, it is said, is characterized by the substitution of corporate for individual ethics. Modern capitalism, by its very mass character, tends to obscure moral issues and dissipate individual moral obligation.

For purpose of this discussion, these three criticisms are segregated, all of which focus upon the importance of the individual. We recognize the interrelation of economic and political factors in this complex problem, but we will perhaps agree with Professor F. A. Magoun when he said, "The fundamental problem underlying every other problem of human endeavor is the problem of human relations."

Try as we may to treat people in the mass, the significance of individual personality reasserts itself. In the long run every human institution is judged by what it does to individual lives and personalities.

Let us view two extremes in human

values. On the one hand the scientist finds that the human body shakes down to about 98c worth of chemicals. On the other hand, the late Michael Pupin of Columbia University, after a long life of research into the mysteries of the physical universe, made this observation shortly before his death in 1935:

"These big hot stars are only the beginning of God's creative energy; the beginning of cosmic history. But the human soul, insofar as science can penetrate, is the last chapter of this history so far as it has been written. The soul of man is the highest product of God's creative handiwork."

Could two concepts be wider apart? And how different one's attitudes and policies, depending upon which of these bases one accepts as a foundation for his life philosophy. It is understandable, therefore, that men, women, and even little children, have here and there down through our industrial history been used like cogs in a machine—as means to a materialistic end rather than as ends in themselves. Discounting all the racketeering in present day social movements, there remains a solid residue of social insistence that modern, mechanized industry give proper recognition to individual personality.

True, this is a confused social insistence. Mass movements obscure it. But let us be clear that we deal here with a fundamental human desire. In spite of mass movements and political distortions, management has in this fact of life a pathway to normal relations within industry. J. David Houser expresses it aptly in these words: "What the employee wants in the situation where he spends half of his waking hours and most of his energy is exactly what every human being asks of life: respect for his personality, his human dignity, an environment that he comprehends, and a sense that he is progressing."

Within the past four and one-half years, federal and state legislation has entered the field of industrial relations with new emphasis. Some stagnant situations, we know, need the physic of the law to start movement, but the law does not discriminate between the sick and the well. We observe other situations in which normal and friendly relations between men have become all but impossible due to the maze of fine spun legalism now governing our industrial life. Out of the confusion and the fight for

power between major labor organizations one fact becomes clear: you can't get cordial and friendly relations by passing a law. Wherever one finds a satisfactory industrial relationship it has come from the inside out, not from the outside in.

Democratic institutions rest upon a working belief in the capacity of the common man, which is another application of this principle of respect for personality. The enterprise order in a democracy must tune its policies, its attitudes, and its programs with this idea or, in time, suffer the social consequence. Over the long swing this concept is as searching as the photo electric eye when turned upon the procedures of hiring, transfer, promotion, demotion, release, overtime, education and training, safety, and all the other relationships between management and individual employees.

Note, in imagination, what its operation does to the criticisms against the capitalistic order mentioned earlier in this paper. Is there one of these criticisms that is not modified or nullified by an active application of the principle of respect and reverence for personality?

Now let us see where and how safety fits into our ideal industrial relations set-up. First of all the safety program meets the acid test of respect for personality. When we cooperate for safe working conditions, it is for the safety of individual men and individual women.

Second: The saving of waste is an objective of the safety program, and what is more wasteful than the needless sacrifice of human skills and abilities? Quoting Arthur T. Morey: "We feel that right conditions for the men are as important a part of the plant's equipment as steam in the boilers and roofs on the buildings. Our men are the most important equipment we have." Right conditions are safe conditions, always. Safe conditions permit a man to give the best that is in him without lurking fears of disaster to himself and sacrifice of family ambitions. A vigorous and sincere safety program reaches through into the home life and, consciously or unconsciously, gives the wife an added sense of security and contentment.

Third: A thorough-going safety program within industry has a definite relationship to public opinion. We will agree, I am sure, that the prevailing attitude of the public toward the corporation is something that

merits our serious attention. Any reasonable change in the public attitude toward industry can be achieved with the backing and support of employees. They know their communities and their word carries conviction. Therefore, if we accept the premise that public relations have their roots in relations within the plant, where can we turn for a feature that offers the degree of mutual interest that is inherent in a well ordered safety program?

Fourth: In the safety program we have a morale builder of the first order. Just as safety was the vestibule through which modern industrial relations programs entered, so it may be the binder that holds it together. Last spring, at the Kimberly Mill of Kimberly-Clark, the second annual safety day was observed. The success of the day lay in the weeks of preparation for it. The central committee saw to it that each department of the plant was made responsible for a booth demonstrating safe or unsafe practices. Civic organizations, the schools, and the home were drawn into the plan. The state industrial commission and the company officials did their part. Meetings began in the forenoon and continued through the afternoon and evening, climaxing in a banquet with speeches, music, and recognitions. A spirit of comradeship was generated through the widespread delegation of responsibility and through competitive features such as school posters, essays, and booth displays. Not only was the direct emphasis on safety thinking impressive, but the by-product in fellowship and a sense of mutual interest was no less significant.

Your officers have referred to the fact that I was the first chairman of the Paper and Pulp Section of the National Safety Council. The inspiration that led me to extend myself into the work of this section is significant. It was in Milwaukee, at the first Safety Congress ever held, that I came under the influence of the late Arthur T. Morey. Mr. Morey was then a director and the general attorney of the Commonwealth Steel Company. I have already quoted from his talk on that occasion, but I close with the paragraph which impressed me most:

"And now I come more specifically to a very important point in this kind of work, and that is the spirit of the organization and of the shop. Our president, Mr. Clarence H. Howard, is very strong in his ideas of organization, discipline and cooperation.

He says if you put ten men around a load, and they all push against it from different points, the result is nothing. If five men pull one way and five oppositely, the result is still nothing. If eight men pull one way and two another, you have the value of only six men, the wages and labor of the other four being lost and wasted, and in this waste is often the difference that makes up the net profits, and the difference between the success and failure of business. But if you can get the whole ten men pulling in one direction together, you get the very

highest result. This is team work that shows on the profit side of the ledger and shows in results in safety work."

What Mr. Morey said in 1912 at the first Safety Congress is still charged with inspiration for us in 1937. There are those in this audience who may be moved, as I was then, to do something about it. If so, let us remember that one of the most effective tools in our industrial relations kit will be an effective and a cooperative safety program.

Demonstration of Accident Investigation

CHAIRMAN ARABIS: The next part of our program is in the hands of Mr. H. G. Noyes, Personnel Manager, Oxford Paper Company, Rumford, Me., and Mr. N. B. Giles, Agent, Industrial Education, Office of Education, Washington, D. C.

These gentlemen are going to give us a demonstration of instructional methods in accident prevention in the pulp and paper industry, followed by a practical demonstration of accident investigation method.

H. G. NOYES: The subject is divided into two parts, A and B. A is entitled "Instructional Methods in Accident Prevention in Pulp and Paper Industry," and B "Practical Demonstration of Accident Investigation Method." We are going to reverse that and put on B first and A second. Obviously, we couldn't have a paper mill here and we couldn't have all of the tools and equipment necessary for the show. Obviously, also, the line line of actors we have here, coming from all parts of the United States and Canada, couldn't have very many dress rehearsals before we started. So we are going to create a pseudo-situation.

But I think we can establish the fact that there is an art to teaching, and that a foreman, to carry out his supervisory responsibilities as a teacher, has to know something about the art of imparting information and teaching in such a manner that the recipient really learns and knows how and can do it.

We propose to do this by setting up an accident and going through the process from

cause to effect and remedy, so that we will have material to teach and the method or technique of doing the teaching.

Some of you people who are more or less schooled and institutionalized know that it takes weeks and months and years to put over a program of teaching people how to teach. Therefore, in the next thirty minutes we won't do a whole lot, but if we can put it over in such a manner that we will give some food for thought after you get back home, perhaps the show will not have been entirely in vain.

Act No. 1 is the explanation of the incident upon which we are going to base the analysis. A workman on a paper machine, whose part will be played by Mr. Reiter of the Kimberly-Clark Corp., Neenah, Wis., was the assistant for putting a wire on a machine. When he was putting the nails back into the suction boxes, he slipped and fell against a valve which was partially open. Steam escaped, and he received a leg burn, a very severe injury, causing considerable loss of time and considerable pain.

The foreman who investigated that accident, whose part is being played by Mr. Clayton Braatz of the Marathon Paper Mills Co., Rothschild, Wis., gave it a very thorough investigation with the superintendent, that part being played by Mr. Jim Plzak of the Consolidated Water Power and Paper Co., Wisconsin Rapids, Wis.

Both agree, after a very thorough examination of the case, having analyzed it, in-

vestigated it and conferred, that this is what would have prevented this particular accident: Had this valve been shut off tightly, that accident would not have occurred. To clinch their case, they also said that this valve on the steam line, below the wire, should be taken out of the way so that the accident won't happen again. That is the build-up for the show. I now present Mr. Giles who really put on the brain part of the show.

MR. GILES: As I understand it, we are to illustrate the use of the conference method in investigating an accident case. The people in it will be people who know something about the case. Would we come nearer to getting all the facts if all that saw the accident listed them? We would bring the facts out.

The results of a lot of tests show conclusively that the combined judgment of a group like this on a problem is as good as the judgment of the brightest individual in the group.

You get all the facts out and you evaluate them in the light of the experience of all the participants, and your conclusion is almost always correct.

Our conference lists the facts. The participants evaluate those facts. They conclude and work out a plan. Then it depends upon the individuals to carry it out. So you see the conference is simply a clear device for thinking.

We have many devices to get a group to do this, and their choice depends on the personality of the individual handling the conference.

With that in mind, I think we had better start in on this case. You have the problem, it is before you. I would like us to be clear that we are not necessarily solving that problem.

(At this point the demonstration took place, with Mr. Giles conducting the questioning.)

MR. GILES: Let me see if I can summarize this group's thinking. I believe we have come to the conclusion, as we have analyzed these causes and the facts regarding them, in the light of our experience, that the man's slipping is the accident; the burn is secondary, a by-product of the accident, one of the results.

I think we have come to the conclusion

that to prevent that accident four or five things are involved:

First of all, more careful supervision, because that is an emergency job. There is a lot of speed in it. Somebody should be responsible for the supervision. The crew should be more carefully trained and organized to click. Conditions should be right, clean as nearly as possible; any slime we had from the removal of the old screens should be cleaned up.

Someone said the steam pipe doesn't belong there. Suppose the steam pipe should belong there. The fact of the steam pipe doesn't enter into this case, does it? We have cleaned up the cause.

Now, then, you may go a little farther. The fact that we had this accident brings another case to our attention—that the steam pipe should be removed; or if it should be there, that somebody should see it is turned off. Then you close the case right there.

Would it not leave a better attitude if we prevented that man from trying to put the blame on some individual and punish him for it? "Who is to blame for it?" is about the first question, instead of finding out the very cause of the thing. This gives you an idea of how to go about discussing it in conference.

MR. NOYES: I would like to tell the jury, before you retire to give your verdict about the disposal of this particular incident, that it was not the purpose of this demonstration to settle the case. Due to the lack of time we had to cut out a lot of the discussion.

The entire purpose was, first, to show that through a conference in which the people involved were in possession of all the facts, they could go through the thinking steps and analyze from cause to effect—then set up the remedy.

CHAIRMAN ADAMS: We will give a few minutes if somebody wants to talk about it.

MR. F. H. ROSEGAUGH (Nekoosa-Edwards Paper Co., Port Edwards, Wis.): I don't know that I should, in view of what Mr. Noyes has said, but one of the points brought up was getting all the facts. To my mind, they didn't get all the facts because when you set up the premise that this man was burned, that was the accident; the facts about the steam valve weren't brought out.

The question naturally arises, why was a steam valve left in that position, that a man

falling against it could open it? Was that a steam valve, or was it a quick opening valve? To my mind, the whole thing was that it was a burn accident. I don't care whether the man slipped three times before he got to that valve. I don't think you got all the facts, because if it were a valve which could be opened by a man falling against it, I would certainly hold the company responsible for allowing that kind of valve to be left there for 12 years.

MR. NOYES: Mr. Chairman, I would like again to say that we tried to bring out this point, that the first thing we do is to define the problem. If it was defined incorrectly, the only one to blame is myself, in my opening remarks, when I read that the cause was the man slipping in putting in the rails for the suction rolls, hitting the steam valve, opening it, and allowing the steam to escape.

Then these two gentlemen here, who acted as foremen, said: "Had this valve been shut off tightly enough, it would have prevented the accident." They said it should be put out of the way so it wouldn't happen again. We tried to set these up as our facts.

We have two things here. One was the accident, and the other was the personal injury arising from the accident, and the supervisory staff investigated the injury which was the result of the accident rather than the accident itself. We may have got our signals crossed in doing so, but that was the intent of the show.

MR. GILES: I think we can say we didn't dig into the facts because there wasn't time, that we were just demonstrating the methods.

MR. NOYES: Then we tried to bring down the steps in thinking, which Mr. Giles had here, trying to put over to the group the fact that most safety engineers, superintendents and other people either start off from a wrong premise or come to a wrong conclusion because they don't go through the thinking processes.

If you will take this as the wrong way to do it and then go home and think it through the right way, you will find out, I think, the value. You determine the cause and determine the effect. You set up your remedy and put it into execution.

I will tell you a trade secret, with due apologies to the people who acted as operating superintendents. If they go through

this problem and help make the plan, they are co-authors of a book, and if there is anybody who can defend the book, it is the fellows who wrote it. Because they are the ones who invented this plan, invariably they will be very much for that scheme when you put it into effect, instead of having a safety guy come out and say, "Well, I think you had better do that." There is a whole lot of psychology back of that.

CHAIRMAN ADAMS: I am glad, Franz, you brought that up, because I think we have all benefited by Harold's remarks now. I think it is much clearer in our minds.

MR. J. H. TURNER (Consolidated Paper Corp., Montreal, Canada): Was it determined that the conclusion was the act of slipping?

CHAIRMAN ADAMS: Do you want to answer that, Mr. Giles?

MR. GILES: I would say we didn't dig into a lot of things that we would have if we had had time to investigate.

I want to make this comment: You are just exactly like any group which tries to study a conference. You wonder what it is all about. After you work through it as a member, you see the thinking process developing and you learn to think that way.

There is another big thing that comes to us and that is that some of you go away fearing it won't work. Try it some day, and see that it does work.

CHAIRMAN ADAMS: I just want to say here that the reason for this demonstration was that we did have this question come in, and so much interest was shown that it was suggested we put on a demonstration, so that you could see how it does work.

MR. NOYES: I am going to try to set up my premises correctly for the second part of this. The first part was trying to study through from cause to effect to remedy, through a joint conference.

Had we done what we should have done, we probably should have followed from this accident to the other, but our working tools couldn't be transported. So we will take something else. We are going to try to put on a demonstration to show how the training job should be done. We are going to use this plank here with a hexagonal nut on it, and some wrenches. I know you people think it is more or less absurd, but we couldn't do much differently.

Try to visualize the actual job. A bearing is being changed on a winder roll. This fellow used a poor wrench, which slipped, resulting in a bad sprain to his right thumb. In the investigation which the foreman made afterward, he said the man should have used a good wrench of the right size for the bolts.

So, if you will use your imagination and make believe this is a winder and that is a nut and here are the wrenches, we have two very eminent characters who are to participate in this. They are known from one end of the country to the other. Mr. Earl Grant will be the foreman who sent the case down to the first aid department, and Mr. D. B. Chant will be the workman who will demonstrate how it was done. Then Mr. Giles and I will attempt to teach not how to put a wrench on that nut but some of the techniques of teaching a person to do a job.

(At this point the second demonstration took place, with Mr. Giles interrogating the participants.)

MR. GILES: The first thing is to find out who is going to give the order—where the job is to be done; when; what, and, perhaps, why.

I want to get the psychology back of giving an order. First, as you walk up to a man to give an order, you don't know whether he is thinking about you or whether he thinks you are one thousand miles away from you. He may be looking at you and dreaming about something else. He may be paying no attention. He may be thinking about his job. He may be tremendously interested in the job he is doing, and when you start to talk to him about what you want him to do, he is afraid to ask you what you said.

The very first thing to do is to attract his attention, prepare his mind, and make sure you have his attention. This fellow never looked at you when you gave that order. He didn't even know you were talking to him.

Where? Let me illustrate that. Suppose you were going to have him change a pipe. He is working in the machine room, and you want him to change a pipe over in the digester room. Wouldn't it be well to switch him from his environment in this room to the place where he is going to do the job, so that he will think in terms of the material he is going to work with? You are

going to break him definitely away from what he is thinking about. You prepare him. Then you give him specific instructions as to what you want him to do and how he is to do it and why.

I would say, in my observation in conducting conferences in industry, that 99.9 per cent of the orders given can be misinterpreted and cause trouble and accidents. In one two weeks' conference, every day for seven days somebody would come in with an order which could mean one to five things, though the management only wanted one. Finally they pinned two written orders onto the management; in one case three things had been done before they got the results they wanted; in the other, two false starts had been made.

Remember, in teaching a man to do a job, the first thing is to get his attention, prepare his mind.

So, in good teaching, the first thing is to ask a set of questions that start the man thinking along the line you want him to think, about what he is doing.

Then, by demonstration and various other devices, you get him to do what you want him to do.

I will wager that nine times out of ten, when you show a man how to do a job, you work with it and he is standing opposite, and you have it backwards and upside down from his outlook. Think that over. On pretty nearly every job, the teacher stands over there (indicating) and his apparatus is backward to you as an operator, and yet he expects you to visualize it correctly.

Perhaps, instead of bawling the man out for using the wrong wrench, you could ask him what wrench he was going to use. By a set of questions, you should get the man to think it through and visualize the actual doing of the job.

I went up into one of your good industries in Wisconsin one time. There was a group of 12 men, all of whom could do the job and do it well. I said, "Break me in on this job."

As they taught me to do those things, I wrote them down. When I got through, there were 10 specific things they told me I was to do. The superintendent said, "I will put you to work. You can do that job."

When I got through with the job, I found there were 43 specific things that I had to do, no one of which could be left out. They had taught me only to do 10 things.

If you are going to teach a man an operating job, you must have the operations clearly in mind as a teacher, either written out or worked out. You must know what those operations are, and you must follow to make sure, and check back to see that the man knows those operations. The reason you leave out so many steps is that you do the job so naturally that it comes automatically; you don't think certain things are important, and so you leave them out in the explanation.

In teaching, first of all, get the fellow to see what the job is; second, what tools he is going to use; third, what operations he must go through.

... Demonstration of proper way to lift a person ...

MR. GILES: If you would analyze those three things, you would have a very fine lesson. I am going to summarize. In the first place, that manager or that foreman thought he could do everything alone. He might have busted that fellow's head. He can't do the job well. Ordinarily, what happens is that a tall man will get over there and a short man here, and they tip him.

They will do a very poor job. What was the difference? In picking him up this way, what took place? There was no leadership in the first. In the next you had some leadership. Let's see what it was.

First of all, I properly placed the men for the job. I got the short ones over there. Then I instructed them on how to do it and coordinated their efforts, so that they clicked together. That would be training men to do things.

Let's go back to our very first case. I wonder if we can't see some very good reasons why we had this first accident.

Perhaps that crew in changing that wire was not properly selected or did not have the proper leadership in coordinating their efforts, to step in and see that everybody did the right thing at the right time.

With that illustration you will realize that there is a training job for every last foreman and superintendent in every single industry of the world, and they are sadly neglecting the personnel. Industry is coming to a realization that they have been neglecting it for years. They are now making a strong demand on the part of supervisors and superintendents everywhere to do a better job of instructing, so that they will get the correct operation, and in the correct operation they will get safety.

WEDNESDAY AFTERNOON SESSION

October 13, 1937

Penalties for Violation of Rules

By L. R. SIMPSON

Safety Director, Brown Paper Mill, Monroe, La.

We made a survey to find out what employees in point of service were the most accident prone and violators of safety rules. We found that violations and accidents among the older employees by far led all others. It is not safe to assume that a man

who has been on the job a long time will be a safe worker all the time.

So many things can happen to a man in a short time. In the mechanical field his work can become automatic. Monotony creeps into the work. The mind wanders.

In the physical realm things can happen to the body. Infection and many other physical ailments can happen in a short time. Mentally, many disturbances can account for accidents such as domestic, financial and other worries.

Yesterday the old type foreman was the hardboiled type. His word was law. Today the new type foreman still retains power of control but it is brought about by leadership and instruction. New processes and changes in machinery and methods take place daily. The employee must be trained to meet these changes.

Now let us take up the two sides of the subject. The weak and strong points of penalty for the violation of rules. First those points that are considered weak.

The penalty system has a tendency to create a fear complex, hard feelings and breaks down morale in an organization. What happens when a severe penalty is clamped on an individual? It is human nature to dislike to admit we are wrong. When criticism, hawling out, and penalty comes to a man he is going to do a lot of superficial thinking. Revenge and ill feeling may be paramount in his mind. He tries to raise that let down feeling by making the other fellow suffer in his own mind.

Penalties are considered by some as short cuts to desired results. But are they lasting results? The penalty system assumes a type of discipline that says—"If you are to blame for violating a rule you are fired." "If you make a mistake it will be too bad." Any man that does anything makes mistakes. We are human beings who are prone to err. Men will not be entirely happy where there is fear of loss of job. Management certainly has the right to control men, but does such procedure build the finest morale?

Penalties are sometimes a substitution for lack of training and poor foremanship. When a foreman accepts the responsibility for safety these are necessary for accomplishment and results: 1. Sympathetic understanding of the individual working under him. 2. Ability to enthuse them. 3. An appeal to the emotions.

The foreman to accomplish results further must remember that all accident prevention work falls under three heads—1. Find the hazards. 2. Get rid of them. 3. Stop exposing people to hazards. The last sometimes means the changing of habits and

practices of employees that is at times hard to do, particularly older employees.

Penalizing tends to shift responsibility from leadership to employees. Most accidents, thoroughly investigated, point the finger of blame on leadership. When an accident happens in our plant I cannot help but feel that I am largely to blame. I feel that if I had done something more in safety work it might have been prevented. I feel that my leadership and efforts have failed down the line somewhere; that man that was injured did not want the injury any more than I did, and if he had known, understood, and if the foreman and his leaders had done something that was left undone, it perhaps would not have happened.

A rule states in no uncertain terms that a man should do a certain operation a given stated way. Time and again this was not done and his foreman allowed this to go on to his knowledge. I have heard a foreman say, "I told that man" after an injury. I could not keep from wondering—Did he tell him—could he have been mistaken—could it have been some one else he told? It will surprise us sometimes if we have some personal interviews with our employees and see how many know the rules. Words are not always sufficient. Writing is not always sufficient. We must be sure that instructions and rules are known definitely.

Talking with foremen who supervise departments requiring men of special technical ability leads me to believe that rules, violations, penalties and the like are not so important. In most cases such men—if they are properly trained—properly handled, properly placed, do the job properly.

For instance in the laboratory in our plant we have never had a lost time injury in the 13 years' existence of the mill. The men are carefully trained or else they could not do the work. In the electrical department very few electricians are injured and rules and penalties are not needed, as they know the hazards of their work and have respect for them. They practice safety. The skilled men in the maintenance department have very little lost time, nor do they violate rules of work and safety.

All Foremen are not teachers. Glenn Gardiner tells us that there are four steps in teaching: (1) Telling; (2) demonstration; (3) testing; and (4) checking. A foreman may be fine on telling but weak on making allowance that words can be misunderstood

and leave the rest to chance. I sometimes realize that I have a weakness in dealing with men. I forget that the man I am talking with and trying to teach may not have average intelligence. He may not have had the advantages of an education.

Rules should be sold just as a commodity is sold. Penalizing indicates lack of salesmanship and understanding. Do we try before a rule is made to get the men concerned together and agree on its necessity? Men do not get much stimulation out of violating something they help make and agree on. They stand for it. They will fight for it. Some years ago I directed summer camps for boys, hundreds of boys. I never had any need for punishment in camp. The first thing to be done was to get the youngsters together and get them to agree on what I wanted them to agree on, letting them think it was their suggestion and rule.

Individuals differ in many respects. A rule is not interpreted the same by different people. Men are not equal. This is a statement by a noted psychologist. Twenty-five per cent of public school children cannot be educated beyond the 5th and 6th grades. In normal times there are approximately 3 million unemployables.

There are four aspects to maturity: 1. Chronological age. 2. Intelligent age. 3. Emotional age. 4. Body age. All these facts must be considered in rules, enforcement, and violations.

Thou shalt and thou shalt not tends to mechanize human beings when it is followed by punishment. It retards initiative, progress and individual thinking. A machine can be controlled because it is not endowed with a brain. Man is controlled by sympathetic understanding, appeal to motives and emotions. The germ of accident and violation is a mental germ. A man in the state of mental depression may stray from the path of safety and conventions and be punished for his waywardness, while others who may have committed the same acts are never caught and do not suffer the penalty. There will always be in his mind the doubt of fairness and square dealing in his case. When we condemn we tend to tear down something that needed to be built up by a kindly word, praise and like action.

When a man, who violates a rule, is laid off, fired and dismissed from the job, some one must replace him. This leaves a gap in

the organization of producing a product. In many cases the replacement must be trained and production suffers. Unless good personnel procedure is followed the new man can never replace the one released. This includes hiring, training, tests and examinations and much other personal work. Employee turnover is costly.

Penalties influence men differently. At one of the regular foremen meetings of a certain plant it was found that one department had made a record in production. The strange part of this record was that the foreman of that department had been absent from his work during the time the record was made, due to a death in his family. One of the members present at the meeting stated that it might be better if he laid off a week, perhaps his own department would get along better and make a record. The superintendent took up the conversation here and stated that the men in this department had been heart workers and not eye workers.

If we can get our men to believe in us, have faith in us, respect us and believe in our leadership, we can earn a place in the hearts of men that rules, punishment and penalties can never reach. There is always a spot in every man's life that can be touched and the finest brought out in him if we can find that spot. What is it? That is our job to find out. It may be something we never dreamed he possessed.

Now we may think that there are not some strong points in favor of the opposite system—enforcement, penalty, punishment. There are many strong points, used by intelligent, sensible leaders the world over. Remember we are trying to present both sides.

Making an example of an employee educates the force in accident prevention and creates a strong company policy in reference to safety. One violation let alone tends to weaken the organization and breaks down discipline. Some companies have experienced high rates of accidents of certain types, such as eye injuries. Everything has been done in the way of coaxing, pleading, leading to get the men to wear goggles when needed. Yet eye injuries continued. These same companies have made hard, fast rules with penalty attached for violating them and have been successful in stopping these injuries.

How many cigarette smokers would stop

smoking in the plant if they knew they would not suffer some punishment for breaking the no smoking rule? The majority would, it is true, as they have respect for company rules. Some would only stop violating the rule for fear of being laid off or fired. However, I find in some plants that this rule alone has not stopped smoking entirely.

Many companies advertise their cases in which penalties are used. This is done so that the entire force may know what has happened. They feel that it gets the safety program over. It has its effect—true. But on the other hand—is this the best method?

Punch rods were causing some trouble in the digester room in punching down chips. We had to send several men to the dentist with a broken tooth. The pulp mill superintendent put a notice in this department that the next man who had this happen would be disciplined. He explained to his men in meetings that this was absolutely an avoidable accident and that a man was half asleep that permitted this to happen. This was a year ago. No more accidents of this type have happened.

Rules teach self control. Self control is obtained by submitting to rules and law. Respect for rules will not be possible where self respect is lacking. You may give a man rules, safe practices, conventions, but, he will never respect them unless he has some

respect for self. Neither will he obey them and let them guide his actions.

One of the strongest arguments for the enforcement of rules is that it saves lives. If enforcement of rules was a popular practice, hundreds of people, yea thousands and millions would be alive today who have died, and others would not be maimed for the rest of their lives. No foreman gets much pleasure out of laying off a man for a few days or firing him from his job. He knows what a few days' pay means. He knows what the loss of a job means to his family and those dependent on him. But these same leaders have had to break the sad news to loved ones and friends. Some men do not understand self discipline. Enforcement seems to be the only answer.

Fear of penalty has a good psychological effect. Many organizations have always imposed penalties for violating operating rules with good effect. It is therefore reasonable to expect that the same effect will be secured in safety rules and practices. Safety is an operating function and should not be separated from operations. Safety cannot be put in one corner of the room and production in the other. They must be combined to be successful. Discipline of the organization should not suffer by allowing infractions to go unpunished. Non-enforcement tends to demoralize. Penalties enforced as outlined will be accepted as a square deal.

CHAS. W. ADAMS: We are going to devote fifteen or twenty minutes to a discussion of this paper by Mr. Simpson. I am going to ask Arthur Winslow to start.

ARTHUR F. WINSLOW (Hollingsworth and Whitney Co., Waterville, Maine): Being very much biased on this subject, I welcome this opportunity. I hope you will all bear in mind that that paper was simply intended to present the pros and cons of the subject and start an argument or debate, and that from it you should try to draw your own conclusions, fitting it to the conditions, the situations, that arise in your own plant. What can we have for discussion on this paper?

C. A. WRIGHT (American Box Board Co., Grand Rapids, Mich.): In actual practice

in the plant is the penalty generally set in the rule book? Is there a definite penalty for a certain definite infringement, or is the penalty based on the case itself?

H. G. NOYES (Oxford Paper Co., Rumford, Maine): We have a book of rules, though we call it a code. It was drafted jointly by the safety committee and the supervisory force.

That code provides that there are certain hazardous procedures that common sense says shouldn't be done, to which all parties to the book agreed. That book is our rule book, as we figure rules.

Under that set-up, the management has a right to penalize the individual for the violation of it. I think since we have had that set-up we have had two penalties en-

forced, which meant a loss of income to the individual who violated the rules. One of them was for not reporting to the first aid room when he should have done so, and the other one happened in production, violation of a production rule, which was regarded as bordering very closely on insubordination.

The penalties are not stated in the rule. I might say, furthermore, that in some organizations where they have agreements with unions, most labor organizations are more or less keen for the safety committee, from the viewpoint of the man himself and his welfare. I know several preambles to the union agreements in which it is specifically stated that it is one of the functions of the agreement to enforce safety.

I know some union agreements in which it positively states that violation of a safety rule is one of the rules for which the penalty may be dismissal.

MR. WINSLOW: Of all the rules we use I recall only two that carry specific penalties. One is for stealing, and the other is for coming into the plant under the influence of liquor.

MR. WRIGHT: When a penalty is set, who sets it?

MR. NOYES: The penalties to which I referred were set by the superintendent of the department in which the thing took place. In our set-up no penalty can be invoked unless the head of the personnel department agrees, and in both cases I cited the thing was talked over and the maximum penalty decided upon, and the victim and the superintendent and the personnel manager conferred with him and made the decision.

C. M. GRAY (Mosinee Paper Mills Co., Mosinee, Wis.): We have a set of safety rules. The last article provides that a penalty may be assessed on the man who willfully disobeys them. Our rules have been in effect about ten years or more.

The first case we had of laying a man off was this year. It was not that he had violated the safety rule but that by his actions he had endangered the other men in his department. The superintendent of the department came up, and we talked it over. He didn't want to lay the man off, and I didn't either, but we felt that we really were not being just to the other men in the department unless we did give him some discipline. He wasn't satisfied with the de-

cision, so he appealed it to the general manager. The superintendent and myself had a session with the manager in the presence of this man. We stuck by our decision to give him a week's lay-off. I will tell you very frankly that I felt badly about it. I had known the man for years, liked him, and he told me how much salary he was going to lose in that week. I was almost tempted to pay it to him out of my own pocket. But I think there are some occasions when you have to have some sort of penalty and action of that kind.

G. N. CARLETON (Detroit Sulphite Pulp and Paper Co., Detroit, Mich.): Our company has no definite penalty rules, but we have a workmen's committee which decides the penalty, and Mr. Gippert here, who is chairman of the safety committee representing the management to some extent, sits in with them. But these men absolutely decide the penalty. Their only trouble is that they have a tendency to be too tough on their fellowmen, and we usually have to inject a little mercy into their findings. Salaried employees come under their jurisdiction, too. Their very first victim happened to be the general superintendent of the plant, who was fined \$5 for sticking his finger in an emery wheel which was running.

G. W. PHILLIPS (The Champion Paper and Fiber Co., Canton, N. C.): We have a safety code. Of course, we explain to our employees that we do not cover all the things that should be done or should not be done to prevent injury.

However, we do have one rule with a specific penalty—that is in regard to drinking. The preface to the code was written by the president. He said something like this: "It should not be necessary for us to say, 'Leave the job or obey the rule.' We hope every employee will live up to the following rules."

I am deeply interested in this subject. It was splendidly presented by Mr. Simpson, but I am wondering if it is possible to get the ideal condition that he pictured, to get a man to do just what you want him to do.

In the Garden of Eden, you remember, Adam and Eve disobeyed, and the result was they were punished. Four thousand years or more ago, on Mount Sinai, God wrote upon tablets of stone the Ten Commandments. In those Ten Commandments he said, "Thou shalt not steal. Thou shalt not

kill," and so forth. There was a certain penalty attached to that.

Upon the Ten Commandments every civilized government in the world has been founded, and we find that it has worked. I don't believe in ironclad rules. I don't believe in severe punishment. But how many of you have violated a traffic law and, in doing so, glanced back through your mirror to see if the cop was following you? Why did you do it? For fear of punishment, didn't you? And you would have driven just a little faster if you didn't think you would be caught.

You can't tell me that the law doesn't make men better. It helps. There must be some punishment behind it all, or men are just going to run away with the whole thing. I did it when I was a boy, and so did you, and your fathers and mothers had to spank you a little to bring you back into line.

It doesn't mean harsh treatment. It means kind treatment. Many years ago I couldn't convince our president and general manager that this was necessary. I said one day, after we had a severe accident, "Mr. Robertson, don't you think it is better to penalize a man before he gets hurt than wait until after he gets killed?"

Which is best? If we let this thing go on, fellows, until some man gets killed, we are all sorry and heart-broken, but it is too late.

MR. WINSLOW: Our time is up. I must turn the meeting back to the Chairman.

CHAIRMAN ADAMS: The next paper was written by Mr. G. W. E. Nicholson. Mr. Nicholson has recently taken on the added duties of starting a new mill, and it is impossible for him to be here. Jim Plzak, of the Consolidated Water Power and Paper Co., Wisconsin Rapids, Wis., is going to read Mr. Nicholson's paper.

Management's Function in the Safety Program

By G. W. E. NICHOLSON

Production Manager, Southern Kraft Corporation, Panama City, Fla.

One of the most important industrial problems is the relationship between management and the workers. Such a relationship can be successful in the long run only if the dealings are frank and honest. The basic principle must be mutual confidence and respect. On this basis, safety work and safe working conditions become part of the functions of the management in the same manner as efficient operation is required of workmen. It becomes the duty of the management to train men in safe and efficient habits. A new worker follows the example of the older men and his foreman. Therefore, the training must be done largely by the foreman.

The top management must formulate the policies of the safety program, which it must also actively support to arouse sincere enthusiasm down through the supervisors to the employees. A wholesome, intelligent and friendly co-operation between the management and the employees is absolutely necessary to eliminate accidents. It is a matter of team work and joint responsibility.

The first step, and probably one of the most important is to select the new employees carefully. The qualifications of the employee will, of course, vary, depending upon the industry. However, age, physical fitness as determined by medical examination, intelligence, clean living habits, background and previous record should be carefully investigated and considered. A great help in pointing out what is expected of the new employee, as far as safety is concerned, is to give him a safety rules booklet especially printed for this purpose. However, it should be very clearly understood by every foreman in the plant that he must take special interest in every new man he puts to work. The new employee must be patiently instructed and must be kept under constant watch until the foreman is positively assured that the new worker is capable of performing his duties efficiently and safely. The new employee is definitely the foreman's particular responsibility.

Every Safety Program should include:—

1. Accident facts.
2. Elimination of hazards.
3. Safety program.
4. Creating a safety record.
5. Safety publicity.
6. First Aid.

An accurate knowledge concerning how and where accidents happen, the nature of the injuries, sources of accidents, and the number of accidents occurring, is necessary to reduce accidents. A careful study of these facts should guide preventive efforts. Proper statistics should be kept so that conclusions may be drawn from them to guide the study of future accident causes and aid in reaching a decision as to the method of eliminating known causes.

All accidents should be investigated, particularly the lost time cases, either by the safety director or a committee consisting of department heads especially appointed for the purpose. The agency investigating the accident should have enough authority to call any witnesses, including the foreman of the department, and take whatever action may be required, whether the accident is due to neglect on the foreman's part, carelessness on the man's part, unsafe working conditions, or other cause. Proper records of such investigations should be filed.

Intensive educational work among employees is necessary to achieve a good safety record. The first step in educational activity must be to win the confidence and support of the employees. Every effort to remove hazards and improve mechanical safety in the plant indicates to the employees the sincerity with which the management regards the safety program. It is only through close supervision and continual carefulness by the employees that a no-accident record can be obtained. Rigid enforcement of every order issued will get results. Chance-taking, unnecessary haste, hazardous short cuts, and other unsafe practices are opening wedges for accidents and must not be permitted. Good housekeeping throughout the departments, strict enforcement of rules, constant watchfulness for laxity, regular and thorough inspection of all operations will bring to light the underlying causes of accidents assigned to man failure.

The management should take the lead in plant housekeeping by creating a spirit of orderliness and system through supervisors and foremen, and by generally insisting upon good housekeeping in all operations. Attractive

grounds around the plant and a well kept up plant tend to encourage carefulness and neatness among the employees.

The success of safety work depends very greatly upon the foreman, since a competent, protected working force depends largely upon his ability to lead and inspire confidence among those under his direction. The foreman can secure full co-operation of all employees more quickly by giving each man a definite responsibility than by presenting the safety program solely in the form of instructions and orders. The employees should have an active part in accident prevention work, develop enthusiasm and the feeling that the success of the program depends upon his individual efforts. It gives each worker an opportunity to accomplish something that the employer desires. He feels that it is a personal service, which gives him much pleasure.

The vast majority of industrial accidents are caused by man failure, which can only be controlled by supervision. Failure to issue and enforce instructions, inattention, poor discipline, improper and unsafe practices, and undue haste are conditions which cause accidents. The foreman must believe in accident prevention as sincerely as he would believe in anything else that would make him more valuable to his employer, and he should be interested in the welfare of every employee working under his supervision. He must exert every effort to protect the men, and he must be a leader who can secure the whole-hearted support of the employees. If the foreman is indifferent, the workers will be indifferent. He must be a leader, and the sincerity with which he performs his part in the Safety Program will be reflected in the co-operation he receives from the workers.

Special safety campaigns or contests between the departments will create and maintain interest in the safety work. An attractively arranged bulletin board showing the record of accidents in the various departments, daily, weekly, monthly, as well as yearly, is of great assistance in creating and keeping up interest in safety work.

Bulletin boards containing displays of safety posters, notices of contests, letters from the management are effective in keeping safety before the employees.

Another splendid aid in safety work in a plant is the suggestion box planted at different locations where the men can drop their suggestions. Suggestions should be ex-

anned and decided upon by either the Safety Director or the Safety Committee especially appointed for the purpose. It is very important that suggestions are not neglected or put off, but should be carried out promptly. To spur further interest among the employees suggestions for safety slogans are of great value. Slogans should be renewed on suitable sign boards every month, and it is very important that the name of the employee who suggested the slogan be mentioned. Furthermore a suitable prize, such as a textbook pertaining to the industry, is very helpful.

Another useful agency for safety work is an Employees' Committee whose meetings should be attended from time to time by a representative of the management who will give a short talk.

One of the important features in any safety organization is the first aid department, which should be well and efficiently managed. The nurse in charge should keep physical examination records locked up, so that the employee can be assured that these records are known only to the doctor and the nurse in charge. She should also keep an accurate card system pertaining to employees' first aid treatment. The nurse should also keep weekly, monthly, as well as yearly statistics which should be posted, as well as

Mr. PLZAK: In Sloan's paper (Mathew S. Sloan, president of the New York Edison Company) he made this statement in regard to the intent to avoid accidents: "It is unfortunately true that the element of risk, of hazard, cannot be eliminated from life. Human nature is fallible, and fatigue, error and carelessness will always take their toll of life or limb. Our task is to reduce the element of risk to its lowest possible dimensions. This involves first the maintenance of the greatest safety factor in our plants and equipment and the highest standards of practice in operation and, second, a constant education of our people, to impress upon them the results of error or carelessness and to lodge in them the positive, active intent and purpose to avoid and prevent acts or conditions which may result in accidents to themselves or others."

I think Sloan packed plenty of dynamite in that one paragraph.

sent to department heads. All injuries, no matter how small, should be reported immediately and treated by the nurse on duty. First aid facilities provided for employees create a feeling of protection, and employees respond to safety activities much more whole-heartedly, as they feel that the employer is doing his part.

The nurse in charge of first aid should keep in close touch with the various safety agencies in the plant, whether the safety director, the safety council, employees' committee or management. All serious accidents should be closely followed up in the form of visits by the nurse in charge, as well as the superintendent and foreman to the hospital, and in certain cases later on also in the home. If a serious accident has happened, it is very important that special interest be taken in such a case and that the man is put to work as soon as possible, although it may be only light work; and the man should be given such a position that he can maintain the same earning capacity as he had before the accident, if possible.

Another important agency in the Safety Program is the resuscitation team. Training in resuscitation should be given continuously, so that in due time a great number of men around the plant can carry out such work whenever required.

CHAIRMAN ADAMS: Are there any questions on the paper Mr. Plzak read?

D. B. CHANT (Ontario Pulp and Paper Makers Safety Assn., Toronto, Canada): In this paper there was a printed set of safety rules. The point occurs to me, is it the custom in most plants to have two sets of rules, one set for operating rules and one for safety rules? If so, how do you distinguish between the two? When you consider the rule, which is quite a universal one, that machinery must be oiled only while motionless, do you consider that an operating rule or a safety rule?

Mr. PLZAK: How many have operating rules as well as safety rules in their plants, printed? (Three.)

E. E. ROHR (National Carbon Co., Cleveland, Ohio): All we have is a small booklet that goes to every new employee. It not only has operating rules, but safety rules in it—just general information. It is up to the

new man's foreman to go over this little book with him immediately when he comes into the department.

Mr. CHANT: It is all in one set of rules?

Mr. ROHR: All in one set of pamphlets.

Mr. CROTCHER (Minnesota and Ontario Paper Company): Our operating rules and safety rules are incorporated in one booklet, together with the rules for conduct. The booklet is not put out by the company, but is a union agreement. The last half of the book is devoted to mill rules and the government of employees while on the job.

For years we had twenty or twenty-five causes for dismissal. This year we kicked them all out. There isn't one cause for dismissal left in the book. The only reference to safety is that men shall conduct themselves in a safe manner. It is more or less tacit. It is left to their own judgment and the judgment of the foreman and other supervisors.

Mr. CHANT: The point I was trying to bring out through the question was whether it was advisable or even possible to divorce safety rules and safety regulations, and penalties for their violation, from the regular code of operating instructions and operating rules.

Mr. PLZAK: Franz, have you anything to offer on that? You do have rules in your organization, I know.

F. H. ROSEBUSH (Nekoosa-Edwards Paper Co., Port Edwards, Wis.): We have very few penalties in our rules. I think the only one is with regard to intoxication. They are all together, operating rules and safety rules. In the back of the book there is one page that is set up so that a man must sign it, tear it out and return it to our department within a few days, showing he has read the book with his foreman and understands it. It is not a rule book; it is a guide book. It contains all the guides for getting acquainted with the job and the conditions of the company and the matters pertaining to insurance, accidents and other things. I believe there is only the one penalty in the book.

Mr. PLZAK: Are there any other comments?

G. W. PHILLIPS (The Champion Paper and Fiber Co., Canton, N. C.): In the preparation of our code book we felt (we have 12 departments) it would be too large for each man to read and memorize, so we

divided it up by departments. The maintenance department is separate from the operating, and the machine, finishing and so forth is covered by another.

Mr. PLZAK: In this departmental set of rules do you incorporate both operating rules and safety rules?

Mr. PHILLIPS: No.

Mr. PLZAK: You have a separate safety pamphlet for the entire organization?

Mr. PHILLIPS: Yes, in loose-leaf form.

Mr. PLZAK: They can be changed?

Mr. PHILLIPS: Yes. We are revising the rules at the present time.

CHAIRMAN ADAMS: We have kept the remainder of this afternoon as an open spot on our program. We call it "Your Hour—Open Forum for Newcomers and Old-timers."

Because of the questions that have been raised at previous sessions, we already have three things listed for discussion. After we dispose of these you may bring up anything you want for open discussion.

Mr. M. D. Kossoris is here from the U.S. Department of Labor at Washington, D. C., to get us started.

Mr. Kossoris: I want to tell you a little about the type of data the Bureau of Labor Statistics of the U. S. Department of Labor collects, handles and disseminates, and the types of services it gives in that connection.

Statistics show up the weak spots and, by showing them up, indicate to you the direction in which to devote your efforts as safety engineers.

Statistics as such, as Mr. Plzak pointed out, if merely collected and put aside, may serve some historical purposes, but aside from that they are useless. They should be directed toward a definite end. They ought to be used as tools the same way a carpenter uses his tools. In one instance he will use one method of approach and in another instance a different method of approach depending upon the situation that faces him.

The statistics you see in the newspapers regarding changes in employment, payrolls, cost of living, wholesale prices, retail prices, rents and so forth, are all prepared by the Bureau of Labor Statistics.

One of the functions of the Bureau is in the field of accident statistics and workmen's compensation. At present the Bureau re-

ceives reports giving employment and man-hour exposure for accident statistic purposes from approximately 30,000 firms in the United States covering about 50 to 55 industries. These statistics have not been broken down in the past by size of establishment, but they have been broken down by industry and, on various occasions, by states.

This year it will be possible for us to give a very much better measure of accident hazards in terms of disabling injuries, by industry, by state, and by various sizes of establishments. We hope the firms cooperating with us will be able to compare their experiences with those of their own industry in the same state and in other states. I hope they will have enough curiosity to inquire why their experiences are worse than the statistics show, if they should happen to be.

You may wonder why the Bureau of Labor Statistics is collecting this type of statistics, when the National Safety Council is already collecting it. The answer is simple. The Safety Council gets data only from its own members. We get data from a very much larger sample, from firms whether they are members or non-members. Further, the type of firms we cover are firms which may not particularly be interested in safety, so that we get a cross-section that is perhaps more representative. As a result, our accident frequencies for industries are invariably higher than those shown by the National Safety Council.

A second part of our facilities concerns the aid which the Bureau gives to the individual states. As you undoubtedly know, the states collect their own statistics as prepared from the reports submitted in connection with workmen's compensation. In many cases those statistics are good, they are well developed, they are well analyzed; and in many cases, due to political turn-overs and so forth, in spite of intentions to do a good job, the personnel handling the information is not equipped to do a good job.

The Federal Bureau makes it its business, when invited, to assist states in the development of statistics both as to the incidence of accidents and as to the cost in terms of compensation, so that the information may be available to industry and also that it may be used by the factory inspectors most effectively. There is no reason why factory inspectors should not ease up on the plants with good accident

records and concentrate on those with the bad records.

Aside from that, the work in connection with the states, if carried on with the assistance of the central source, gives greater uniformity in the statistics and permits comparison from state to state.

One of the manuals which is now in preparation deals with standard codes defining the various types of disabilities and will give a method of approach to an analysis of accident causes far superior to any now in use as a standard method.

Bulletin 276, prepared in 1920 by the Bureau of Labor Statistics, was the first approach to standardization of accident statistics. As you can readily surmise, that manual has been long outmoded because of the steps made during the last ten years in the analysis of accidents.

I would like to outline the so-called Heinrich Cause Code.

Under the old method of analyzing accidents, you had falls from elevators as one cause; falls on the street as another cause; falls from scaffolds; falls from ladders, and so forth. These accidents might be coded statistically and tabulated as falls, whether they be allocated to elevators or whatever. So, if you were interested in any particular type of accident, you were never sure of getting the complete list of accidents under that heading.

Further, the analysis we so far have had was not really an analysis of causes of accidents. It was an analysis of causes of injuries. If a man had his arm caught in a machine, that was coded as a machine accident, because the injury was sustained on the machine. What actually might have happened was that the man slipped on a greasy floor and landed his arm in the machine and sustained the injury. Therefore, the cause of accident was the grease on the floor and not the machine. What you are after fundamentally is not how the man got hurt but why he got hurt.

The new cause code analysis proceeds on the basis that most accidents are preventable and that when an accident does occur it is due to one of three things or possibly a combination of them. It is either an unsafe act on the part of someone, it is an unsafe condition of machinery or equipment, including tools or working surfaces, or it is some personal defect in the worker himself, such

as poor hearing or poor eyesight. The theory is that if you can determine what the defects are, you can then rectify them.

The code breaks down each accident into six parts, not concerning itself with the analysis of the type of injury or part of the body affected.

You start out first with the agency that was closely connected with the accident. It may have been the floor that the worker slipped on, the machine that the accident occurred on, or boxes that fell down and struck him.

Second, the part of the equipment that was closely concerned, as transmission apparatus or point of operation.

The third part of the analysis is the type of accident—a fall on a level, a fall from one level to another, struck-by, accident, a toxic condition caused by a rapid poisoning, a slow toxicity developed over a period of years, such as in silicosis. These types of accidents are mutually exclusive, and any one accident can very readily be classified in that particular category, and there are only eight or nine of them.

The fourth factor concerns the unsafe act. Roughly, this divides itself into a relatively small number of categories, each of which is in turn broken down into a larger number: Operating equipment without authority or proper clearance; operation or working at unsafe speed; making safety devices inoperative; using defective or unsafe tools or equipment; using tools or equipment unsafely; overloading; crowding; poor arranging; unnecessary exposure to danger; working on moving or dangerous equipment; distracting attention; teasing; abusing; horseplay; failure to use safety or protective devices; unsafe acts not otherwise classified, and so forth.

The fifth step in the analysis concerns the failure on the part of equipment or machinery, the unsafe mechanical condition, which may be that the chisel had a mushroom head, or that the machine was unguarded, or that the workplace was not properly illuminated, or the work surface was slippery so that the worker couldn't get a good foot support.

The last point is the personal defect on the part of the worker.

That method of approach permits coding every accident into its component parts and

permits you to cross-classify and create any number of these elements you wish. You can make your breakdown by department; you can make it by your plant; you can make it for industry; you can make it for the whole country.

That is perhaps the most important contribution that the statisticians and safety engineers working with statistics have made in the field of accident cause analysis during the last decade.

This method of analysis is being developed by several agencies cooperating with the American Standards Association, and the code should be available some time in the spring. In addition a manual is being prepared by the Bureau of Labor Statistics which will embody not only the code and its application but will give a good deal of other information pertaining to the analysis of accident statistics. This is intended largely for the use of state departments, but it is very easily adaptable to use by industrial concerns. That manual also will be out in the early spring, and you can obtain it then by writing to the Bureau of Labor Statistics of the U. S. Department of Labor, Washington, D. C., asking for the Manual on Accident Statistics.

You can obtain from the Bureau a good deal of information on safety codes, standards, codes used by various states, and information pertaining to accident statistics or any work in connection with workmen's compensation.

CHAIRMAN ADAMS: Another subject scheduled in this open discussion is the making of paper boxes. I have asked Mr. Patton to lead the discussion.

MR. PATTON: Will you say a few words, Mr. Murray?

ARTHUR MURRAY (Container Corporation of America, Chicago, Ill.): I was going to raise a question as to whether the speaker was referring to the folding industry or the set-up box industry. There are two very distinct branches to be considered, and I don't think they should be considered at the same time.

MR. PATTON: Let's see how many men are interested in the corrugated boxes? (About ten.) In folding boxes? (Six.) We haven't had many accidents in our box plant. Most of ours have been in the mill.

MR. WRIGHT: The greatest number of our accidents in the last two years have not

been caused by machinery, but by fellows bumping against trucks, by uneven floors, by pulling on trucks.

G. J. BIENVENU (New Orleans Corr. Box Co., Inc., Bogalusa, La.): My request the other day was that we box people—and by box people I meant corrugated manufacturers, solid fiber, and set-up cartons—be given a more representative part in these discussions. Also, that if we are going to revamp the method of reporting accidents, we break it down into departments known to the box people. All of our accident forms have been in terms of paper mill accidents.

We have a warehouse, a pasting room and corrugated room and finishing room and cutting room and bundling and shipping—and accidents may occur in any one of those departments. A man will run an overhead crane off a track, get caught in the corrugator, have his hand up on a slitter, knock his teeth out with a lift truck.

As to infections, we employ girls for stapling boxes. They get infections from cuts from paper. We have combated these accidents and have methods to prevent them, but we may learn more advanced methods by exchanging views.

CHAIRMAN ADAMS: Does anybody else want to discuss box hazards?

E. E. GRANT (The Crystal Tissue Co., Middletown, Ohio): This gentleman is from the boxboard industry. I am from a tissue mill, and I hear very little about tissue. As a matter of fact, the hazards he brings out are exactly our hazards. We have stitchers. We have lift trucks. I am not sure we are so far apart after all. We are speaking the same language but in different terms.

MR. BIENVENU: Possibly we are not understanding it. I think we are close enough together to be in one group, but I still think some time should be given to our particular part of that group. I think when reporting accidents, if you are going to have statistics that mean anything, you ought to have the departments in which these accidents happen and not just departments that can only be in paper mills.

MR. GRANT: The annual report has practically all the departments in it, hasn't it?

MR. BIENVENU: No. It is not broken down enough.

MR. GRANT: It has finishing department, shipping and unloading, which would cover

your warehouse. I am just wondering what else there should be. I don't think it would take a great deal more refinement to fit the needs of the whole industry in your manufacturing plants.

MR. BIENVENU: You wouldn't have to revamp the whole thing, but it would help to have it revamped a little.

CHAIRMAN ADAMS: I think I see your point. In our company we have a good many bag machines where we have injuries both to the operators and girls. We have a company form for filing statistics. We have provided on our statistical charts a place for bag machines right alongside the paper machines. I think that is what you have in mind, something that will limit it to box-making.

MR. BIENVENU: If you will pick out of the statistics given, those for the box departments and bag mills, and you have a converting mill—

CHAIRMAN ADAMS: We must remember that statistics are general, and we can't get it down too finely, because we have so many different means of conversion, after the paper is made, that if we embraced everything in each one, we would just get beyond ourselves.

D. S. GARDER (Hummel and Downing Co., Milwaukee, Wis.): This man talks about the crane running off. In Wisconsin you are obligated to put stops on all cranes.

MR. BIENVENU: We have the same stops, steel stops that you have to push off before the crane will move.

MR. GARDER: In our plant they have to unlock them.

MR. BIENVENU: They are steel locks.

MR. GARDER: Before they can move the crane, they have to get a mechanic up there. We have them locked so they can't take them off.

MR. BIENVENU: The cranes can go through a steel lock. The crane fall I am talking about did this very thing.

MR. GARDER: Are your cranes hand or motor-operated?

MR. BIENVENU: Motor-operated.

MR. GARDER: We haul rolls (some as high as 5,000 pounds) on an electrically operated crane, and yet we have never had that happen. We probably have twenty-five or thirty cranes in our plant, including two

monorails in which an operator rides. We have good heavy stops which we make ourselves.

MR. BIENVENU: Ours have been furnished by the manufacturer.

MR. WRIGHT: We had an unusual problem in our box plant, an accident with a man setting up a press. The operator left the motor running on a press, idling along. There were two helpers, one adjusting the plates on the printing press, and the other on the back side, up on the hopper form. He started to jump down, caught his pant leg in the lever, and it drew him in. He wasn't seriously hurt. He lost a week's time.

We tried to set up rules about shutting down the machine. We ran into this question: If a belt breaks, are you going to shut the machine down? That question came up between our box factory and our mill, which left us open to an individual problem in our box factory.

MR. GARDER: We have had that same thing come up. The paper mill superintendent insisted he wouldn't slow a paper machine down to put a belt on. It went along until one day a fellow put a belt on and went right with the belt. Since that time we have shut down every machine for makeready. We also, on starting boxes, hang a sign whenever a machine is down for makeready or any other cause, which reads: "Do not start this machine."

CHAIRMAN ADAMS: You are talking about the box-making machine?

MR. GARDER: Yes, cutting presses and printing presses. We have signs on the starting boxes.

MR. WRIGHT: We have that same thing now. In fact, it was a rule before that, but there was one case where the operator stood by the control box, and the accident happened to the helper. I was trying to bring out the problem between our box factory and our mill.

MR. PATTON: Mr. Chairman, in picking up rolls of paper I would like to know what is the most satisfactory kind of grip to catch the roll.

CHAIRMAN ADAMS: Pick it off the floor?

MR. PATTON: The hoists pick the paper up and carry it.

MR. GARDER: Do you refer to the jumbo roll?

MR. PATTON: The large roll.

MR. GARDER: We have a device that we make. It is two heavy bars of iron with a slit in the middle, and it has two T-hooks. You can slip them along by hand. We have those on all our hoists. We don't pick any rolls up by hand. We pick everything up by crane.

CHAIRMAN ADAMS: Does that answer you?

MR. PATTON: That is one type of hook. I would like to hear from several men who have different methods.

MR. BIENVENU: We use overhead cranes. A man rides in the cab and drops the hook. It is motorized. It will open and close to fit the roll. It has teeth. It is about one foot by three feet. It will come in and grip the roll and pick it up. We did use, previously, a hook type of lift, two pieces of pipe run into each other, with holes in it, and a pipe with an arm hanging down. A man would have to get down into the place and put the hook in each hole.

With the present method the man in a crane can handle the roll by himself without another man at the bottom. It reduces the hazards considerably.

MR. WRIGHT: In tiering rolls on end you can't tier them very high because of the hazard of toppling. In tiering them on the side, you lose a lot of space. I was wondering which was the safe way.

MR. GARDER: We stack on the side. Stacking rolls on end is hazardous. If you stack them flat, they can't topple over. Most of our rolls are wide, 60 inches.

MR. BIENVENU: The ones we stack on end are 28 inches in circumference and about 8 inches wide, little narrow ones. You can stack them up about 8 high. The total height would be just about the width of one of your rolls.

MR. GARDER: You don't make your own board?

MR. BIENVENU: No.

MR. GARDER: We have our board right off the machine.

MR. PLZAK: I took the liberty to go down to the National Safety Council exhibit and bring up a sample of the folder I referred to. Unfortunately, I have to return this. You in the paper box industry will be pleased to know that this pamphlet is available through the National Safety Council

offices. It is called "Paper Box Manufacturing."

CHAIRMAN ADAMS: Is there anything else?

MR. GRANT: I have a question I have been wanting to ask for two days. You have talked about penalizing guys and not doing anything about fellows who get hurt. We have a chronic at home who gets hurt constantly. He has been with us a long time. He owns his home and takes a great deal of pride in it. Now he is just having one injury after another. The department was keeping the old man because of his value on certain jobs. The other day the superintendent came around and told me he wanted to lay the old gentleman off, and, candidly, I told him it wasn't going to be that way until I got back from this meeting, that I was going to get the experience of experts. What would you do with an old man who has been with you probably 10 or 12 years, and in all probability would be unable to get a job any place else, who is constantly having accidents?

MR. GARNER: We had that same experience with a master mechanic in our paper mill. He was a fellow who had been with us a long time. He started to have one accident after another, and we demoted him to a lower job, and paid him the same rate of pay until we got our bargaining committee together, and they listed him as an overpaid man. Each time we issue a general raise, we still keep him at his old rate because we can't raise him, but we still keep him on.

CHAIRMAN ADAMS: In other words, he is a working pensioner.

F. H. ROSEBUSH (Nekoosa-Edwards Paper Co., Port Edwards, Wis.): I can give our experience, which I wouldn't recommend for usual procedure. We had one case of a man who had, as I recall, some 32 accidents in 10 years. We called him before the central safety committee, which consists of the management—the president of the company and the treasurer and the superintendents—went over his record with him in as easy and nice a way as we could, pointing out that he couldn't very well pose as a safe worker.

While there was no discipline attached to his case, he got the idea very quickly. In the four or five years since we took that

action I don't believe the man has had a single accident.

As I say, that is rather a severe thing to do. If you follow it as a permanent procedure, these fellows will not report their accidents. In spite of your rules you will find that they will evade reporting those accidents and cover them up, and give you other excuses as to why they are not coming to work.

MR. GRANT: I would like to ask Franz what age that man was. Our man is probably 55, 56 or 57.

MR. ROSEBUSH: I think our man was that age, past 50.

MR. PLZAK: We had a man very much like that. He is still with us. He started on a construction job I think perhaps 10 years ago. The first mistake he made, which might have proved very serious to him, was in working in one of the shafts of the sulphite building, one of the elevator shafts, using a suspension rope that even his helper told him wasn't safe. But Tom was one of those fellows who knew more about it than anybody else. He fell from the suspended scaffold. He had compound fractures of both legs and compound fracture of the right arm. He recovered from that. We had sympathy for him because he had a family of six children. We put him in the wood room.

One day the motors in the wood room all stopped, and the electrician pulled out the disconnect to start solving the trouble, and for some reason Tom decided the machinery should run. He went up and threw the main Square D, almost killing one of the electricians working on the motor. There was a sudden jar, and Tom was burned all over the left side and face.

Again the union committee begged for Tom. We gave him another job, this time in the heater room. He was almost killed by a heater. We were quite concerned about it and gave him a month's leave of absence, because he himself was responsible, and finally the president of the company got Tom his job back. We put him in the finishing room, and he has been there seven years and nothing has happened.

I think the answer is this: We didn't have Tom in the right place. We finally found where Tom belonged. Maybe it was our fault. But it is difficult sometimes to study the man and the job he might be particularly

fitted for, especially when he is an individual like this one.

MR. PATTON: We have a problem where men get hurt at home and say they got hurt down at the factory; nobody sees them, but they report the accident, and we take care of them. We have had cases where men have been hurt down at the plant and didn't want to say they have had an accident, although we have never punished anybody for having an accident. They say the accident occurred at home. I wonder if anyone else here has had that experience.

CHAIRMAN ADAMS: Does anybody want to comment on that?

MR. GRANT: Probably the one most outstanding case of this kind in our community happened at the American Rolling Mills Company. A fellow cut his finger off chopping wood at home, came in the next morning, and after he had been on the job an hour, went up to the hospital and told them he had cut off his finger and immediately applied for compensation. They are very thorough. They made a check-up immediately and went back on the job. I think that is where some of us fall down on the job. We don't make an investigation quickly enough. They went out into the mill and couldn't find anything there. It developed that the portion of his finger was left at home. They immediately chased it down.

CHAIRMAN ADAMS: We are self-insurers and have a number of thousand of employees in different localities. It has been our experience that it is just the odd one that tries to put something over. But a prompt, thorough investigation usually discloses the fact.

MR. PLZAK: I want to ask Mr. Patton, are you self-insured or insured under a carrier?

MR. PATTON: Under a carrier.

MR. PLZAK: Does someone have charge of the department first aid?

MR. PATTON: We are just a small plant. We have about 200 employees.

MR. PLZAK: Do you have a rule in which you demand that no matter how trivial the injury, it must be reported at once?

MR. PATTON: Yes.

MR. PLZAK: That is one of our strictest rules. A man is subject to discipline quicker for not reporting an injury than anything else. We are not interested so much in side-

stepping an obligation as we are in finding the facts and then placing the obligation where it belongs, whether it is with the employees' benefit association for off-duty accidents or disability, or under the compensation department if it is a compensable injury. We demand that. We do the deciding. After we have the facts, we decide where the case should be placed. If he differs from that, he may appeal to the proper board.

MR. PATTON: Have you ever had an accident where the man reported it a week later, saying that at the time he hurt himself he didn't think the injury was sufficient to warrant first aid treatment?

MR. PLZAK: Yes. We have had such accidents, and so has everybody else here. Unfortunately, in accordance with certain state laws, a man has thirty days in which he may report his accident. If there are certain circumstances surrounding it that indicate it happened on the job and was not self-inflicted, you are responsible for taking care of him. It is perhaps a good law. However, in our industry we still demand that they report them immediately. If not, we proceed to set up disciplinary measures in accordance. He may be laid off a week after he has recovered from his injury, or perhaps dismissed entirely, depending upon the circumstances. No commission objects to that punishment. That is entirely up to yourself as long as you compensate properly. What you do from a disciplinary measure, if it is justified, is your business.

MR. ROSEBUSH: We are in the same state in which Jim is, and while that is a rule, we have published in our plant rules which state to the men that unless these accidents are reported immediately, we reserve the right to disclaim liability and throw the burden of proving that accident upon the man. We have had lots of cases just as you mentioned, where men have not reported their accidents. Of course, if a man can substantiate with proof by his fellow-worker that he got injured in the plant, we will accept it, but we make it difficult to go through that process, so he doesn't usually try to drag in an accident after it has gone a week. We almost force him to have a hearing before the Industrial Commission and prove his case. Not many of them do it. So gradually the tradition has grown up in the mill that to put an accident in the files of the company it must be reported immediately.

MR. GARNER: Do you still give lay-offs as penalties for breaking a safety rule after the unemployment law is in?

MR. PLZAK: Yes, we do. Fortunately, in the State of Wisconsin the unemployment compensation law provides what they call a disciplinary measure clause. You may discipline a man by a one or two or four weeks' lay-off and not be obligated to pay unemployment compensation during that period. The weeks in which such disciplinary measures occur are called barred weeks, and they are not included under unemployment compensation.

MR. GARNER: Have you been reading the returns on any cases where they decided on that?

MR. PLZAK: Yes, they pass through my department.

MR. GARNER: Did you see any place where they had allowed that?

MR. PLZAK: I have, not only in our instance. There were two, both for drunkenness. We have had no other disciplinary measures, lay-offs. I have noticed in the Wisconsin Manufacturers' Association bulletin a review of accidents or, rather, of lay-offs that were either accepted or not accepted by the unemployment compensation division as disciplinary measures.

MR. GARNER: I went down to the industrial commission in Milwaukee, and the fellow there told me that it was a very dangerous practice, and three times out of four they wouldn't be allowed, so I discontinued it.

MR. PLZAK: It is a dangerous practice in that it becomes a very useful weapon for an employer to take advantage of lay-off without assuming liability, but if you are justified in your action, I am confident that the Industrial Commission will uphold that action.

MR. GARNER: You are still doing it?

MR. PLZAK: Yes. We had a case last week in which a man came to work under the influence of liquor sufficiently so that he could not continue his work.

MR. GARNER: Had that fellow already had his waiting period?

MR. PLZAK: Yes, an old employee.

MR. GARNER: Every year the waiting period is renewed, two weeks out of fifty-two.

MR. PLZAK: In this case this man had

even drawn benefits for partial unemployment.

MR. GARNER: Did you give him more than a week lay-off?

MR. PLZAK: Two weeks.

MR. GARNER: Had he had his three weeks' total unemployment waiting period?

MR. PLZAK: Yes. He was in a department that is not worked as fully as others.

MR. GARNER: Have you had a machine break-down where you had total unemployment? We had a line-shaft blow up, and it took us a full week to get new pulleys and everything that was needed. I thought that that was an act of God. I will tell you the way the thing happened. We had this pulley insured. It had been examined the week before by the insurance examiner, and no defect was found. They wouldn't allow it as a waiting period.

MR. PLZAK: I am afraid I would be inclined to agree with the commission that it would not constitute a bar. I am very sorry to say that, but we do this when an occasion like that occurs: We try to provide and present to that employee other and suitable employment, and if he turns that down, then you have a bar, providing you can prove that such employment was suited. In a paper mill, a large organization, that is very possible. A man could go into the finishing room or even into the yard.

MR. GARNER: Do you have enough spread for eighty men?

MR. PLZAK: No.

MR. GARNER: That is what this involved. I figured it would be better to give them a week waiting period than to fool around.

MR. PLZAK: We have not attempted to jeopardize operating efficiency to avoid paying unemployment compensation liability.

MR. GARNER: We haven't either.

MR. PLZAK: I fully sense that. I think the employer who attempts that sooner or later finds himself in a lot of trouble.

MR. GARNER: I figured out a standard working force, just exactly the number of men it takes to operate our plant, and that is what I keep all the time. Whenever we go into our peak periods, and they only last a matter of two or three weeks, we can bring in inexperienced help and put them on jobs. You see what we do, we put our semi-skilled and skilled help back, and then as these peak

periods come, raise them up and bring in new help for the common labor.

CHAIRMAN ADAMS: I think we will get away from the discussion of unemployment insurance. Is there any other question?

MR. PATTON: I have a question I would like to hear discussed. It is about this safety contest. Is it fair, when a man gets hurt and he is unable to continue on the job he has been doing, to shift him around and give him a lighter job and not count the accident as a disabling injury?

CLAYTON BRAATZ (Marathon Paper Mills Co., Rothschild, Wis.): I would like to answer that by asking another question. About two weeks ago one of our machinists, a top machinist, ran a sliver in his hand. He had it taken care of, but an infection developed. He told me about it a couple of days later and said that the doctor advised him to take a day off. I told him how sorry I was about it and how sorry his foreman would be that he was going to have a lost-time accident and ruin his department's record. He suggested we go down to his foreman and find out if he could do anything, which we did. We found that the foreman could give him work, productive work on a lathe, which would only entail the use of one hand. I would like to ask your opinion as to whether I am cheating a bit when I put that man back to work on his own job.

CHAIRMAN ADAMS: Before I call on Scott Dowd, I would like to have the opinion of some of you other fellows.

D. C. HUNTER (Oxford Miami Paper Co., West Carrollton, Ohio): Our prime interest is in preventing an accident or an injury. I can't quite understand how a man can break a leg and be put on some other kind of work and that firm have a clear record, regardless of whether the man was on productive work or anything else. You have had a hazard in your mill. A man has broken his leg. While it is well to keep the record nice and clean, that thing is happening. He still has a broken leg.

M. D. KOSKORIS: Perhaps I can cite the case of the plant which had a perfect safety record. A man fell and broke his leg, had it in a cast, was placed in a waiting room, kept on the payroll, and the employment commission is engaged at the present time on a horrible example of what not to do. It kept the record clear.

CHAIRMAN ADAMS: I suppose every paper mill in the United States that has ever been in a contest has probably cheated a little bit. Maybe cheating is the wrong word. But in their anxiety to get a good record, they do provide work for people who ordinarily wouldn't be back to work if they weren't involved in some sort of a contest or to make some kind of a record. I think everybody will agree with that. I think our mills have done it, too.

But we have been trying in our mills to promote the spirit of honesty in reporting accidents. If a man is off the job on account of an injury, he has to be declared able to do his job by the doctor before he goes back or before the lost time is stopped.

Our statistical record has apparently suffered because of it, but I think our financial record will improve because of it.

Scott, do you want to say anything?

A. SCOTT DOWD (The Paper Industry, Chicago, Ill.): The rules were adopted by the Section. That is all there is to it.

MR. WRIGHT: I believe the rule says the man must return to work the starting hour the next day.

CHAIRMAN ADAMS: That is right.

MR. WRIGHT: What do you do if a man feels he should have medical attention, goes down to your company doctor, and comes in at ten o'clock. He is due on the job at eight and comes in at ten. He doesn't lose the day or doesn't even lose half a day.

CHAIRMAN ADAMS: I don't think that is lost time.

MR. WRIGHT: I call it lost time.

CHAIRMAN ADAMS: Just for a couple of hours, because of medical attention?

MR. WRIGHT: No, the man himself thought he couldn't come back to work. He went down to the doctor, and the doctor fixed him up.

CHAIRMAN ADAMS: Maybe I didn't make myself clear. We depend upon the doctor. We don't depend upon any man to tell us whether he is going to work.

MR. WRIGHT: The doctor said he could work.

CHAIRMAN ADAMS: I would say there was no lost time.

MR. GRANT: I have a questionable case. A man comes to work on the last shift the last day of September. He gets hurt on the

morning of October 1, though the shift he is on started on the last day of September. What day do I report?

MR. CHANT: The third shift of September 30.

MR. ROSENST: Our industrial commission, on that point, has ruled that in unemployment insurance cases, where a shift starts at 11 o'clock at night—for instance, in computing at the end of the week, Saturday night, the shift starts at 11 o'clock and ends at seven o'clock Sunday morning—all of that time is chargeable to Saturday.

MR. BRAATZ: George, what do you do in a case like mine?

CHAIRMAN ADAMS: I think if a man can go on a productive job—I don't mean to carry a man back and forth or anything like that—but if he can come in and go on a productive job that somebody has to fill, o. k. It certainly is rehabilitating that man, keeping him at work; it is taking up his mind, and it is a distinct benefit to him. I think any doctor will tell you that.

MR. MURRAY: Won't there be some permanent partial disability in a broken arm case?

CHAIRMAN ADAMS: It is probable.

THURSDAY LUNCHEON SESSION

October 14, 1937

Data on 1936-37 Paper Industry Safety Contest

By A. SCOTT DOWD

Associate Editor, The Paper Industry Magazine, Chicago

The 1936-37 contest of the pulp and paper industry had an enrollment of 139 mills and remanufacturing plants. Of this total, 126 units remained through the entire period, exceeding the number of participants in any previous contest.

The total number of hours worked by more than 56,000 employees was 123,612,000. This is the greatest exposure ever recorded in the pulp and paper industry contest.

The average frequency rate for all par-

MR. MURRAY: Then it is chargeable.

CHAIRMAN ADAMS: Not under the contest. It is under the statistics, but not under the contest. In the contest we just have frequency.

MR. PLZAK: I think you had the answer to that when you stated "if the doctor permits the man to work," providing you do not use undue salesmanship in persuading the doctor. I would like to ask Clayton Braatz, if this man came to his office with that hand infected, if he would give him a job, if he were a new employee.

MR. BRAATZ: I wouldn't, Jim, but I called the doctor before I took the man down to the shop, and the doctor told me by all means to put him back to work, providing he didn't have to use his hand very much. The foreman told me he had some maintenance work to do. It necessitated another man taking the injured man's place. This was essentially his own job, only he couldn't do all of the details attendant to that job. It was a fill-in for half a day. That is what it amounted to.

CHAIRMAN ADAMS: If nobody has anything else, we will stand adjourned until tomorrow noon.

Participants was 16,301, which is slightly higher than the 1935-36 contest rate of 15.096. However, frequency rates in the paper industry contest have been reduced 17 per cent since 1933, when production curves began their upward trend. It is also worth noting that the frequency rate in the contest was more than a point lower than the 17.59 rate of the 198 mills reporting to the National Safety Council for the year 1936.

Contestants in the Paper and Pulp Divi-

sion had an average rate of 16.861 in comparison with 9.041 for participants in the Paper and Board Remanufacturing Group, Division 2.

The largest mills in the Paper and Pulp Division, composing group A, had the lowest frequency rate, averaging 14.198. Contestants in group C of this division had the highest frequency rates, averaging 25.318. Group A and group B lowered their frequency rates from those in the previous contest.

Seven contestants went through the entire year without a single disabling injury.

Five of these were in group D, and two were in the remanufacturing division.

The enrollment in the 1937-38 contest stands at 146 plant units. During the first two months 46 of these units operated without a disabling injury. The average frequency for all participants in these two months was 14.502, a reduction of four points from the rate in the corresponding period of last year.

The rules for the 1937-38 contest are the same as for the previous year.

Pulp and Paper Section Safety Contest

In the Paper Industry Annual Safety Contest seven of the 139 competing mills went through the entire year without a disabling injury. For the entire group of participants, one out of each 28 employees had a disabling injury during the contest period. This ratio compares with 30 to 1 for 1935-36 and 29 to 1 for 1934-35.

Ten plaques were awarded in the contest to winners of first place; seven certificates were awarded to winners of second and third place.

The trophies were presented by Harry Guilbert, Director, Bureau of Safety and Compensation, The Pullman Co., Chicago. Winners of plaques were as follows:

Paper and Pulp, Group A—Hollingsworth and Whitney Co., Algonquin and Taconnet Mills, Waterville, Me., 3,028,195 man-hours, 9 injuries.

Paper and Pulp, Group B—Hoberg Paper Mills, Inc., Hoberg Division, Green Bay, Wis., 1,047,753 man-hours, one injury.

Paper and Pulp, Group C—Escanaba Paper Co., Escanaba, Mich., 711,073 man-hours, two injuries.

Paper and Pulp, Group D—Five tied for first place—Bird and Son, Inc., Phillipsdale, R. I., 312,744 man-hours; Rogers Fibre Co., Inc., Fibreboard Mill, Bar Mills, Me., 192,545 man-hours; the Mead Corporation, Nashville, Tenn., 188,296 man-hours; Central Fibre Products Co., Vincennes, Ind., 157,034 man-hours; International Paper Co., Riley Mill No. 23, Chisholm, Me., 142,578 man-hours. All five winners completed the contest period without a disabling injury.

Paper and Board Remanufacture—Two tied for first place—Container Corporation of America, Anderson, Ind., 278,853 man-hours; Bemis Bro. Bag Co., East Pepperell, Mass., 86,494 man-hours. Both winners completed the year without a disabling injury.

On behalf of Mr. E. B. Fritz, publisher of *The Paper Industry Magazine*, Chicago, A. Scott Dowd presented the paper industry major trophy to the Phillipsdale, R. I., plant of Bird and Son, Inc. During the contest period, from July 1, 1936, to June 30, 1937, the plant operated a total of 312,774 man-hours without a disabling injury.

THURSDAY AFTERNOON SESSION

October 14, 1937

CHAIRMAN ADAMS: Our subject this afternoon is a round table discussion on paper mill machine room hazards. There seems to be an unusual interest in the hazards of the

paper machine department. The nature of the process, the impossibility to guard different points of operation, create hazards that are always a problem. Now there is

one definite trend that reduces hazards in the machine room—modern machinery. For instance, in our company in Canada we have several modern newsprint mills, machines that run up to 1,500 feet a minute. Those machines are all comparatively new. Practically everything is handled automatically, and accidents are very rare, that is, paper machine accidents. They do have accidents in the machine room, but they are mostly slipping, stumbling and occasionally a burn or some such type of accident that you get in almost any department in the mill.

On the other hand, a paper machine has very long life, and you can't replace a paper machine because it is hazardous. Particularly in the older type of mills we have machines that present a problem, that are not up to date. They are not equipped yet with modern devices such as rope carriers, steam jets and air jets to carry the paper, and this work has to be done by hand.

Speaking of the actual number of accidents that occur in the paper machine department, I have jotted down in the group of International Paper Company mills the percentage of the total over a period of years, from 1931 through 1936: '31, 24 per cent of the total accidents were in the paper machine department; '32, 20 per cent; '33, 27 per cent; '34, 24 per cent; '35, 26 per cent, and '36, 27 per cent. In other words, it is fairly consistent experience that about one-quarter of the accidents, at least in our group of mills, have been chargeable to this one department, the paper machine department. I haven't the figures on the severity of these accidents, but we all know that a paper machine accident is usually severe.

This discussion was developed with the thought that the first requisite of any safety program is to provide ideal or as nearly ideal working conditions as possible; in other words, the equipment guarded as far as possible, and the floors in good condition.

I have listed on the board six major parts of the paper machine on which we experience the most frequent and severe accidents.

What are the principal hazards encountered in changing wires?

E. H. REITER (Kimberly-Clark Corp., Kimberly, Wis.): Most of the injuries are minor injuries, mostly pinches or scratches or little cuts. We haven't had a real lost-time accident in changing a wire for fifteen years. The last one was with a pulling T

rail and the rail riding along the valve. As the man pulled it out, it opened up the valve, and a man standing about ten feet away from the steam hose, a ten-foot long hose, was burned. I know all about that, because I was the victim.

CHAIRMAN ADAMS: Your mill's experience evidently has been very good. What is the reason?

MR. REITER: We always have the boss machine tender right there with the wire changer. Most of our wire changes come in the daytime, and we have a boss machine tender and what they call a tower foreman. The boss machine tender is responsible for it, and the tower foreman supervises. We have two supervisors there as much as possible.

CHAIRMAN ADAMS: You think supervision is the answer?

MR. REITER: Of course, there is some training connected with it. We have all old hands there.

CHAIRMAN ADAMS: You safety directors—can you think of any reportable accident during wire changes?

MR. REITER: I could mention one more thing. A couple of years ago we put new floors in, and they were quite slippery, so during the first couple of wire changes we laid drier felt on the floor, and gradually we put sulphuric acid on, which roughened it.

CHAIRMAN ADAMS: New cement floors that were slippery after being laid?

MR. REITER: Yes.

CHAIRMAN ADAMS: That is a very important point. I have seen plenty of machine room floors that were improperly laid. What is the remedy for that?

MR. PLZAK: Could the gentleman tell us how they applied the sulphuric acid, the concentration?

MR. REITER: We just took the sulphuric acid and had a section marked off, and somebody stayed right with it and let it soak on the floor for a while and then washed it off with water. We did just enough to take the smoothness off. We haven't had a man slip in changing wires for as long as I can remember.

W. A. GLEASON (Hammermill Paper Co., Erie, Pa.): We have adopted a new scheme during the last year or two. Whenever a floor needs replacement in the paper mill, we

have reinforcement put in, and the cement, of course, doesn't entirely cover the reinforcement. The squares of the reinforcement are just filled up evenly, and that leaves a rough surface.

L. C. HAGGARD (Champion Paper and Fibre Co., Hamilton, Ohio): We have prepared all of our floors in our machine room, and we have used cast iron grating and filled the openings with cement. That has eliminated a lot of slippery floors.

CHAIRMAN ADAMS: The grating is exposed?

MR. HAGGARD: The top of the grating is exposed.

CHAIRMAN ADAMS: If you take a bunch of cement workers or cement finishers and tell them you want a floor laid, they smooth it over like a piece of glass. If you try to get them to put in a rough finish, they think you are crazy, unless they know something about the conditions.

J. H. TURNER (Consolidated Paper Corp., Montreal, Canada): We use carborundum crystals in a mixture of cement, about fifty-fifty. We have found that pretty good. The carborundum crystals do not get into the machines. That has eliminated quite a lot of slipping. Further, when we replace the floors, we replace them at the ground.

CHAIRMAN ADAMS: In changing wires, would you all agree with this, there are not very many hazards involved because we do supply proper supervision? Does anybody dispute that?

MR. GLEASON: I do.

CHAIRMAN ADAMS: Why?

MR. GLEASON: There are two machines in our machine room. When you change a wire on one of them, naturally you block the passageway between the two machines. Invariably at that time there are people who want to travel through the machine room. Our biggest difficulty is keeping people out who have no business in there at that time. Of course, the tube rolls and boxes of all descriptions are pulled out and put into the aisle, and then, of course, there is the slime that comes from the wet machine equipment that you constantly have to keep washed out of the aisle, but that is all very slippery.

On the older type of machines you pull and haul so much machinery back and forth. There are plenty of hazards in connection with that. In back of the machine there

isn't any adequate place to stand when making a lot of those lifts. Of course, in the more modern mills, where you have this electrical equipment, that brings a lot of your four-drivers right out in the center of the floor, where you change your wire and eliminate a great many hazards. Electric cranes have come into their own more in recent years, and that takes a lot of the pull and haul out of changing a wire.

Of course, everyone knows that when your paper machines shut down, you are not making paper, and the speed that enters into the operation of changing a wire causes a lot of hazards.

CHAIRMAN ADAMS: I agree with you, Walter, that it is very hazardous. I think I agree with you also that we don't get very many accidents as a result of those hazards. I wonder if this has anything to do with it. I have helped change many a wire. Joe and Jerry know they are going to take out the tube rolls, and Jack and Jim know they are going to do this. Isn't your work planned? Everybody knows where he is going and what he is going to do.

MR. REITER: Yes. I might mention, also, that we tried to eliminate some of the speed. Some of the gentlemen mentioned the other day that they paid their men so much for wire change. We don't do that. We pay them time and one-half. So we eliminate some of that extra hurry.

MR. GLEASON: Do you bring the heater room help in to help out at that time? Your heaters are down at the same time.

MR. AUGUSTUS: No.

MR. GLEASON: What do you do with them?

MR. AUGUSTUS: They clean up.

FRED G. COX (M. & O. Paper Co., Kenora, Ontario, Canada): In our mill, when we put on a wire, we use 21 men, a couple of machine tenders, a couple of tenders, and so on down the line. We have three heaters for the two machines, and when the heater men are not doing their own work, they help out. The other machines are generally running.

We have had very few accidents in this operation—a few pinched fingers from three or four boys at one end letting tube rolls down a little bit before the other end.

In regard to keeping out people who are not supposed to go through that part of the

mill, up in Canada it is a practice not to allow visitors in the mill. They have to get a special permit. If they were changing a wire, you wouldn't get a permit to go there, no matter if you were the prime minister of Canada. Our finishing floor help has to go through the machine rooms. We have lots of room to walk back of both sides of the machine. They can go around. All we use is 21 men on the wire.

MR. AUGUSTUS: Didn't you bring out yesterday afternoon that one of the greatest hazards you have on wire changing is your lack of coordination of effort? I think that is true not only of wire changing but a lot of other operations. If each fellow knows what he is to do and when he is to do it and knows how to do it, there is very little chance for injury.

CHAIRMAN ADAMS: I think we have covered this topic quite fully. Let's go on to the wet felts. The wet felts are hazards and vary somewhat, although they are similar, depending upon the age of the machine and the speed. What are the hazards? Are they more during the constant running or are they greater when you are washing up?

RALPH BAILEY (Lawrence Paper Co., Lawrence, Kansas): One hazard in changing a wet felt is the slippery machine you are to step on. We run cylinder machines. There is a danger of slipping and losing your balance when you have a load.

CHAIRMAN ADAMS: While you are washing up, or while you are running?

MR. BAILEY: While they are changing the felt. It is impossible to remove all the slime. You can get the machine clear, but you can't get rid of the slick surface.

CHAIRMAN ADAMS: Does anybody have anything in his mill on the walkways?

F. E. MIXON (Kenora Paper Mills, Ltd., Kenora, Ontario, Canada): We found it a good practice to use the Fourdrinier wires. We cut them up in strips and tack them onto the walkways. Of course, they do not last very long, but there are lots of wires on hand, and we always have a wire we can get out there in a few minutes' notice. If the wires overflow, and anything gets on there, we can wash it out. Fellows with rubber shoes have found it very effective.

CHAIRMAN ADAMS: You put the old Fourdrinier wire on a wooden surface?

MR. MIXON: Yes.

MR. COX: We also had our tinsmith cut sheets of tin and punch them, punch them from the inside, with the rough edge up on the wooden walks. No matter how much slime or stock gets on there, you can't slip. There is a hole that is hardly bigger than the point of your pencil.

CHAIRMAN ADAMS: That is all right as long as you wear shoes. We have mills where the men still go barefooted.

MEMBER: Are they positive they have no tripping hazard? If they did have one, what would happen?

CHAIRMAN ADAMS: Ever have anybody stumble over those?

MR. COX: No, they are only up an eighth of an inch. Every now and then we change the piece of tin that is tacked on, so there are no nails sticking out.

C. M. GREEN (Mosinee Paper Mills Co., Mosinee, Wis.): We use what we call a rubber bonded aluminum tread, made originally by the Norton Company, not around our wet ends, particularly, but around calenders and on the bed plates where they get slimy, and oil and water apparently do not affect them. They retain the non-slip qualities. We have had them in for four or five years now, and they are apparently as good as when we put them in.

MEMBER: Is the tread flexible so that it can be wrapped around?

MR. GREEN: It comes $\frac{1}{4}$ inch thick, any length you want and in varying widths, up to 12 or 14 inches.

CHAIRMAN ADAMS: It can be put on either metal or wood surfaces?

MR. GREEN: It is drilled and countersunk so you can put it on with wood screws or machine screws, whichever you wish to use. I am getting on the wrong end of the machine, but we have equipped many of our machines with that material.

L. R. SIMPSON (Brown Paper Co., Monroe, La.): Our machine steps and runways are all equipped with a similar product, known as Kass.

CHAIRMAN ADAMS: So far in our discussion it seems that slipping is the predominant hazard at the wet end of the machine.

MR. HAGGARD: We have covered some platforms and steps with expanded metal. We are using subway grating.

CHAIRMAN ADAMS: That is on steps leading up to the side of the machine.

MR. AUGUSTUS: Isn't there a hazard in turning the felt? We have had several accidents in that operation on old machines where there wasn't much clearance.

CHAIRMAN ADAMS: That is on wash-up, where you are turning the second felt.

MR. AUGUSTUS: We had one fellow thrown clear around the roll. This was on a small machine. They had some experimental equipment in, which gave less room for working than usual. This fellow got down in the pit to turn the felt, and as he reached to grab it, he pulled his fingers around the roll and was thrown over the roll and into the pit, dislocating his shoulder. Of course, it wouldn't ordinarily happen the way this did, had the machine not had this experimental equipment on it, but we have had several others in the past ten or twelve years similar to that, where men have been caught turning the felt.

CHAIRMAN ADAMS: When men are turning a felt on the machine, or pulling a felt (indicating on blackboard), a felt is going up over this roll, and they are usually standing on a platform here performing the operation. If the felt is traveling in this direction isn't it a fact that it will come away easier if you pull right before it goes onto the roll?

MR. REITER: Yes.

CHAIRMAN ADAMS: Is that the reason we get those accidents, that the fellow was working where he knows his work is going to be more effective, right before the pinch? Is that right?

MR. REITER: That is right.

CHAIRMAN ADAMS: What is our remedy?

MR. REITER: We haven't had an accident of that type since we raised the top roll up so high that a man couldn't reach the top of it.

CHAIRMAN ADAMS: There is the man, and you put the roll way up here (indicating). Is that right?

MR. REITER: Yes, and a man at the stop-and-start switch.

CHAIRMAN ADAMS: You keep a man stationed at the lever all the time?

MR. REITER: Yes.

MR. COX: We haven't washed a felt for eight years. We have the modern machine. We don't wash out, don't even change them.

CHAIRMAN ADAMS: I would like to tell you what one of our mills did on the old machines. They arranged their platform (illustrating) so that it forces the fellows to pull the felt on the side of the roll away from the pinch, and there is no danger of getting caught.

But one day they had the felt all bunched in the middle and were ready to pull. You know how they do—reach under and pull around. The boss machine tender thought it wasn't coming fast enough, so he jumped up, reached around to give it a couple of tugs, and went up over. So that doesn't seem to be a remedy, although it is a case of the boss breaking the rule himself. If you can enforce those rules, you will have safe conditions.

It seems to me so far that the raising of that roll way up in the air is probably the best solution.

MR. GLEASON: How about a bar guard, something in which his hand can go so far and then strikes the guard between the framework of the machine?

CHAIRMAN ADAMS: Would that stop him from going in?

MR. AUGUSTUS: He means where you have the platform on the opposite side. The man couldn't reach through on the other side.

CHAIRMAN ADAMS: Put something through there so he can't reach through?

MR. GLEASON: Yes. I have a request for a bar at the third felt framework where we had a man get his arm caught in the felt. I haven't investigated it thoroughly. We talked of it in the safety meeting. It is my understanding that he wanted it in the center, between the framework of the machine, below the roll. The boss machine tender said that would be in the way all the time that you are washing your felt. It is a question of whether it goes inside or outside, under the felt. That hasn't been settled.

CHAIRMAN ADAMS: Do you fellows ever have this happen while the machine is in operation—stock crumbs gather on a felt roll, and a fellow reaches in with his hand and catches them?

MR. PLZAK: We had such an accident occur not over three weeks ago. Incidentally, I would like to ask you machine tenders a question. As I understand it, you throw crumbs in and take them out to stretch the roll. Is that correct?

MR. REITER: That is right.

Mr. PIZAK: This was on the second pass. As you know, there is a water jacket down here, something like that. (Illustrating.) He put his hand in to remove or put crumbs in and it was gashed badly, several tendons being cut. We had quite a time getting that man out of there.

We put a guard across temporarily, and until we find out whether he has to put his arm in there, he tests it out here (illustrating) and can only get it in a short distance. It prevents it from being dragged down, because the nip is out here, and his hand is perfectly safe in there. There is about a six-inch clearance with just a guard strip right across here. His arm rests in there instead of being loose and likely to be dragged in.

Mr. REITER: Do you mean that is the tray to catch the water going out of the nip?

Mr. PIZAK: Yes.

Mr. REITER: Why don't you have the tray made bigger? We have trays with about one foot between the rolls and the trays.

W. R. OWENS (West Virginia Pulp and Paper Co., Covington, Va.): Why don't you lower your trays?

Mr. PIZAK: That doesn't happen to be the nip. He wasn't caught in the nip. This roll is turning this way, and this one in the opposite direction. He was caught between the lower roll and this water jacket, as they call it. There was maybe one and one-half to two inches of space. He happened to be a thin man and was able to have his arm drawn in there. I presume his arm went as far as it could, and the rotation of the roll kept cutting that hand.

Mr. REITER: You wanted to know the solution for the use of crumbs. If you have any felts which continually run crooked in a certain way—for instance, if the center keeps on running behind or something like that—why don't you crown the roll or else the opposite?

Mr. PIZAK: Would the condition be the same with every felt? Wouldn't that condition vary?

Mr. REITER: We crown the rolls to eliminate the use of crumbs. We don't use crumbs very often. When a felt has a tendency to run in one certain way we overcome it with the felt roll.

CHAIRMAN ADAMS: Let's go on to the hazards in the drier section.

We had one bad accident where a man crawled up and stood on top of the drier, first bottom drier, during a temporary shut-down, to mend the seam in the top drier felt.

Two felts, top section and bottom section. The clutch grabbed, and he, of course, went into the driers. That was a hazard. It isn't any more in our mills, but I just relate it because it might be well for you fellows who do have the older type machines to inquire how they mend the seams in the top drier felts, that they don't stand on those drier drums. In this accident nobody touched the lever at all. The clutch was a little out of order and it grabbed and started the machine.

What are some of the other hazards in the drier section?

Mr. REITER: Burns.

CHAIRMAN ADAMS: What else do we have?

Mr. BAILEY: A few years ago we had a vertical stack drier six feet high, and we had a man fall from practically the top. We were lucky he fell on a catwalk just part way down. It didn't hurt him seriously. We have drier ladders beside the drier that carry the paper over. That is our main hazard, foot slippage. Men will either get burned or fall.

CHAIRMAN ADAMS: That drier is vertical. How fast do they run?

Mr. BAILEY: We run 30-point board to about 12-point, so that our speed varies from 200 down to 90 feet a minute. When we have a new man, we generally let him watch the older fellows take the paper over until he gets onto it, and then when we are on 30-point we break him in easily and try to make him efficient before we give him something a little fast. I think slippage generally causes the burns. We use felt four-inch strips up on the drier ladders to eliminate the slippage.

CHAIRMAN ADAMS: On most machines where the speed goes up to 500 or more they usually use the rope carrier, and that does help from the safety angle.

Do you fellows have any hazards with these fast, modern machines?

Mr. Cox: The only hazard we do have as far as the drier is concerned is, of course, the rope carrier; we travel 1,200 feet a minute. Occasionally the tail will fall off the ropes, and the back tender or the boss machine tender will have to reach in and pull

it back on the ropes again. It goes pretty fast, and sometimes he does get the end of his fingers burned on the drier.

CHAIRMAN ADAMS: What has become of the old problem of the drier spears? People would be hit in the back or eye with the end of a drier spear while walking by. You don't hear anything about those any more. At one time it was quite a problem to get the fellows in the drier machine to put the spears back on the hooks when they weren't in use, and to be sure, when going up and down on the machine room floor when somebody was using a spear, that you didn't get poked with it.

The calendar stacks do still present quite a problem in producing pinched fingers and pinched toes. We had a man stick his feet in one not long ago. He had on a pair of rubbers, and he climbed up to make an adjustment on the top of the stack and with the stack running. The steel rolls caught that rubber toe in nice shape. He had a very bad injury, had to be amputated above the ankle. What has anybody to offer on the calendar stack? What has anybody to tell us that is new in handling paper, or preventing getting caught in the calendar stacks?

J. FRED BERRY (Alton Box Board Co., Alton, Ill.): I would like to hear from some of the boxboard mill representatives here if they have some type of guard on the calendar stacks to keep the fingers out when putting on the heavy grades of paper.

CHAIRMAN ADAMS: You mean the in-running nips—whether they have a guard?

Mr. BERRY: If they do and what type.

Mr. WRIGHT: We put a two-by-four across the full length of the rolls, about eight inches out from the in-running nips, so that if a man is going through and slips and falls, he will have something to throw his hand against rather than into the nip. There is plenty of room to get around and put the plug in, but if a man falls, he can throw his hand against the two-by-four.

CHAIRMAN ADAMS: Do you have it next to the winder?

Mr. WRIGHT: We only have it up about 6 feet high. A man won't throw his hand any higher than that.

CHAIRMAN ADAMS: It will be high enough to protect the fellow on the floor. It doesn't interfere with your operation?

Mr. WRIGHT: We don't let them work up to the side of the stack.

CHAIRMAN ADAMS: That is a board, isn't it?

Mr. WRIGHT: Yes. Our greatest trouble was in bringing the sheet from the drier over to the top of the calendar stack. In getting up there a man was in an awkward position. We put a little leg hook up so that a man can throw his leg over it and allow both hands to be free to bring the sheet over the top. We had trouble with that. In allowing a man to have both hands free, we have eliminated the difficulty.

CHAIRMAN ADAMS: Would the metal serve the same purpose as the two-by-four?

Mr. WRIGHT: It would, but we find if the sheet gets plugged in the nips and any great pressure arises, it will break the board away rather than cause trouble on the bearings.

CHAIRMAN ADAMS: That is a good point. Does it help you any?

Mr. BERRY: To a certain extent. An expert on guards has a type which he has been showing us. He is Mr. Boraks of the Liberty Mutual Insurance Company.

CHAIRMAN ADAMS: We will give him a few minutes.

LOUIS BORAKS (Liberty Mutual Insurance Co., Boston, Mass.): I travel the country for our company and get into a lot of paper mills, but I am not a paper man. I have been a mechanic for about 26 years. We have had a great deal of success in guarding finishing calendars and finishing stacks, using different types of guards, particularly two boards in the shape of an angle iron.

CHAIRMAN ADAMS: You are talking about board machines?

Mr. BORAKS: I am talking about either paper or board. We have had more success with paper than we have had with board.

CHAIRMAN ADAMS: Is this on the paper machine calendar or on the finishing room supercalendar?

Mr. BORAKS: We have had more luck on the superfinisher. We have had some on the paper machine stack. It has been very difficult to get men to use them because they have not been educated to use them. That has been our greatest difficulty. You can get a good picture of the guard when I say it is two boards ninety degrees to each other, with a separation in the center.

CHAIRMAN ADAMS: Could you illustrate that on the board for us?

MR. BORAKS: (Illustrating) Here is the nip point. The two boards of the guard are joined together on the ends. There is a slot in here so they can be bolted to the machine there. There are three ways that the paper can go in.

I will make this down here again. At that point there is a considerable opening. I have made it considerable for a purpose, the idea being that you have a natural funnel or lead for the paper to thread, while down here it is narrow enough so your hands can't get in. Still we can leave it pretty wide, because if you brought that guard up close to the nip point, you would have to bring it down to the thickness of your finger, three eighths or a half inch; but your hand gets thicker as you go up, up by the knuckles, you have pretty nearly an inch. In other words, if the guard is about four inches from the nip point, you can have an inch of space there and still can't reach the nip point. If the paper has a big lead there, it naturally goes in. By making that sharp point, as you see it, there is no tendency for the paper to come out. If that were a round guard, the paper might come out that way. By having those sharp points, the paper does not go around at an angle and come down here and go that way. The suction of the roll itself and the sharp point tends to thread it.

That is the guard with which we are having the most success. There are three ways to feed: Come in from the front or either side, top or bottom. If you make them of wood, you still have the same good point the gentleman before me brought out, that it will break.

The big trouble in trying to use nip guards on these stacks has been that you tried to bring the guard too close to the nip point. In doing that, it gets choked up very quickly, and it is hard to feed the paper. By bringing the guard further back you can put your hand in there but you can't reach the nip. There is no friction between the guard and the roll because you have at least an inch there.

MR. WINSLOW: Suppose your hand goes in there and the roll is pulling it right down in?

MR. BORAKS: It won't pull your hand into the nip.

MR. WINSLOW: I am not talking about

the nip. I am talking about a friction burn from the roll and the guard.

MR. BORAKS: It is a question of whether you want to have a burn or have a hand off. I don't think you would be very likely to get it. You could get it, but it is the lesser of the two evils. We have used that guard quite considerably but we have an awful time introducing it, and I blame it on the fact that the trade hasn't been brought up in the right manner. I have drawings of that guard if anyone wants them.

CHAIRMAN ADAMS: Have you ever put this guard on a paper machine calendar stack? At what maximum speeds?

MR. BORAKS: We put it on the fast machines and on the slow machines, it doesn't make any difference. Speed doesn't affect this thing at all, because you just cannot reach the nip point. We are leaving a tremendous amount of space to thread the machine.

The weakness in all the nip guards in previous years has been to get the guard close to the nip, leaving a small space. But then they couldn't thread the paper. If your paper broke, it would crowd up in there. There was no room for it; it jammed.

By leaving a lot of space and taking advantage of the thickness of your hand, you can do that. By moving the guard back, you are all set. I will send anybody who wants them half a dozen different types of guards. You can use the one best suited.

We find in our business that inrunning rolls are the third largest machine hazard we have. Of course, we have inrunning rolls in every industry, paper, metal, food, anything.

MR. GLEASON: Doesn't your doctor take care of the nip hazard?

CHAIRMAN ADAMS: Will you explain?

MR. GLEASON: Over the face of the calendars, on the paper machines, we have what they call the doctor, which is practically a two-by-four across the face of the roll at a point possibly six inches from the nip, and when they throw the paper they hit their arm against that doctor. That keeps it from going up into the nip.

MR. PLZAK: There is another hazard in connection with the supers. I appreciate that you are talking about calendars, but let's stay on the super for a minute.

CHAIRMAN ADAMS: I am a little confused in my own mind as to whether we have been talking about the paper machine calendar stack or the super.

MR. PLZAK: This is the super here.

CHAIRMAN ADAMS: Mr. Boraks said it could be applied to the paper machine calendars on any speed.

MR. BORAKS: Yes, we use them on all the calendar stacks, any kind.

CHAIRMAN ADAMS: Whether or not this works on the paper machine calendar stack I think it is a step in the right direction.

MR. PLZAK: Could I digress from paper machine hazards and ask one question? Has anyone had experience in using sponges on the supercalenders instead of rags for wiping off the dust? We have had three accidents in a row with rags on supercalenders. We have been tempted to get sponges. The information we received is that sponges seem to disappear—I won't say they are stolen. They have to buy them by the hales. Who has had some experience in that—the use of sponges in place of rags for wiping off lint and dust on the supercalendar rolls?

MR. HAGGARD: We use sponges but haven't had trouble from stealing.

MR. PLZAK: How do you prevent it?

MR. HAGGARD: We haven't witnessed it at all. We use sponges on the supercalenders.

MR. BORAKS: Isn't it the proper thing to clean the roll on the outrunning side? Then you don't have to worry about it. If you clean a calendar on the inside, you are likely to get caught. It is the same point you made on the felt.

CHAIRMAN ADAMS: I think what Jim has in mind is that there is still the danger of the nip above getting you.

MR. REITER: I think this gentleman is talking about the bottom nip.

MR. PLZAK: That is right.

MR. REITER: You can't do that on the outrunning side.

MR. GREEN: I don't know anything about calendar stacks, but one method we have used with equipment that is likely to be stolen is to give every man who might need that equipment one piece, whatever it may be, and charge him with it, and if it wears out, he can bring back the old one. They may slip in a few old ones from home, but you

won't lost quite so many as if you were trying to keep track of them some other way.

CHAIRMAN ADAMS: Is that of any help?

MR. PLZAK: The thing I am pleased to hear is that sponges are being used. I was interested in that expression rather than in the other.

CHAIRMAN ADAMS: Mr. Boraks, how about feeding paper into the calendar stacks, from the drier section into the calendar stacks? Somebody brought that up the other day, particularly with respect to board, feeding of heavy grades in slow moving machines. Mr. Wright, did you ask that?

MR. WRIGHT: The question came up as to whether you could use plugs, and somebody said you couldn't. We have always used plugs. If anybody has any questions on it, I will be glad to answer them.

CHAIRMAN ADAMS: That is on the heavy board?

MR. WRIGHT: We run all the way from 12 to 55 or 60-point and use plugs all the time.

MR. PATTON: In my paper I mentioned that we couldn't use plugs with any degree of success because they interfered with the operation, and Mr. Wright brought this point up in connection with that.

MR. GLEASON: What is a plug?

CHAIRMAN ADAMS: A piece of broom-handle about one foot long, and rounded off.

CHAIRMAN ADAMS: A piece of broom-handle about three inches wide and about one and one-half inches thick, rounded off, not pointed, so they can't be drawn into the nip. There is enough point to bring the tail down; they break the sheet so it goes double into the nip. I would say the handle is drawn down. It is about the size of the broom handle. The plug itself is wide.

CHAIRMAN ADAMS: In other words, it is a piece of wood shaped so you do this (illustrating) with the paper and shove it right into the pinch.

MR. WRIGHT: When you bring over a tail—we usually start twelve inches wide—it breaks the sheet, so it automatically folds right into the nip. As it comes over to the other side, the fellow tears it off.

MR. WINSLOW: Where do you keep the plugs?

MR. WRIGHT: We have a shelf right on

the edge of the frame. As the men run up the stack, they grab the plugs.

CHAIRMAN ADAMS: The same idea can be used on a book and bond machine, 500 or 600 feet a minute. We do it in stacking paper.

MR. WINSLOW: The fellows complained that the little steps on the calender stacks were so small that they couldn't stand, so we widened our steps out and made a little tray—about half an inch raise—around the edge. It is probably eight to ten inches wide, sets out a little bit farther, so the men have a good foothold when they get up on the stacks, and that eliminates slipping.

MR. BORAKS: I have seen plugs used very successfully.

MR. HENDERSON: We use them on board machines. It was quite a job to get the men to use them.

MR. WRIGHT: We found the broom-handle too small where it went into the nip, so we widened them out.

CHAIRMAN ADAMS: How about your fast machines? Have you any hazards? Do you want to describe how the paper is put into the nip?

MR. COX: The paper is put in off the driers into the top nip by hand. Of course, the third hand and back tender stand on a footboard, and the third hand spears the tail for the back tender to grab hold. He has a rope with a handle on the stack, takes hold, and has to put his foot up on the step. We have a toeplate around it so the fellow can shove his toe up against it, and he steps up and throws the tail over. We have doctors. All the third hand does is throw it up there, and the air will blow it into each nip all the way down. We have doctors there to close when we are stacking paper. As soon as we have the paper stacked, we open.

MEMBER: What type of doctor?

MR. COX: We are using the Dicker blade. There really isn't much of a hazard in stacking paper. When the third hand throws the paper up there on the top roll, unless he jumps or goes too high, he is bound to hit the doctor with his hand.

CHAIRMAN ADAMS: He throws the tail?

MR. COX: Yes. You couldn't go fast enough to climb up. You have to throw it.

CHAIRMAN ADAMS: Have you ever had a device to feed the tail into the stack, a chute with compressed air?

MR. COX: Not in the mill I work in, but one of the company mills tried that at International Falls. I don't believe it worked very well. We have only had one severe accident on our stack in twelve years.

CHAIRMAN ADAMS: I think we had better get along to the reels. I just jotted down the stacked reels and the drum reels. I know there are other types, and I guess there are hazards in connection with all of them. What type reel do you have?

MR. REITER: We have both.

CHAIRMAN ADAMS: For a minute let's stay on the stacked reels, because I think quite a number of them are left. Our company has several. The winders are right up against the wall, and we haven't room to spread them out. When you don't have the space, you are out of luck and have to continue with the stacked type. The reels are one above the other and fixed. When this one (illustrating) comes up and is full, the paper is broken off and put on this reel, and this one, staying in its same position, is wound off on the winder, and vice versa when this one is full; that is, they can't be taken off and put on the stand over here.

When the paper is coming up on this reel, it is going off on this reel, onto the winder, and when they get close enough together here, particularly if you get a little behind on your winder and the two rolls approach close to each other, you get a very bad hazard, in that you get an inrunning nip formed that doesn't ordinarily exist.

I heard of an accident just this year where a man went through stacked reels. Of course, he was crushed to death. There is no escape from it. Would you describe how you overcome that hazard on mill stacked reels?

MR. REITER: We haven't put any guard or anything on it. We have a very strict rule. If the nip gets close, so that it is dangerous, we shut the machine down.

CHAIRMAN ADAMS: How close do you allow the rolls to come?

MR. REITER: I couldn't say offhand. We have never had to do it, but I think if it would happen to me I would use my own judgment. I know nobody would say anything if I shut it down.

SECRETARY ROBINSON: In the mill where Mr. Reiter is working they come closer than the Wisconsin law permits, namely eight inches. We do not have a guard there yet

at the Kimberly mill, but we will have one. We tried out the guard, I believe your company developed, at our Niagara mill, and, with some changes, adapted it to our machinery, and it is working fine. They are going into the other mills.

The other guard that serves to keep these reels from coming close enough together for a man to get into the nip, I believe, is the wheel that you have at your plant, isn't it, Franz?

MR. ROSEBUSH: Yes.

SECRETARY ROBINSON: That breaks the paper as soon as the distance between the two reels becomes eight inches.

CHAIRMAN ADAMS: You have a wheel right in here, Franz, and it stays there all the time?

MR. ROSEBUSH: Yes, fasten the side of the frame on sort of a balance, with a weight on one end, so the wheel just idles there and is really a balance between the two reels. They can't get closer than eight inches.

CHAIRMAN ADAMS: How many here have stacked reels in their mills? Quite a number. How many have guards on them to prevent this from occurring? (Three.) This type of guard is very effective, that Mr. Rosebush has in his mill. But we get an awful kick from production men when we try to put anything in there. Men on the machines don't like to have around the reels anything that is going to interfere with them.

I might describe what we use in our mills. It can be adapted particularly if these reels are directly above each other. We just put a bar in here, a piece of pipe, that extends across the width of the machine, and it is adjustable up and down. They can move it with a finger. It is counterweighted. The only thing it does is to serve as an immovable surface.

I remember only one accident occurring at that point where the reels did get down very close to each other. This pipe was in here, and the back tender did go into the reel of paper and was caught between the pipe and the bottom reel. He got a friction burn on his hand and was out of work for two or three days. There is one back tender who won't work around a pair of stacked reels unless he has something between them, because he knows he would have been a dead man if that pipe hadn't been there.

The advantage of the pipe is that if you

can install it satisfactorily, the production men won't kick very much because it doesn't hold up their production. In other words, it is only a two-inch pipe, and your reels can come down very close together without shutting down the machine. It does not meet the requirements of the Wisconsin law, does it, Fred?

SECRETARY ROBINSON: They gave me an interpretation saying that that would apply under their law. I didn't put it in at all until I got that interpretation.

H. L. BURNS (Carbide and Carbon Chemical Corp., South Charleston, W. Va.): I don't see how you get a burn from that pipe. We have the same thing on one of our machines. In fact, it is the one Fred speaks of; we got it from you. The pipe is counterbalanced so that a hand going in there would push it up. What position was that pipe in to make that burn?

CHAIRMAN ADAMS: The two reels were very close together, and the pipe was here. His hand went into that space between the pipe and the lower reel. It couldn't go any farther because the pipe held it from going in.

MR. BURNS: The pipe goes up against the next roll.

CHAIRMAN ADAMS: Yes. They were closed right up. He got a friction burn on the back of his hand.

MR. BURNS: Your pipe is counterbalanced so the movement any place on this pipe will raise it up?

CHAIRMAN ADAMS: That is right.

J. A. MOORE (Paterson Parchment Paper Co., Bristol, Pa.): Just this past year we had a man killed. The two reels were filled up pretty well. We were making good sized rolls. It is more or less speculation, but we assume that the tip reel broke off and the flying tail dropped down and was going to run into the lower reel. The man reached in, apparently with his left hand, to catch that, and in some way he was driven forward. The space between the two reels was just enough to snap him in, crush his skull and shoot him back out again onto the floor. He must have lain there probably two or three minutes before he was found. He wasn't dead yet. We rushed him to the hospital, and he died about two hours later.

We learned then that about two years before another man had been shot through the

rolls in the same manner, but there was enough room to shoot him through to the other side, and all it did was knock the wind out of him.

To overcome that hazard we extended the bearings of the two reels, allowing sufficient room so that if a man got in there at all it would be too wide to pull him through. Now we are negotiating for one of these revolving reels, and that, we think, will eliminate any danger of that condition again.

CHAIRMAN ADAMS: That is the cure. Do away with stacked reels.

CHAIRMAN ADAMS: Do we have any hazard in the operation of the drum reel? You know what I mean, it is a huge drum, and the reel rides and is driven by the power of the drum revolving. Has anybody had any accidents? You have those up in Minnesota and Ontario.

MR. COX: There is a certain amount of hazard there, but we don't know of any way to overcome it. We put the paper up there on the reel by hand, and the man has to be very careful and wide-awake. He follows the edge of the drum around and takes the winder side of the reel; that would be the stack side going that way. He has to take the sheet along up so it will follow the drum around.

We have stands on both sides, stacks on the winder side. When the stack side is full, you let your winder wide reel down and start on that and take your hoist. We carry five reels on each machine; that is, we can have one coming up and one on the winder and still have three spare reels.

In 1928 or '29 a man went through there. He got his arm caught. We have to carry six hands on our machine; for the size and speed, we need them. This sixth hand came over from the other side of the mill, that is the other machine. (We have two different machines, one a Canadian Dominion and the other a Bagley-Sewell, which is an American machine. This sixth hand let the reel down, instead of lifting up, and the fellow got his hand caught. He was underneath the stacked reel, putting on the winder reel, and instead of lifting it up, he let it down. It knocked the man out and broke four teeth and his collar-bone. The only thing we can figure that saved him was that when his hand went into the winder reel, the reel jumped, and the speed was enough to take him through before that reel came

back down; otherwise he would have been dead.

A third hand will put his fingers in. He will probably get a finger or two fingers caught in there and pinched. If there is any paper on the reel, it doesn't hurt very much. If it is a bare reel, you will have a pretty badly smashed finger.

MR. GLEASON: Every try to put it on with air?

MR. COX: We have never tried it.

CHAIRMAN ADAMS: There are air jets directing the paper. Some mills have this. It is a little chute like this and blows the paper right up into the space.

MR. COX: We use air in changing from one reel to the other; the only hazard we have is when taking from the stack to the reel.

CHAIRMAN ADAMS: There are several different types of drum reels. There is one important point we found in one of our mills. We had a man killed. The front end of the drum was exposed; it just happened to be that type. Most of them are guarded by equipment, that is by the framework in connection with the installation of the reel, but this front end was revolving absolutely open. You know, there are bolt-heads all around the outside of the drum. This fellow leaned against there and the motion of the drum threw him in. His head went through between the drum and the reel and, of course, he was killed instantly. We just covered that over, put a shield in front of it.

MR. SIMPSON: Is that the end of the reel or the side that was exposed?

MR. REITER: How much pressure do you use on the air, and do you use a certain type of nozzle? We have tried air on our drum reel, and we either don't use it right or there is something we don't know about it. We couldn't make it work.

CHAIRMAN ADAMS: Shooting the tail of paper where it comes off the stack onto the drum?

MR. REITER: Taking the paper from the stack to the winder reel, how do you do that?

MR. COX: Have you ever tried slacking off your belt?

MR. REITER: We haven't a belt. We have a motor on it.

MR. COX: The way we overcome that, we

use full pressure air, but we have a reel belt that we slacken off and then tighten up when changing reels. If you have a slack, it isn't so tight that it will take the pressure of the air.

CHAIRMAN ADAMS: What do you do down in the board mills when the paper comes off through the stack? What kind of reels do you have?

MR. WRIGHT: We have the single reels.

CHAIRMAN ADAMS: You don't encounter any hazards?

MR. WRIGHT: We bring the paper over the top. When we are going over the stack, we bring it clear from the top, so that a man can carry it over there without getting near the reels at all.

CHAIRMAN ADAMS: We can leave the reels now and go to the winders. There are so many different types of winders and so many different types of accidents in connection with them that I don't know just how to start. Let's take the slitters. Does anybody know of a decent slitter guard?

MR. BORAKS: We have pictures of slitter guards, winder guards, inrunning guards and all those things.

On the winder and rewinder we use a hinged barrier that moves outward as the roll builds up. There are aluminum wheels running up against the paper roll. It is made so that, being hinged, you can turn it down at right angles to the floor and get your paper off without any trouble. When you bring it halfway down through an electrical interlock, it will stop the machine. We have even used that guard and built it heavy enough so that it acts as a skid, so that you can roll the paper off on certain machines.

On the slitter we do practically the same thing. We make a hinged guard that you can raise instantly, to adjust your slitter knives without any trouble, no loss of time. We interlock that electrically, so that when you raise the hood, when the machine stops are interlocked, if it is a mechanical shift, belt or something, it would have to be brought back into place before the machine could be started. We don't have many accidents on slitters. We have a lot of them on the winders and rewinders.

It is simply a hinged guard interlocked. We find that the only one drawback to that guard is that in threading the rewinder on the start, you have to do it with the machine

stopped and bring the paper over and glue it on, or fasten it on in some way. Then you have to bring your guard up, and then you can start the machine. You can't start it otherwise. You must start threading the rewinder or winder with the machinery stationary. A lot of people don't like to do that.

MR. ROSEBUSH: Is that rewinder guard suitable for the nine-inch counter rolls?

MR. BORAKS: Yes, it doesn't make any difference.

MR. ROSEBUSH: Can you use it on a Cameron winder?

MR. BORAKS: Yes.

MR. HENDERSON: When you tip the guard back, is it heavy enough to come down on a man's toes?

MR. BORAKS: It never reaches the floor. We recommend making them light. We use duraluminum frames. Angle iron or channel stock makes a very solid, substantial frame.

MR. WINSLOW: That guard is for the in-running nip and not for the slitter.

CHAIRMAN ADAMS: He said it will fit the Cameron, that has the slitter here, as well as the other type of machine, that has the slitter on the slitter board before the drum.

MR. REITER: I wish somebody would say something about the use of rope.

CHAIRMAN ADAMS: All right, I will tell you an experience in one of our mills. The other day I met the general superintendent in front of the machines. We stood there talking, and along came a fourth hand, with a big coil of rope. He threw a loop over and let it go. He knew the roll was going to slip. They had safety collars, but they were a little bit out of kilter. That same mill, just about three years ago, was using rope on a winder to keep the roll from telescoping. A fellow got one of his fingers caught in the loop, and when it came off there was a tendon that long on it (illustrating). They didn't learn a lesson.

They are not using rope in that mill now. I think the problem is what kind of safety collar you can devise to use instead of rope.

Can anybody describe something successful?

MR. COX: We used to have that trouble with rolls slipping and the boys putting rope on, the same as you say there. Though we

had no really serious accident, it was a dangerous practice. On our shaft we put the one collar on and screw it down.

CHAIRMAN ADAMS: Do you shut down to do that?

MR. COX: We carry two shafts all the time. When we put a shaft on the stand alongside the winder, outside the guard, we have a guard running around down into the double drum and off the back drum. We have a plate guard that runs right around.

On the old style we have a collar on the one end. The others are stationary collars bolted right through the shaft. If you put a collar on your shaft and screw on your nut, a lot of times the fourth hand won't get them on tight, and if they want to tip the roll, it will start slipping.

Instead of having one collar, we have two, the first one on tight, and we take up a little bit extra; the next one we put on the same way and hold that with a wrench and slacken the other one. Then you have it tight, and it will never slip.

MR. REITER: What I had in mind is if the roll of paper starts to slip from not being started tight on the core.

CHAIRMAN ADAMS: I think there is a little more to some of our problems than there is to your problem. On some of our machines it is impossible to put a collar in place until you get three or four inches on the core, because the collar will ride on the driving drums. Isn't that right?

MR. REITER: That is right.

MR. COX: Our boxes where the shafts fit in have so much space between them and the drum. The cores go on the drums. We use two different cores. We have collars exactly the same thickness as the cores. The collars themselves are actually outside the drum. We can drop on down to the shaft. We use rider rolls up there. The shaft will go down and fit right in between the two drums. We have the space to do that, between the drum and the end of the framework, where the boxes are.

CHAIRMAN ADAMS: Can anybody help us with this other problem where we don't have that space? Here are your two drums (illustrating). Your core sits down in this position. When you start your paper on the core, that core is right down in this position, riding on those drums. If you had a collar that would keep your rolls from telescoping,

it would be like this. Your core would be up this high off your drums. When you get this much paper on your core, you can put a collar on.

MR. REITER: That is right.

CHAIRMAN ADAMS: How many use collars on their winders? (One).

MR. WRIGHT: We use a square wooden block that runs slowly until we get it large enough to put the collar on. We have never had trouble with telescoping.

CHAIRMAN ADAMS: You don't have any trouble with telescoping until it gets large enough to put your collar on. Then you shut down to do it?

MR. WRIGHT: That is right.

CHAIRMAN ADAMS: That is what they don't like to do, shut down.

MR. WRIGHT: We are on rewinders, so we have time enough to shut down to do it.

CHAIRMAN ADAMS: Has anybody had any experience with a collar that will work without shutting down? We had one, but it wasn't very successful. Most of the collars will do the trick but you have to shut your machine down to put them in.

MR. WINSLOW: We don't use rope and we don't use collars. The rolls don't slip. Why they don't, I can't tell you.

CHAIRMAN ADAMS: You are lucky.

MR. WINSLOW: It may be the type of winder, I don't know.

CHAIRMAN ADAMS: It may be the grades of paper. You go on for months, and then you get a certain grade of paper that will slip.

MR. HENDERSON: I think they use a little gummed paper to start it.

CHAIRMAN ADAMS: What I am talking about is a roll of paper when it gets up above, like that (illustrating). There is the edge of the roll. It will slip out like this.

MR. HENDERSON: You have to slip on the core first.

CHAIRMAN ADAMS: Not necessarily. The sheet will slip on itself.

MR. BAILEY: We have that trouble to some extent, but we don't use any collars or ropes. The boys take a piece of plank, two by eight, hold it against an end and hold it back.

CHAIRMAN ADAMS: You have a very

slow moving machine compared with some of our book and bond and print machines.

MR. ROSEBUSH: We use rope and two men. One man takes the end of the rope and walks up to the end of the machine as the other fellow feeds it out. One man had his thumb taken off with the rope clipping around it.

STAFFORD A. BENEDICT (Southern Advance Bag and Paper Co., Hodge, La.): I use the rope on our rewinders that come off the machine in making the back rolls. We have some rewinders in the finishing room that we use rope on. We have had the same experience that Mr. Rosebush has had. We use two men on the winders and the rewinders in the finishing room in making counter rolls. The rewinders run at such speed that we can only use one man there.

MR. BENEDICT: We found one thing to use to take the kinks, the whipping knots that might be thrown into the rope, out of it. As a secondary safety measure we have installed on our machine, on our winder that comes off the machine, two little rods, two

complete circles. The boys take the rope and throw a half-hitch around the circle, and any knot or kink will stop at the circle before it gets to their hand. They are not likely to get their hands into the rope or the shaft.

CHAIRMAN ADAMS: We are all agreed it is a hazard, but it doesn't seem to me that we have anything but the use of rope in a safe manner, or stopping the machine to put a collar on when it gets to the point where this is possible.

That would be a good problem for the engineering committee for this year.

MR. GRANT: Mr. Secretary, I would like to make a motion that we go on record as commending George Adams for the excellent way he has handled these meetings. I would also include in that motion the Chairman of the Program Committee.

MR. WINSLOW: I second the motion.

(The motion was put to a vote and carried. Chairman Adams expressed his appreciation, and the meeting was adjourned.)

ADJOURNMENT

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Secretary—H. N. BLAKESLER, American Petroleum Institute, New York, N. Y.

MONDAY AFTERNOON SESSION

October 11, 1937

The session was called to order by General Chairman A. W. Breland, Lone Star Gas Co., Dallas, Texas, who introduced the speakers and directed the discussion.

Industry's Responsibilities in Community Safety

By HENRY W. BOGGESS

Superintendent of Safety, Sinclair Prairie Oil Company, Tulsa, Okla.

During 1936 111,000 American citizens died in accidents. Sixteen per cent, or 18,000 of them, met death while employed at occupations from which they earned their livelihoods and so are called *industrial fatalities*. The remaining 93,000 accidental deaths are broadly referred to as *public fatalities*; at least, they were non-occupational.

The ratio of public to industrial deaths is more than six to one. It is obvious that the broadest need for safety is outside and not within the ranks of industry. Whether or not industry has any responsibility for these public or outside accidents, whether or not it has within its power the ability to prevent any of them, is the question.

That there is a close relationship between accident causes classed as public and those classed as industrial is recognized by all students of the subject. That relationship causes one to ponder over the right and the wrong of arbitrarily segregating industrial and public accidents. Safety men have long realized that the fundamental causes of industrial accidents differ not at all from those that kill people in the home, on the street or at the seashore. If hazardous equipment leads to injury in the plant, it will lead to the same thing on the highway or in the home.

From the standpoint of society at large there can be no basic difference between giving a green and wholly untrained industrial worker a well guarded jointer to operate and giving a green and wholly untrained citizen a modern, safe motor vehicle to operate. Trouble is potential in either instance; irretrievable loss is imminent in either case. The question should not be, "Who is responsible?"—the question should be, "Why are such foolish things done?"

It does seem that a united front should be brought to bear upon the fundamental causes of accidents as a whole: not entirely in lieu of, but at least in connection with, the many piecemeal thrusts and parries at contributing causes that are now flying in all directions. It is altogether probable that a closely knit and well organized one-front safety movement will appear on the horizon eventually.

It is readily granted that certain necessary legislation must come if safety is to grow more efficient. The Uniform Vehicle Code is an outstanding example of the right kind of legislation. Much necessary legislation will indeed be sponsored and fought for by safety men. But all such legislation must be sound and based upon scientific knowledge of the subject.

Aside from industrial safety men devotedly entering the so-called public accident field, just what else can industry do to help minimize accidents outside its gates? Just what are industry's responsibilities which it has not yet recognized and accepted?

One critical view is that the so-called technological development in this country, to which so many of our ills have been charged, is the result of research and development by American industry. It is said that through this research and development, the entire social tone of America has been changed from a Beethoven sonata to a Duke Ellington

swing. To attempt to free industry from responsibility in even the more remote reactions due to this increased national tempo would be difficult—if it could be shown that industry had both the antidote and the authority to administer it.

The thought seems to be that, having changed the environment in which men live, it would follow as a logical sequence that industry should so train men that they can live securely in that changed environment. The answer to such a charge is not difficult: The limits to which industry may go in training humans to safely use its products are very well defined by the liberties that society grants to its citizens. Factual information, detailed instructions and pointed warnings just about exhaust industrial limits. Persuasion is possible but coercion is impossible. Mandatory requirements must be left to society.

But there are criticisms that are more practical and less idealistic. It has been suggested that the individual consuming the product of industry is entitled to as much protection in its use as is the workman in its making. Unless industrial safety is a mere monetary gesture, unless it was devised and is being maintained for purely economic reasons, this thought must be accepted as true.

What right has industry to sell a farmer a water pump with ungarded gears that will sooner or later mangle his hand? What right has industry to sell a housewife a porcelain bathroom fixture that is known to frequently break and sever arteries? What right has industry to sell a road commission an asphalt road that will be slick in wet weather and result in broken necks and broken hearts?

If the water pump can be guarded; if the bathroom fixture can be made of non-breakable material; if the asphalt road can be built so that it will not be slick in wet weather, then industry should not be permitted to plead economic or competitive pressure, nor even the value of replacement business.

It will not even attempt to do so when the time comes that the accident problem is looked upon as one problem and the safety efforts of America are united in a one-front, efficient drive to stop preventable accidents without regard to where they occur.

In a few quarters, industry yet covers up behind the old English Common Law principle known as "caveat emptor" which means, "Let the buyer beware." But this is rapidly being recognized as poor morals, poor ethics

and rotten business. Letting the buyer beware has caused pain, destitution, deaths and great financial losses; it is an unchristian principle, an unprofitable practice and should become the object of every honest safety man's righteous contempt.

If it is wrong to sell poison meat that will be eaten by an innocent purchaser, it may also be wrong to sell an unsuspecting housewife a wringer that may ruin her life. Especially, when we know how to guard that wringer and fail to do so. Consumers have rights of protection which the law does not as yet recognize and it is to be hoped that industry will see to it that legislation is never necessary.

Happily, facts prove that accidents coming from industry's failure to protect consumers comprise an infinitesimal part of the whole accident problem. The number of people hurt as a direct result of using unsafe industrial products constitutes but a fractional per cent of the ten million yearly injuries. Happily, too, American industrial concerns are few and becoming fewer where safety of products is secondary to fad and fashion, secondary to competitive fears or secondary to selfish interests. Most establishments do recognize their public responsibilities. Whole industries plan, research and spend with a view of consumer protection which is equal to if not greater than the protection afforded employees.

Every individual producer of American products would make money by following the lead of the automobile industry. The development of safety in the motor car has been a very potent factor in the increased sale of it. Mr. R. H. Grant, vice-president of General Motors recently observed, "It is to the best interests of the automobile industry to do its full share in the safety movement for the sake of the public and for the preservation of its own business."

The oil industry can sell more asphalt when it insists that each and every road contractor adhere to a formula that will insure friction surface for automobile tires in wet weather. Safety among employees is not the only safety that industry can practice and make money in the bargain. And there are other angles to the monetary value of public safety, not the least of which is the increase in the number of customers that will automatically follow in the wake of truly efficient safety.

It seems difficult to realize, but it is nevertheless true, that approximately one million American people have died in accidents since

January 1, 1927. Industry has not caused these deaths, to be sure, but industry has lost because of them. Each of those million who have died in accidents since 1927, was an American customer. How many water pumps would they have bought? How many bathroom fixtures? How many automobiles? How many million gallons of gasoline and million quarts of oil?

A million dead customers in the last ten years and, unless the increase is checked, more than another million customers will be lost in the next ten years. Not only have we lost and are losing the buying power of this vast army of the world's best spenders, but the destructive effects of their deaths on those near and dear to them diminish the survivors' abilities as producers of wealth. Again, industry loses.

Social losses, industrial losses, individual losses due to accidents comprise an unexplored field. After twenty-five years of organized efforts, it is evident that entirely too little is known of the economics of safety. We know, to be sure, that the accidental dead are but a small part of the economic loss compared to the millions that have been permanently and totally disabled and most of whom, coincident with their injuries, not only stop producing but, what is worse, start sapping wealth—and compared to the millions sustaining less consequential but nevertheless costly injuries—and compared to the untold, the unknown losses in property.

Even in the absence of scientific treatment of the subject, it is quite obvious that industry cannot exist without society and that anything that seriously harms society and affects its well-being is also a hindrance and an encumbrance to industry. To preserve itself, industry must interest itself in those influences that are detrimental to the social structure. Thus, of all of industry's responsibilities, the duty of self-preservation points as strongly as any other to the necessity for increased community safety.

It may seem that the tone of this discussion has pointed to the importance and the value of money in the campaign for the conservation of human life and limb. Certainly, it is understood that the safety of to-day and tomorrow is only partly dependent upon financing and it should not be inferred that such responsibilities as properly belong to industry are confined to money. The future progress of safety is more dependent upon the men who carry its banner than upon the dollars that pay its way. Inasmuch as industry develops

and employs eight-tenths of all men devoting their lives to accident prevention, its contribution in leadership in safety is of utmost importance.

As an illustration, there seems to be a general belief that, inasmuch as the accident problem came to the front rapidly, grew to alarming proportions by leaps and bounds, it can be subdued quite as suddenly. Nothing could be farther from the truth. The rapidity with which the menace of accidents has arisen does not by any stretch of the imagination infer that it will end quite as quickly. The accident problem is definitely destined to follow in the footsteps of the human race, as long as it remains a mechanized race, even onto the very brink of eternity.

Safety men, unequipped as they are today, cannot be expected to suddenly solve a problem of such magnitude as the accident problem; they will do exceedingly well to mollify its full force and effect a hundred years from

now. One of the more important things that exponents of safety can do to-day is to prepare for tomorrow; they can lay a firm foundation for safety so that the generations of tomorrow and all of the tomorrows to come may add to, detract from and otherwise improve upon the science that is now in the process of formation. And this thought, unimportant as it may seem, is uttered with the full meaning that the words imply.

To-day, there should be a code of ethics to guide us and to point out pitfalls for those who will take our places tomorrow; we need such a code as much for ourselves as for the generations to come. We need to agree upon our objectives, we need to understand our purposes, we need to respect our responsibilities and we need to bind ourselves together to faithfully fulfill them. A code of ethics for exponents of safety would dispel petty misunderstandings, solidify efforts and imbue all of us with the spirit of human service which is our only real reason for existence.

The Worker's Health in the Petroleum Industry

By G. E. KASSEBAUM, M.D.

El Dorado, Kansas

Four major divisions of the oil industry combine to bring the oil and its varied products to the public.

1. Production, with its geological, drilling and pumping operations.
2. Transportation, with its pipe-lines, pump stations; ships with their terminal facilities, automobiles with their garages and tank cars with their shops.
3. Refining with its stills, natural gasoline, grease, and other plants, tank farms, test and research laboratories.
4. Marketing, with its storage tanks, ware-houses and service stations.

One hazard is common to all four major divisions—gas fumes, which are given off by the oil and its products. The effect of these is not so much incipient and cumulative, as it is sudden, due to the nature of the poisons in the gases. We have several kinds—the gaseous hydrocarbons such as butane, methane, propane, and ethane. These groups are harmful to health. They act as asphyxiants

and irritants—and even in small quantities are poisonous.

The hydrocarbons in gaseous form are found more in natural gas and refining gas than in crude petroleum. Their composition is related to the temperature, consequently appreciable quantities are not present until the temperature is near the boiling point. Air atmosphere containing small amounts of hydrocarbon gas may be considered dangerous. Then we may have hydrogen sulphide in petroleum or its products. Here is a real health hazard, for its poisonous effects are well known—even when the air contains only 0.0005 per cent. This is commonly known as "sour gas" and fortunately is found in but few oil districts. The light oils in Mexico have the highest per cent. Those in Ohio and the Mid-continent fields have considerably less, while scarcely any is found in the oils in California.

Carbon dioxide, of course, is here, there and anywhere, because it is the chief product of complete combustion. It is found

primarily at all wells, in wash gases, from furnaces, and engines. This gas is not considered deleterious to health—but it surely will put one out if he gets enough of it and the recipient remains sick for several days.

Unlike carbon dioxide—carbon monoxide is one of the most insidious of the poisonous gases. It is produced by the burning of carbon containing materials such as natural gas, coal coke, wood or gasoline whenever the supply of air is not sufficient for complete combustion. Due to the outdoor nature of the oil industry and proper disposal of the waste, concentrations of this gas are not likely to occur.

Sulphur dioxide is a product of combustion when sulphur or any fuel containing sulphur or sulphide is burned, and it is the chief irritant present in flue gases when natural gas or any gas containing hydrogen sulphide is used as fuel. It is also formed when lubricating oils are treated with sulphuric acid. It is used as a treating agent in purifying gasoline, kerosene and lubricating oils—so is primarily used in refineries. It is handled in cylinders, as it is poisonous in very small concentrations. It is so irritating to the eyes and lungs in minute quantities that it warns a person of its presence.

In refining—add to the gases and vapors already described, ammonia and chlorine. This will complete the gas hazards of refinery workers. What has been said about the other gases holds true for these also. They present primarily accidental hazards—and not health hazards as we define them. Ammonia and chlorine, however, inhaled over a period of time will produce a chronic catarrhal condition of the respiratory passage. They should therefore be kept in their proper tanks and storage vessels and all leaks prevented. If necessary to be exposed to the gases, of course, the proper gas masks should be provided—and the worker will remain healthy and safe.

Another hazard claimed to be common to all the major divisions is the production of skin rashes, and acne from direct contact with oil or its products. This affects employees in varying degrees. Some not at all, while others cannot be allowed to work in contact with oil or its products. However—this is not a hazard of oil *per se* but rather a special sensitivity of the individual. I occasionally see cases of this type and in

nearly all there is a history of allergy in some form and these people just happen to develop more sensitivity to those substances than the average individual.

Then there is the question of acne—so called petroleum acne. Frequently these cases come to my attention. Here again is a condition that is easily preventable. Invariably it is seen in an employee who is slovenly in his personal care and hygiene. He finds the oil accumulations difficult to remove so makes little more than superficial effort to do so—consequently his skin is not thoroughly cleansed for weeks at a time. He frequently looks as though he is made up for a stage appearance with the dark shadows around his eyes and ears and in the hair line.

Eventually the pores of the skin revolt—lesions form due to the infection dammed up, pustules develop and all stages of the condition become apparent. Proper cleansing of the skin will prevent all of this.

Now let us survey the hazards incident to the production division. If you stand on the floor of an oil rig while drilling you are impressed with the possibilities of the accidental hazards. But what about health? Well, the men seem healthy, they are out in the open, subject to fine sailing and fair weather—but also they stay there through wind or rain, heat or cold, day or night.

Theoretically such exposure is certainly not conducive to good health. These men however develop into a hardy lot and while they are subject to many of the upper respiratory diseases, yet we find comparatively few cases of pneumonia. The less severe respiratory maladies seem to build up an immunity which gives them protection from the more serious diseases. The cases of pneumonia among the field men are far less than in the office worker or in the families of these men.

I found that in 683 of my consultations with field workers, 314 or about half were for respiratory infections, influenza, colds, bronchitis, grippé, etc., and only 15 cases of pneumonia. Now in 469 time loss illnesses among refinery workers exclusively there were 199 respiratory infections, or about one-fourth of the total and 15 of these were pneumonia. In another group of 506 consultations with other than petroleum workers 175 were for respiratory infections and 31 for pneumonia.

You will see there are a great many more respiratory infections of all types among the field workers. After a careful study I have come to believe that much of this is due to the housing conditions existent in most of the oil fields. At best they are inadequate. These men throw aside their heavy clothing worn in the field and lounge around in drafty cold houses. The frail construction of these houses makes proper heating difficult and certainly increases the respiratory health hazards of the employee. Most of these houses are constructed by the oil companies during a boom because there is no place for the workers to live. Usually considered temporary dwellings they are very poorly constructed. Practically they turn out to be quite permanent dwellings in most fields. This condition exists in nearly all of the housing in production departments and to a certain extent in the refining department.

Should companies furnish satisfactory housing they would be far ahead in the end because it would greatly reduce the time loss illnesses with the attendant loss in training new or temporary help to carry on the same work. Thus the industry by assuming its obligations regarding their employees' health is in reality improving its own efficiency and production.

The repeated exposure of the eyes to foreign bodies and chemical irritants may be detrimental to vision. Frequent washing of the drill pipe and greasing of cables reduces this hazard in the case of the drillers and tool dressers; but it is still present to some extent. These workers, as well as the pumpers, roustabouts, and gaugers are also in contact with various chemicals, such as pronax, tretalite, caustic soda, tannic and hydrochloric acids. There also is the dirt from blowing dust which is constantly present in out of door work. These factors create an accident hazard primarily, but by constant recurrent irritation it may mean a definite health hazard as to vision. We frequently have to treat eyes because of the above conditions and not uncommonly we see cases of trachoma following such situations. Reduction of this hazard of course will follow in the wake of safety education and proper equipment.

Pumpers and roustabouts are quite free from further health hazards after those due to natural elements are eliminated. Regulation of health habits is sometimes difficult

for production and refinery workers because of shift work.

In the transportation department the main hazard is exposure to gases and vapors. Storage tanks, reservoirs, railroad tank cars—pipe lines and their pumps have to be cleaned. Opening them up to fresh air, washing them down and steaming them out is not always enough. It must be possible to have through and through ventilation. The gauger or workman may inhale enough fumes from a man hole to make him ill, but the main danger is not there—nor is it a full tank, but rather the partially filled or empty tank where there is room for an accumulation of gas. This gas, usually a mixture of petroleum vapors and hydrogen sulphide, is very deadly and works very rapidly. It is both asphyxiant and irritant.

There are other materials used in oil production that may prove to be health hazards, such as sand, lead, tar, acid and alkalis. Sand and carbon black may produce a silicosis. Lead in the form of tetra ethyl lead is very hazardous—but it is handled in a certain prescribed manner so that the oil worker has little contact with it in poisonous quantities. The finished product is received at the refineries in tanks and under supervision of the Ethyl gasoline corporation. It is mixed into the gasoline by specially selected workers.

It is interesting to study the following analyses of three comparative tables. The first table is taken from the files of a mutual health insurance organization of a local refinery.

Of 469 consecutive time loss illnesses, we find most prevalent the following 10 conditions: influenza 156, tonsillitis 41, appendicitis 30, gastro-enteritis 34, bronchitis 18, sinusitis 13, arthritis 14, hemorrhoids 13, pneumonia 37, and peri-rectal abscess 10.

The next table covers 683 private consultations in all walks of life. Here the conditions were influenza 180, common colds, 75, tonsillitis 53, bronchitis 38, pneumonia 18, sinusitis 31, grippé 30, heart disease 18, syphilis 10, hypertension 22.

The third group is one of 503 private consultations with oil workers only. Here we find influenza again at the top with 130 cases, colds 56, tonsillitis 46, pneumonia 15,

bronchitis 24, grippe 22, hypcet 22, heart disease 18, zonha 15 and sinusitis 15.

Here we find no great difference in the diseases of the refinery workers, the field workers and the community at large aside from the respiratory infections. These seem to be more prevalent among the field workers, probably because of their exposure to the elements. More predominantly on the increase seems to be sinusitis. All of these conditions have quite likely been aggravated to a great extent in the midcontinent field by the severe dust storms of the past few years.

Next but by no means less important is the problem of venereal disease. With the recent drive being made by Surgeon General Parran of U.S.P.H.S. against syphilis it would be a colossal mistake not to talk about it. Dr. Parran claims that one in every 10 adults has syphilis. To me it has been an interesting phase of my work. Early in the development of the field with the great influx of new people in the community the incidence of syphilis was quite high, but as new development subsided and the field settles down to a pumping field primarily—the incidence of syphilis has dropped nearly 50 per cent. Whether this is due to the fact that during boom days prostitution rides high and with a shifting of developments to new fields, the prostitute moves on or whether people who develop new production are more loose in their sexual activities is a question. But even at that it seems that syphilis is very prevalent among oil field workers.

To tell a wage earner in these times of small wage income that he needs treatments for syphilis is creating a great mental hazard unless treatment can be obtained at very low cost.

Furthermore, the majority of cases are past 40 years of age, married and have families. Thus social as well as mental and financial problems are created. Here then is a large overwhelming problem. What are we going to do about it?

At the same time we must mention gonorrhea. It is probably three times more prevalent than syphilis. The symptoms of this disease are more acute and disabling in the early part of the disease; consequently the sufferer seeks medication. Gonorrhea causes a great deal of time loss illness—however the employer is little aware of it

because the employee never reports the true cause of his absence. Here again is created a social as well as a physical and economic problem. And an answer should be sought.

Successful industry depends largely upon the mental and physical fitness of its employees. It is conservatively estimated that it costs approximately \$200 to train an employee. Naturally then time loss illnesses are expensive.

Much has been said about preventive medicine. It is not sufficient for industry to make safe all supplies and equipment within its gates—as more than two-thirds of the employee's time is spent elsewhere. Hence it is necessary to visualize—first his home and then his places of recreation.

Is the home comfortable, clean, does it keep out the elements, and can it be properly and adequately heated? These factors should be considered when the company undertakes building projects in a new field and will greatly reduce the illnesses due to improper exposure to the elements. Is the water supply good? Are the members of the family including the wage earner well nourished? If not, why not? Perhaps education along the lines of budgeting and spending should be provided.

Notation should be made of the use which the employee makes of his spare time and the kinds of recreation he pursues. Too much idle time leads to mental unrest and improper recreation often makes an inefficient employee. This is already being cared for in some places through the introduction of interdepartmental sport competition, i. e. soft ball, baseball, howling, golf, etc. First aid classes and team competition are offered and are in many places compulsory. To thus occupy a man's time improves not only his knowledge of such things but dispels his mental torpor as well and helps to keep his thinking straight. To this we might add instruction in hygiene. Such provision would go a long way in solving the problem of venereal diseases. Such instruction should be frank open discussion so all classes of employees would be able to understand.

Periodic examinations of employees should be made with a follow up to see that defects are remedied. The examinations should not be made with the idea of discharging the defective—but to encourage the removal of defects as are found and

thus prevent many time loss illnesses. This would create an improvement in the mental outlook of the employee and would materi-

ally help in controlling venereal disease as the course and progress of same could be watched.

Can the Safety Engineer Make Effective Motion Pictures?— What One Company Has Done

By A. L. ANDERSON

Standard Oil Company of California, San Francisco

I wonder how many of you have played with the idea of making safety motion pictures but have given it up saying, "We haven't the staff to handle it—we haven't the facilities or the equipment—the cost would be too great."

You need not have given up the idea.

If the cost of a safety picture made by a professional producer is beyond the limits of the safety budget, the safety engineer can, in my opinion, make effective motion pictures at reasonable cost by using amateur equipment and methods. Of course, his picture will not compare in quality with the photography and editing of one made with Hollywood type cameras and professional personnel. It will, however, put over his safety ideas in an interesting effective manner. There is one thing in favor of the safety engineer—he knows his subject better than the professional photographer.

I will try to support my statements by telling you about a picture I made. I had had no previous experience in motion picture making, but thought we could use motion pictures in our safety educational work. A limited budget made it necessary that I write the scenario, direct the acting, take the pictures, make the animated diagrams and do the editing, in fact the entire job.

Of course, having no knowledge of the technique of making motion pictures, I found it necessary to do some studying before starting the work. Making the picture was not easy, but it was interesting work and we were amply repaid by the increased attendance at safety meetings and by the greater interest shown.

The making of the picture was not a special job. It was made during the course

of routine work. The scenes were photographed at various points during regular inspection trips. Material is being gathered for our next picture while the present one is being shown.

We believe that what we have done any safety engineer can do.

To those among you who have already made safety motion pictures, what I have said is not new. I can only hope you may carry away a useable idea. The motion picture was made during the reenactment of motor vehicle accidents by the use of toy automobiles on diagrams drawn to scale, the toys traveling at actual speeds on the basis of the scale. This was done by means of stop-motion photography.

You may be interested in knowing why our men like this type of safety picture. They like it because it is based on fact—reenactments of our own accidents. The actors are not professionals, and that is another reason our employees like the picture. They like to see themselves and their fellow workmen on the screen. We try to include a scene or two from each district.

The picture was made for our sales department, but was shown by request in nearly every department of the company.

Please don't think that Standard Oil men are a bunch of careless and reckless drivers. In our picture we show two or three serious accidents we had in one year, but please keep in mind that we drove 3,100 vehicles 40 million miles on all kinds of roads and in all kinds of weather. Under the circumstances, some accidents were to be expected. The picture was made to teach our men the need for safety.

TUESDAY AFTERNOON SESSION

October 12, 1937

Efficiency and Safety in Oil Field Transportation

By J. U. TEAGUE

Petroleum Engineer, Humble Oil & Refining Co., Houston, Texas

It is a matter of record that wells are being drilled deeper and faster and at a lower unit cost today than ever before; but what has this new efficiency meant in accident prevention? Some of the most important safety problems are found in field transportation.

A well organized and operated field transportation system is absolutely essential to conduct a major drilling program effectively. Drilling rigs must be moved from a completed well to a new location and necessary supplies must be delivered under all weather conditions, day or night, and without interruption. This in itself is a huge task and certainly one of the most hazardous of field operations.

Moving the average heavy duty rig requires the handling of about twenty large truck loads of machinery weighing nearly one-half million pounds. The time element is important; the move must be completed in from four to six hours in order not to delay the drilling crews. Another half million pounds of pipe and supplies must be delivered to the well while it is being drilled. How well this problem is being met is illustrated by the decrease in time required to dismantle, move and reassemble the drilling rigs in one of the typical Gulf Coast fields.

There have been 175 wells drilled in this field by one operator. On the first ten wells drilled, these operations required 5.4 days; on the middle ten, 1.9 days, and on the last ten, only 1.4 days.

Several factors have been primarily responsible for this increased efficiency.

1. Improvement in design and arrangement of drilling equipment.
2. Improved transportation equipment and methods.
3. Most important of all, the promotion

of better cooperation among the field personnel.

Drilling Equipment

The most important changes made in drilling equipment are the unitization of equipment and the adoption of standard procedures for dismantling, moving and assembling the rigs.

Whenever the nature of the equipment permitted, the various pieces have been assembled into units designed to increase their portability. This has simplified transportation by decreasing the number of loads to be handled, and it has furthered the safety of operation by decreasing the number of individual pieces of equipment to be handled by hand.

Equally as important in simplifying rig moving, as well as reducing the hazards of the operation, has been the development of standard procedures for dismantling, moving and assembling equipment. Special attention has been paid to the elimination of all unnecessary equipment and the arrangement of essential pieces so that they are easily accessible to the drilling and transportation crews.

For example, the procedure followed in dismantling the rig, after the well has been completed, is to strip the derrick of all hoisting equipment first. The rotary, crown block, travelling block, rotary hose and swivel are laid into a specially constructed rack. This is done while the well is being washed in. As soon as the well starts producing, the drawworks, slush pumps and boilers are dismantled. The smaller pieces of equipment such as valves, pipe fittings and bolts are placed in special steel boxes which can be easily handled. As each piece of equipment is dismantled, it is placed at a predetermined location, easily accessible for

loading, and when it is moved, it is unloaded in the same position. The equipment is moved from the completed well to the new location in the same order that it is to be assembled. It is customary to begin with the boilers, then the slush pumps, and last the drawworks and engine. This moving schedule eliminates congestion of transportation facilities at the old location, and at the same time assures the arrival of the equipment at the new location in the order needed.

The adoption of this standard procedure has promoted closer cooperation between the drilling and transportation crews. Each man knows precisely what his duties are and how he can best do them to insure safety in the quick completion of the job.

An incident which occurred in the Conroe field several years ago illustrates how doing things in a systematic manner appeals to the men. We were doing the preliminary work toward developing a more satisfactory method of moving drilling rigs. As the idea was new, on the first move made each man was given an instruction sheet outlining his specific duties and it was explained to him

that perfect coordination of efforts was necessary if the plan was to succeed. Shortly after this move, some other work came up and several of the men came to the office and requested that they be given "slips of paper" on that job too. The adoption of systematic procedure of operation, together with full explanation to the men why the procedure is followed, has aroused a spirit of team work among the personnel which has been of prime importance in increasing the efficiency of transportation.

Transportation Equipment

The development of large tractors and trucks with four wheel and tandem drives, has been an important factor in achieving speed in transportation. The trend toward deeper drilling has necessitated the construction of heavier drilling equipment which can be handled successfully only by heavy duty transportation equipment. This equipment has also permitted the grouping of related pieces of equipment into large loads, which reduces the total number of loads and unnecessary handling.

Transportation Equipment and Loads Handled in Typical Heavy Duty Rig Moves

Equipment No.	Pieces	Type	Loads Handled No.	Nature of Loads
2	95	HP tractors with 2 tractor wagons	2 (1 each)	Boilers, Engine and Engine Platform
1	10	ton truck	4	Rotary, drawworks, slush pumps, crown and travelling blocks and other heavy equipment
3	1½	ton truck	15 (5 each)	Light equipment, piping, accessories, etc.
2	Crane trucks		—	Assisting in loading and unloading trucks and handling equipment for drilling crews

This equipment moves the drilling rig as fast as the drilling crews can dismantle and reassemble it, and avoids the confusion of having too many trucks and tractors standing idle waiting on loads.

Other items and practices which have contributed to safe and efficient performance are: the development of special racks and skids for grouping small pieces of equipment; installation of guards for the safety and convenience of truck operators; the use of gas flares for lighting the location

when rig moves are performed at night; and the frequent inspection and maintenance of automotive equipment.

Field Roads and Drainage

Regardless of how well formulated the moving program may be or how adequate the transportation facilities, reliable transportation depends on a well planned field road system.

First it is necessary to determine to some

extent the trend of the field. Afterwards, permanent roads may be constructed which will give access to all the wells to be drilled. When diversified lease ownership makes it difficult for one operator to build a satisfactory road system for properties, a system may be worked out for an entire field by cooperation among the various operators.

In most cases an all-weather road system may be constructed economically. In the coastal area where the terrain is comparatively flat a suitable road with a gravel or shell topping can be built for \$5,000 to \$6,000 a mile. To supplement the permanent road system a temporary board roadway may be built from the road to the well location. After completing the well the board road is taken up and used for another location.

In areas not naturally well drained it is advantageous to provide artificial drainage to care for normal rainfall. The cost of these systems in most cases has been moderate, and the investment more than returned by uninterrupted field operations during the rainy seasons.

Cooperation of Personnel

The cooperation of the personnel has probably been the greatest single factor in attaining the present degree of efficiency in oil field transportation. In our own company an extensive program of developing better cooperation has been under way for some time, with encouraging results.

In addition to developing standard procedures of doing things, regular safety meetings are held, individual initiative is encouraged and a closer relationship between the supervisor and his men is promoted. Each department has its own safety meeting at least once a month and more often if necessary, where the ways of doing work more efficiently and safely are discussed. The chairman of these meetings is a member of the group, selected periodically by popular vote. There is a safety engineer available to assist the chairman in planning the meetings. Everything possible is done to promote a free discussion among the men.

It is significant that from these discussions have come many of the ideas which have been incorporated in the standard procedure. A general safety meeting, which all departments in the field attend, is held periodically. Although more formal than the

meetings held by individual groups, it is to promote a better understanding and closer relationship between the men in the various departments.

In addition to the safety meetings, foremen's meetings are held monthly at which the superintendent and the foremen of the various departments discuss their operating and personnel problems. The better understanding which results is revealed in the conversation I had with one of the transportation foremen recently.

I asked him how he went about handling a new job which his men were not familiar with. He said that the crew selected to do the work had a five or ten minute meeting with him in which they discussed the details of the job and how it might be done most effectively. This supervisor insisted that I go out to the garage with him and look at some of the devices his men had worked out. He went over in detail with me each device, how the men had made it, and what its advantages were. He displayed a personal pride in what his men had been able to accomplish.

The initiative of the individual worker has also been encouraged with gratifying results. Our own company has a "Coin-Your-Ideas" program, which gives monetary awards for worthwhile ideas submitted by the men. This plan has brought out ideas which have proved of real benefit to the company's operations and at the same time has had the result of increasing the interest of the worker in his job. A man who has developed a device, takes a pride in its success and consequently becomes more interested in his job as a whole. We have used many ideas developed by the men which were of somewhat doubtful operating value simply to encourage them to take a greater interest in their work.

Safety and Efficiency

The natural question is, what has been the actual safety experience since these methods were adopted?

In 1935, during 32 rig moves, one accident occurred in every eight moves; in 1936, 92 rig moves were performed with one accident occurring in every 13 moves; and so far in 1937, 51 rig moves have been performed with an accident frequency of only one in 17 moves.

Unusual Refinery Accidents

By R. T. HENDERSON

Safety Engineer, The Standard Oil Company of Ohio, Cleveland

Cable Failure

Men were preparing equipment to paint steel stack after inspecting cable by attaching rope to one end and pulling other end to ground. One end of rope falls was then attached to other end of cable and cable was pulled back so that block of rope falls touched hanger on top of chimney. Boatwain chair attached to other end of block falls was then tested by two men springing their weight on it and painter then sat on boatwain chair and was hauled up the stack. When 68 feet above ground, the ropes fouled and it was necessary to stop and free them. When freed, hoisting was resumed and after being pulled up several feet the cable supporting the rope falls broke just below the supporting hook on the stack and the painter fell to the ground, dying shortly after of his injuries.

Investigation disclosed that a seven strand guy cable was used and three outer strands at the break were projecting away from the cable and the rest were wound together so tight they showed discoloration from heat. Apparently when the falls fouled a twisting strain was transmitted to the cable, which was not designed for strains of that kind and the cable failed.

In this case the wrong kind of cable was used and no swivel was placed between the cable and the rope falls.

Chemical Poisoning

Chemist in control laboratory had a small amount of aniline oil in a test tube and he accidentally cracked the bottom of the tube. A few drops of aniline oil dropped on his shirt over his stomach but he did nothing about it.

In the course of an hour the men working with him noticed his lips, finger nails and tongue had turned blue. He was immediately taken to a doctor who ordered him to a hospital and after remaining there several days was released.

In this case the aniline oil was readily absorbed by the skin and, if enough had been absorbed, death would have resulted.

The only remedy for accidents of this type is to see that laboratory men wear protective clothing, such as rubber aprons and gloves,

immediately remove clothing on which poisons of this type have been spilled and wash the skin thoroughly as soon as possible.

A periodical safety discussion by the laboratory staff of the methods of analysis and chemicals used will develop methods of protecting the men as well as keeping the risks involved in their minds.

Gas Explosion

Equipment consisted of centrifugal water pumps located in a pit in a pump house circulating water from cooling tower through coolers at D. & S. Plant and discharging back into tower sprays. Electrical equipment in water pump house consisted of a 2300 volt, 150 H. P. synchronous motor with push button control starter switch of type as installed in non-hazardous areas.

The water pump had lost suction about 6:30 P. M. and again at 8:00 P. M. Procedure of starting pump both times was to close suction valve and vent the pump through $\frac{1}{2}$ " valve on top of pump. After pump was started the second time, the operator noticed strong gas fumes in the pump room and walked over to pump motor switch to shut the current off. As he touched the switch an explosion occurred, wrecking one side of the building. The operator was painfully burned and injured by flying bricks.

The cause of the accident was a leak in the water cooler which allowed light gasoline at 300 pounds pressure to leak into the water circulating system operating at 80 pounds pressure and accumulate in the pump which caused loss of suction.

Remedy would be to install explosion proof motors and electrical equipment in the pump rooms of this type and extend all pump vents to outside of the building to vent any gas to the open air.

Explosion in Tank Car

Loading rack man was steaming out tank car to remove several inches of ice in the bottom. After ten minutes steaming the steam was turned off and a violent explosion occurred in the tank, burning the rack man slightly.

Investigation showed that the steaming out line consisted of a piece of $\frac{3}{4}$ " pipe a foot shorter than the car diameter with a tee on the bottom end and two nipples 10" long screwed into the run of the tee. When the steam out line was placed in the car tank the lower end was insulated from the car by the ice in the bottom of the tank and the top of the line was insulated from the car with the rubber covered steam hose. When the steam was turned on, it may have kicked the end of the pipe away from the shell of the car and when the steam was turned off the pipe probably charged with electricity by the steam jets swung over and touched the car shell and the static spark ignited the gas fumes in the car. While it is hard to see where there could be enough air in the car tank after the steaming operation, air may have entered through the bottom outlet.

The answer to a case of this kind seems to be that the pipe extending to the bottom of the car be long enough to touch the top manhole opening, thereby grounding the steam out line at the dome manhole.

Explosion of Boiler Fan

Just previous to the time the fireman was injured, the steam pressure at the boiler house was somewhat high, and it was decided to bank No. 9 boiler. The engineer in charge instructed the fireman to shut down this boiler. The fireman proceeded to No. 2 boiler first to examine the coal feeder in connection with the burning of pulverized fuel, and as he was standing in front of No. 2 boiler, he reports that he heard a noise at No. 9 boiler, and saw a piece of metal fly from the location of the forced draft fan into the passageway between boilers 9 and 10. He hastened to No. 9 boiler for the purpose of shutting off the steam supply valve to the fan.

However, just as he was about to reach for the valve, which was located over the fan, an explosion occurred to the steam turbine which resulted in completely wrecking the turbine, tearing off the door to the turbine location and fragments of flying metal striking fireman. His engineer's attention was immediately attracted, and he shut the steam off the turbine by going up on top of the boiler. He then removed the fireman from the passageway between the boilers where he was lying, and made arrangements to have him taken to the hospital.

The equipment, consisting of turbine and

fan, was very badly damaged; in fact, the blades of the fan were all broken off into small pieces and scattered about. We have recently had a representative of a Blower Co. visit our plant and give his opinion as to the cause of the accident. This man informs us that this is the first accident of this nature that they have ever had or heard of, and it is his opinion that the blades of the fan must have broken first, which allowed the turbine to run wild, and that this threw such an extensive load on the turbine that the turbine itself exploded.

We, ourselves, cannot see any possibility of anything striking the blades in the fan, which was screened in. However, our machinist foreman suggested that it might possibly have been caused by an accumulation of dust upon the fan blades, and he has suggested that we arrange to shut down the fans once a week, and blow off the grease, dust, etc., by means of a steam hose, and our boiler house foreman has been instructed to carry out this procedure.

We might advise that in the past, upon several occasions, we have found cracks in the blades of the fans. Upon one or two occasions we have found that one of the blades have been broken, however, this has never been accompanied by any damage to the turbine itself.

We had considered the possibility of the shaft driving the fan breaking, due to crystallization, probably caused by lack of lubrication. However, upon inspecting the fan after the accident occurred, it would appear that the bearing was receiving sufficient lubrication.

Laboratory Explosion

A chemist was making a test of freezing point of a sample of aviation gasoline. Apparatus and materials used consisted of a closed one quart thermos bottle containing liquid air. The bottle was provided with a two-hole stopper, to one outlet of which was connected an aspirator bulb, the other hole being used for a siphon tube leading from the bottom of the bottle to a copper liquid evaporator cell $4\frac{1}{2}$ " long and 5 cu. in. in volume. An outlet tube led from the evaporator cell to atmosphere. The evaporator was immersed in a bath of petroleum ether, contained in a wide-mouth thermos bottle. A test tube containing 40 CC. of aviation gasoline, in which was immersed a thermo-coupler,

was also immersed in the petroleum ether bath. A small copper rod was used to stir the aviation gasoline. The liquid air in use had been weathered to some extent, and was probably almost pure oxygen.

Shortly after the operator had started to pump the liquid air or oxygen through the evaporator by applying pressure from the aspirator bulb to the surface of the fluid in the first thermos bottle, a violent explosion occurred inside the evaporator. The apparatus was totally wrecked, petroleum ether and gasoline were scattered around and ignited and the chemist was rather severely burned.

Investigation disclosed no apparent source of ignition in the vicinity. Fragments of the evaporator indicated that it had been repaired by soldering, and it is presumed that sufficient petroleum ether had leaked into the evaporator to provide an explosive mixture of ether vapor and oxygen. Ignition may have resulted from rapid oxidation of some foreign material, such as resin, remaining inside the evaporator after the soldering had been done. This, however, is pure conjecture.

In order to avoid similar occurrences, in the future, pure liquid nitrogen will be used as a cooling agent wherever it can be obtained, and investigations are being made of the feasibility of developing small motor-driven refrigerator equipment with portable coils and a totally enclosed system, by which such work can be accomplished. (A.P.I. Fire Protection Circular No. 24.)

Explosion While Welding Tank

A 115 foot tank, in which gas-oil was stored, was found to be leaking. Examination disclosed that its bottom had corroded so that the oil leaked out. The tank was blanketed, steamed, cleaned, washed and gas freed; and an electric welder was sent inside to weld the holes. Welder had been working some thirty minutes or so when a sharp report under where he was at work was heard, following which the tank vibrated quite noticeably. The welder, uninjured, came out of the tank immediately and awaited instructions as to what procedure should be followed.

After investigations, it was concluded that oil which had leaked through the corroded places in the tank's bottom had been pocketed underneath and heat from the electric arc (or possibly sparks falling through the holes) had ignited the oil or gas, causing a minor

explosion. Instructions were issued to drill holes through the bulged places of the tank bottom and steam thoroughly through these holes to free the pockets of any oil or gas before the hot work was resumed.

While the occurrence was of a minor nature, it would seem to be advisable, before doing hot work on a bottom of a tank having contained volatile stocks, to steam thoroughly the pockets on the underside of the bottom.

Gas Free—But

Man was preparing face of flange on the bottom manhead nozzle of Evaporator Tower, prior to bolting up the head, when he was blown off scaffold to the ground, probably due to explosion in vapor line which was transmitted through tower to the open manhead. The explosion was apparently due to welder working on outside of vapor pipe, same getting red hot. Line had been gas freed. New gas was formed, apparently from scum or grease on side of vapor pipe.

Tests made on similar towers have since proved that vessels once completely gas freed may become explosive again due to release of gas from apparently solid scum or grease sticking to side of vessel or pipe. This material is such that steaming or washing with water at time of gas freeing will not always remove it.

Danger of Unanchored Lines

A recent accident in an eastern refinery in which three men suffered fractured legs and the fourth a fractured skull clearly points out the danger attendant to steaming or blowing out plugged lines when the ends have not been securely anchored.

Three men had parted a plugged wax line and turned on the steam, retiring to a presumably safe distance to protect themselves from hot wax or steam when the line opened. A few seconds after the steam was turned on, the pressure caused the line to whip, striking the four employees.

All parted lines should be securely anchored, to prevent line whipping, before pressure is turned on.

Carbon Monoxide

A sand-blast operator was found unconscious on the floor of a sand-blast room in a plant. His mask was removed and he was taken immediately to the plant hospital where

artificial respiration was given and an oxygen inhalator applied. He never recovered consciousness and his death was pronounced due to carbon monoxide.

The report states that this operator was wearing the approved type sand-blasting helmet supplied with air from the compressor air line used for the operation of the sand-blasting equipment.

An examination of the compressor revealed that a valve had broken on the high pressure side. It was, therefore, concluded that the air, while passing back and forth through the broken valve, raised the temperature sufficient to ignite the lubricating oil and carbon deposit in the cylinder. The carbon burning with a deficiency of oxygen produced carbon monoxide gas together with other fumes which were passed through the air system to the sand-blaster's helmet.

In checking into this explosion, I found that the chief chemist was preparing to run a B.T.U. test on a sample of coal and had hooked up his bomb calorimeter to the oxygen system. However, after turning on the oxygen he found that there was insufficient pressure in the present tank to produce 30 atmospheres of pressure in the bomb. He therefore shut off the valve adjacent to the bomb and requested that the oxygen supply tank be replaced with a new tank. The supply tank is located outside of the laboratory and the oxygen is piped into the laboratory through a system of steel valves and piping. Full tank pressure of 2,000# per square inch is carried in this system up to the pressure regulator located at the calorimeter.

The valves in the oxygen system were shut off on the outside of the building while the boiler-makers changed the oxygen tank. After tying in the new tank, the valves in the system were opened first, after which the valve

on the oxygen tank was slowly cracked open. Immediately after this valve was opened, an explosion took place within the line, which blew all of the fittings apart and completely wrecked the entire piping system up to the calorimeter bomb. Luckily, no one was hurt by this explosion and the only damage was to the oxygen system itself.

The investigation indicated that undoubtedly the cause of this explosion was the use of oil and graphite asbestos packing in the valves. The gas manufacturing company's representative stated that where it is necessary to use valves other than those furnished by their company, the valves should be taken apart and thoroughly cleaned of all grease and oil by washing with either caustic soda or carbon tetrachloride and repacked with "Special Ullmer Packing." The correct packing for the valves can be secured by furnishing the gas manufacturing company with the type of valve, name of manufacturer and size of valve that is to be used, and they will furnish the packing designed for that valve.

It was also found that the joints in this system at this refinery were made up with red lead, which is also a very dangerous material to use in connection with oxygen, and the gas company's representative advised that all threaded joints should be made up with litharge and glycerine paste. Before the system is used, it is also recommended that the entire piping system be purged again with carbon tetrachloride to make sure that all grease and oil has been removed.

The gas manufacturing company's representative also recommended that a regulator be installed next to the oxygen tank. This regulator will reduce the pressure from 2,000# to 500# and in this way will maintain a maximum pressure of 500# in the system, which obviously is less hazardous than maintaining a 2,000# pressure in this system.

The Handling of Pipe as It Applies to Oil and Gas Pipe Line Work

By O. R. BURDEN

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Regardless of the nature of the work, there are some general rules applicable to handling pipe which should be followed:

(a) A workman should never get under a joint of heavy pipe for the purpose of moving it, because something may break, slip, or fall,

causing severe injury or death.

(b) Hands should not be placed over the ends of pipe joints because an unexpected longitudinal movement may jam the hands against the end of an abutting pipe or some other object and cause an injury.

(c) Palms of the hands should be kept away from pipe threads because they are sharp enough to cause severe lacerations.

(d) Proper equipment for doing the work should be selected and a schedule for periodical inspection of the equipment should be set up and observed.

(e) Some persons are naturally awkward and think more slowly than others. Such persons should not be assigned to the handling of pipe.

(f) Foremen and workmen should eliminate every element of chance. The safest way is the most profitable in the end.

(g) Neither intoxicating liquor nor persons under its influence should be allowed on the job.

(h) Workmen should be protected by adequate appliances to minimize accident hazards.

(i) Much handling of pipe is done by the use of wire cable; badly damaged cable or cable of insufficient strength should be avoided.

(j) Skids should be made of straight grained hardwood free from serious defects and of sufficient size to carry loads safely. If used to support pipe over an open trench, they should be long enough to support the load without the trench walls caving.

(k) Often pipe is handled where explosive gas or oil is present; if artificial light is necessary, foremen should select only gas proof electric lights or lanterns.

(l) Many pipe line activities demand the use of goggles. Foremen should see that the proper type of goggles is selected and insist that workmen wear them.

(m) When welders or others are working about oil or gas where there is danger of fire, carbon dioxide or other suitable fire extinguishers should be provided.

(n) The hazards of obstacles such as tools, loose boards, and rubbish should not be permitted. Men handling heavy material are concerned with their load and cannot always select their footing.

(o) Last but not least, all persons should become safety minded and not only avoid

danger to themselves but should also aid in protecting their fellow workmen.

Loading Pipe on Cars

Pipe manufacturing plants are customarily equipped with traveling cranes and other facilities for loading pipe intended to reduce accident hazards to a minimum. The following are some general rules:

(a) The cars being loaded should be long enough to permit working room between the ends of the joints and the ends of the car.

(b) If electric magnets are being used for loading, close attention should be exercised to see that each joint is securely caught by the magnet.

(c) Wire rope slings should be of adequate strength. Chain slings should be carefully inspected for defects because a severe side strain may break a link or hook. If chains are being used, under no circumstances should there be any knots tied in them. A sling should be spread to proper distance by means of a spreader to keep the lift from tilting with spreader ends the same distance from their respective ends of the pipe. A sling may be placed under one end of the lift and the end raised to a height of about 2½' or 3' while the other slings are being placed beneath the lift. The lift should then be lowered before slings are hooked on.

(d) If hooks are used they should be made with long shanks so that workmen can seize shanks instead of curved part of hook when attaching hooks to pipe, thus protecting their hands. Some contractors bronze the curved end of the hooks to give protection against wear and provide a more flexible surface to contact the end of the joint, thus protecting the beveled surface of the pipe end. If threaded pipe is being loaded, hooks should be securely caught in the ends of the pipe. This avoids damage to threads and eliminates possibility of hooks slipping out and pipe falling.

(e) For cable slings the best grade of wire rope of adequate strength should be used and the "U" of the clamp should bite into the loose end of the cable.

(f) A simple set of signals should be arranged. Usually one of the employees handling the slings or hooks is selected to give the signals to the crane operator. When all is ready for the lift to be raised he points his thumb up; if not ready, he points his thumb down. Before giving signals it is his duty to see that any other slings and hooks being used are in proper position.

(g) When pipe is being loaded, either in single or multiple joint lifts, a flexible guy line should be attached to the end of the lift to control lateral motion.

(h) Extreme care should be used in stacking pipe either in cars or in temporary stacks. When the lift is lowered to the pipes already piled no attempt should be made to remove slings from the crane hook until the pipe set down has come to a complete rest. The pipe will usually roll after the tension is removed from the slings, and a man close enough to the lift to remove the slings might have the pipe roll on his foot. In a stack or pile of pipe joints there is the possibility of a slight jar causing one or more of the top joints to roll down. To prevent this hooks should be used to remove sling from crane hook so that the sling can be pulled out from under the lift. Workmen should always remain out of the way of joints which are likely to roll.

(i) When loading cars, where load extends above the sides of the cars, straight grained hardwood upright stakes of sufficient size should be used. These should be bound across the top of the load with a sufficient number of strands of No. 8 or heavier iron wire. Care must be taken to see that the stakes are held securely in a vertical position. If stakes are not vertical there is danger of their falling sideways — longitudinally with the car — and perhaps striking a man.

(j) It is poor practice to allow men to remain in the car or on the pile when pipe is being lowered into the car or onto a pile as there is danger of squeezing them between the head and the side of the car or knocking them from the pile.

(k) If the car is to be removed before completion of loading, men should get out of the car because motion might cause load to shift with consequent danger of accident.

(l) If pipe is being loaded into car with gin pole it is important to select the proper type of gin pole. A joint of 6" line pipe or 6½" casing is recommended. This should be guyed securely with heavy wire line. The guy anchors should be placed at least two lengths of the gin pole away from its base and the bottom end securely anchored to the track rail. Only steel blocks should be used and these of 8" or 10" size.

Unloading Pipe onto Piles or Stacks

Small pipe, 2" to 4", is generally handled by hand and rolled from car to pile by means

of skids. Larger pipe is raised out of car by means of cranes or booms powered by trucks or tractors or winched out of car by means of truck, winch, and gin pole. The same general safety rules apply when unloading as when loading.

When skids are used for unloading they should be of sound straight-grained hardwood of sufficient size to carry the load of pipe safely.

If the unsupported length of skids is too great to avoid overloading they should have intermediate supports. They should be fastened at each end and spaced about 3 feet from each end of stack or pile of pipe.

Skids should not incline too much vertically because the speed of the rolling pipe increases in direct ratio of increase in vertical angle. To insure proper safety, flexible rope guides should be used for lowering the pipe. The guide lines aid in prevention of accidents and give added protection to threads and couplings.

Protectors should be used on male ends of threaded pipe joints, and it should be emphasized that workmen should not grasp the end of the joints because threads or steel slivers may cut their hands. Leather or leather-palm gloves should be worn.

Men have been hurt by standing between skids and being struck by joints being lowered, pipe rolling off skids between car and pile, or while attempting to stop rolling pipe on the pipe pile by means of a club or piece of timber held in front of rolling joints. All such accidents are avoidable and are the result of carelessness. If each man will remain in the clear of rolling pipe and outside the skidway the percentage of accidents will be greatly reduced.

When piling pipe on the ground it is essential that the bearing value of the ground be sufficient to sustain the load.

There have been incidents where the strain on the upright car stakes was too great after all tie wires were cut, causing stakes to break and allowing the pipe to roll off the car. By first removing the two stakes nearest the ends of the car and replacing them with heavier stakes before cutting intermediate tie wires, such accidents may be avoided.

Short lengths of pipe should not be piled in the same pile with longer joints without suitably indicating the location of the short ones, because later if a list of more than one row of

pipe is being made and one of the lower rows contains a short joint, this will be held by only one sling end and can easily slip out of the lift.

In preparing the pipe pile, sound lumber should be used for layer strips or separators. Size 1" x 4" strips are suitable. For cleats, which should be nailed securely to the separators, 2" x 4" x 4" blocks are suitable. The layer strips should be cut off even with the outer edge of the cleats to prevent workmen or trucks from running into them and knocking pipe from the pile. Keeping both sides and one end of the pipe pile even and vertical improves the appearance of the pile and pipe yard; makes more passage way between the piles; and facilitates measuring and checking pipe.

Pipe should be placed in the center of the pile and rolled to position against cleats to prevent upending of separator and joint falling off the pile.

No loose separators should be left on top of stack because some one climbing the side of the stack may grasp a separator, pull it from the stack, and perhaps suffer a bad fall.

When cleats are removed from separators, nails should be removed to prevent persons stepping on them.

If height of piles of pipe is in excess of 16' the last five rows should be tapered in to prevent stack from becoming top-heavy.

Unloading Pipe to Truck

The truck should be placed parallel to the side of the car at a suitable distance. Small pipe, size 2" to 4", is usually unloaded by hand, using a short skid. Larger pipe, or double length smaller pipe, is usually unloaded with truck or tractor equipped with booms. A crane may be operated from either side of the car. If cranes are not available the usual method of unloading is with team, truck, or winch line and gin pole.

When trucks are loaded from pipe stacks along railroad rights-of-way, the loading of small pipe is usually by hand and the large pipe by truck or tractor boom in about the same manner that trucks are loaded from railway cars. Loading trucks from stacks of pipe on the ground is more difficult for many reasons. Often the ground is rough or sloping; sometimes it is muddy, causing pipe to become slippery, and it is difficult to move trucks or tractors. At times pipe stacks are

scattered and working space between obstructions is limited.

To give more protection under these conditions all trucks equipped with a winch should also be equipped with suitable winch guards to protect workmen from flying winch lines and shifting pipe. The winch line on a crane truck should never be pulled until the tail chain hangs in the pulley.

When a rope and power are to be used in rolling pipe up a skidway the free end of the rope should be dead-ended to the truck or car.

When pipe is to be loaded on truck from stack, heavy hardwood skids should be used. The truck should be stopped as close as possible to the rack or stack avoiding the need for steep skids. Workmen at each end of the truck should make sure the skid is securely placed on the bolster and laps over far enough to prevent slipping.

A truck with part or full load should not be moved until the bolster uprights are in place and the load boomed down. The bolster stakes should be securely fastened and after each joint is rolled onto the truck it should be blocked to prevent its rolling back on the workmen. The truck driver should see that his load is properly balanced and distributed. He should also supervise personally the booming of the load. This is hazardous work and workmen should stand well back when pulling down the boom handle.

Sometimes truck drivers load the trucks with winch line powered by another truck. This is dangerous and hard on both material and equipment. A workman should never stand on or at the side of the truck being loaded.

There should be at least one boomer chain on a load before anyone places himself under the load to fasten a chain, and all truck loads should be boomed with at least three booming chains of proper size and strength.

Truck loads should be boomed on the right side if possible so that the driver may work on side opposite highway traffic in event some adjustment of boomer is necessary. A load of pipe will usually settle and clamps will become loose after traveling a short distance and truck should then be stopped and the chains retightened.

No wire lines or chains should be allowed to drag and if load extends over the rear end of the truck it should be flagged with red bunting. All trucks should be equipped with

flares regardless of whether so required by state laws.

Before a truck or wagon load of casing or pipe is unbound the load should be examined closely to see that all stakes are secure in order to prevent pipe from rolling when boomers are released.

Hauling Pipe

Economy in handling longer joints of pipe is attractive to many users; therefore, the percentage of longer joints is increasing steadily. This type of joint is, of course, more difficult to haul either on cars or trucks. If pipe joints are longer than available freight cars, two gondola type cars may be tied securely together with the inside ends of the two cars dropped making one long car.

When long joints are loaded onto a truck, the trailer is forced so far back that it makes driving difficult, especially along crooked or narrow roads, through rough country, etc. It is necessary to procure special highway permits to move these long loads over highways if their over-all lengths are greater than permitted by local or state laws. Truck drivers should be well trained, and with these long loads they must understand the necessity for driving slowly, leaving ample room for turning curves. They should never forget that half the road belongs to vehicles traveling in the opposite direction or more rapidly moving traffic moving in the same direction.

Unloading Pipe from Truck

When pipe is being unloaded onto racks in pipe yard skids are generally used in a manner similar to unloading from cars onto trucks.

In the field and along the pipe line right-of-way, pipe is often dropped from the truck to the ground. This method is objectionable and should be permitted only in special cases. If one end of the pipe strikes the ground or a hard surface before the other end it may damage the threads, couplings, or its beveled ends; or, if the pipe should strike heavily on a rock, stump, or any raised hard surface, it would probably injure same necessitating expensive repairs. There is also the danger of the pipe falling on a high center which might warp it or cause it to rebound and strike some one or damage the truck. By using a side boom to lift the pipe from the truck to the right-of-way the pipe is subjected to less damage; the hazard of the entire load rolling off where the surface is uneven or sloping is

eliminated; and the chance of injury to employees is reduced. Every precaution should be taken against the possibility of pipe rolling onto the legs or feet.

A reasonably safe procedure for unloading pipe from a truck depends on the circumstances; however, in every case the work should begin at the top of the load and chocks should be used to prevent the remainder of load from rolling off or kicking out as the joints are removed.

Connecting Pipe

Laying threaded pipe with tongs or with pipe machine requires considerable man power, especially if laid with tongs. Coordination of work is essential if accidents are to be prevented and good results obtained. The pipe crew should properly understand the work to be done and should be furnished with proper tools in first class condition. Workmen should not be allowed to use faulty or makeshift tools even though the job be of a temporary nature.

If pipe is to be moved or carried by hand, "U" shaped carrying bars and carrying tongs should be used. Substitutes for these have resulted in many broken bones, mashed fingers and toes.

When a joint is to be moved the carrying irons and tongs should be placed on the pipe. The men carrying the load should take a firm grip, bend the knees so as to place the load on the leg and thigh muscles instead of the back, and all lift in unison. The foreman or some one selected by him signals when the joint is to be raised. The men should watch each step so as not to fall or stumble.

While stabbing threaded coupling pipe the carrying iron should be held under the male end of the joint until the threads are caught and, if the pipe diameter is large, the stabber should be assisted at the collar or female end of the connected pipe by other pipe carriers with another carrying iron. This relieves the stabber of too much lifting and the front carrying iron prevents the pipe from falling to the ground in case the free end is pulled from the collar by the rolling rope before it is caught.

Pipe is laid under many hazardous conditions; therefore, pipe jacks, jack boards, growler boards, etc., should be made from sound materials and kept in first class condition. Tongs should be carefully inspected and tried on the pipe before using. Dull jaws, pins loose in the handles, sprung reins, and de-

fective keys should be repaired or replaced. In removing defective keys a cloth or some other soft material should be placed over the end of the key before it is driven in or out of the tongs because the hard brittle material from which the key is made may shatter and cause injury to the eyes and face. Workmen are often hurt by pinching fingers between tong reins while they are being closed; bruising fingers or toes under falling tongs; or suffering a bad sprain if the tong key fails to hold while joint is being made up.

If the tong crew will keep time with the collar pounder, and each member will perform his particular task properly and in coordination with the other members of the crew, many accidents will be avoided.

Welding Pipe

Welding is the preferred practice for jointing oil line pipe.

In a welded line, joints are lined up and welded into sections of desired lengths and later the sections are tied together and make a continuous line. The greater portion of the work, other than the welding, is done with tractors equipped with booms which move the pipe about or place it on rollers or dollies along the right-of-way to facilitate welding. Sections are pulled together so that they may be welded. By using ordinary care in keeping clear of booms and cables and keeping hands and feet from between and from under the skids and joints, no unusual danger is involved. The firing-line welding is simple and if the welders and helpers will wear helmets and goggles when welding, and if other workmen will use goggles when viewing the welding operations, there should be few accidents.

Field bending of pipe is difficult but, by doing the work carefully and placing bending blocks properly, most any size pipe may be bent readily by the use of caterpillars and winches. Torches for heating the pipe at sharp bends will reduce the possibility of buckling it.

Careful and periodic inspections of cables and other equipment used under heavy strain and subjected to much wear are essential.

After the firing line sections have been welded they are connected by bell-hole welding. No welder should be assigned to bell-hole work unless he is properly qualified and experienced. Bell-hole welding is difficult. In order for the welder to get at the bottom of the pipe a hole is dug below the joint and

he works in this hole on the weld above him. The welder must protect his eyes, neck, and ears from the hot metal, and the supervisor should see that suitable protective devices are used.

Blasting on Right-of-Way

The preparation of the right-of-way and trench generally requires some blasting in order to remove stumps, large rocks and other obstructions. If pipe has been strung or connected ahead of this work the line should be moved far enough to one side to protect it from damage by explosions, flying rocks, and pieces of stumps.

Ditching of Pipe Lines

While ditching by hand if men will remain far enough apart to prevent striking each other with their tools, and use only tools in good condition, there will be few accidents. Any rocks should be thrown well back from the ditch. Where the ditch is several feet deep or in soft earth it should be well shored. Tools not being used should be placed in a pile out of the way of the workmen.

On ditching machines, operators and their helpers should wear goggles and respirators to prevent injury by dust, dirt, and small particles of rock thrown out by the trenching wheel and belt conveyor. This exposure is increased if strong winds are blowing. Only experienced men should be allowed to operate trenching machines. The machines should be shut down for making repairs. The use of a stick to hold out the clutch in order to stall the machine for making minor repairs should be avoided. When the trenching machine is in an inclined position going up or down grades no attempt should be made to prime the carburetor with gasoline in order to keep the engine running. The gasoline tank should be located high enough to provide gravity without priming, thus avoiding back-fire.

Machine operators should ascertain in advance where other pipe lines are located and allow plenty of clearance when passing over them. If the line has been connected in advance of the ditching machine the operator should use care in avoiding damage. If damage cannot be avoided, he should immediately notify the foreman so that repairs may be made ahead of the insulating crew.

There are several types of plows or excavators for use in ditching lines, usually short field lines. As long as the ditch is kept

straight and squared up at the bottom to allow for expansion and contraction of the pipe, this equipment is satisfactory. The striking of stumps, roots, or rocks, causing the plow to be thrown out of control and probably striking the operator, presents the principal hazard.

Insulating Pipe

Most pipe lines are protected by some form of protective insulation which should be applied after removal of mill scale, dirt, and moisture. The revolving brushes and discs of a cleaning machine will throw off small particles of hard matter dangerous to the eyes; therefore, operators should wear goggles. A guard should be provided on each side of the machine to protect operators from the revolving brushes and projections. Guards can be placed so they will not interfere with changing the brushes. The balance pole projecting from one side and passing through the machine should be securely fastened.

If caustic liquids are used, the eyes, hands, and arms of men handling them should be protected.

If the insulation is to be applied cold there is little danger of accident except when the pipe is being raised by pry pole or boom in order to patch bare spots on the bottom; however, if hot material is to be applied, more caution is required.

No fires for heating the coating should be lit without first ascertaining that there is no danger from petroleum gases or exposure to other flammable material. All employees handling hot material should wear goggles, gloves with tight wrist bands, and suitable high shoes.

Kettles should be free from water and should be equipped with draw-offs with ends on end pointing downward so that dipping of the hot contents may be avoided. Two or more kettles will permit heating of one kettle while material is being drawn from the others. This expedites the work and reduces frequency of accidental burns.

Whether hot insulation is applied by hand or machine, workmen should always bear in mind that the material can cause severe burns, and they should avoid splashing it on themselves or others, or falling down while carrying it.

Unnecessary haste, buckets overfilled, bucket filler standing too close to draw-off when filling buckets, defective or dirty burners,

trucks or teams jerking kettles too suddenly and causing them to splash, have all caused numerous accidents.

Dust and fumes from some enamels are harmful and in such cases the use of fume and dust respirators is recommended. At times dust and fumes injure the face and arms, for which zinc oxide ointment or any good cold cream is helpful.

Enough workmen should be assigned to each job to permit adequate rest periods. Tired men are awkward and susceptible to accidents. Many accidents to eyes have been caused by a workman wiping away perspiration with a soiled hand.

Lowering Pipe into Ditch

Caterpillars with side booms or tripods and hand power jacks are frequently used in lowering pipe into the ditch. Such equipment is capable of handling the line with little strain and is not particularly hazardous. Operators of jacks should be thoroughly warned of the danger of permitting the jack handle to get away from them and cause accidents.

Men should not be allowed to enter the ditch beneath the pipe while it is being suspended by booms, jacks, tripods, etc., except when unavoidable, in which event the pipe should first be lowered onto suitable skids.

There is no other part of pipe line work, except at river crossings, where so much weight or strain is applied to side boom tractors, slings, and cables as that of lowering the pipe. This is especially true with large pipe when several lengths of pipe are lifted simultaneously. The best cable should be used and all equipment should be kept in proper condition, sharp kinks in the cable particularly to be avoided.

Two to four-inch pipe is sometimes crowded or lowered into the ditch by means of a pry pole called a mope pole. This is poor practice because it often damages the pipe and the pole may get out of control and strike some one.

Repairing Pipe Lines

Much of this type of work is done while lines are full and frequently under pressure. The work is dangerous and only skilled labor should be used. After the line has been located it may be exposed by use of hand tools or ditching machinery. Care should be exercised to avoid striking and damaging the pipe.

After the pipe has been exposed and raised

on skids it is then cleaned and inspected. If pits the depth of one-half or more of the wall thickness are found they should be patched. If the pits are less than one-half the wall thickness they may be spot welded. Leaky couplings, if not too bad, may be welded; otherwise, a sleeve may be welded over them. Spot welding requires a welder of judgment and skill. Much bell-hole work is necessary and welders and helpers should make sure that all bell holes and their immediate surroundings are free from gas. Arc welding generators should be stationed as far from the work as the cable will permit, preferably not less than 100 feet.

No smoking should be permitted and only approved electric flash lights or lanterns should be used, as any kind of a spark is dangerous. Any oil or oil soaked soil should be removed from a bell hole and replaced with fresh dirt before welding is started.

When welding a sleeve over a collar or coupling a vent hold should be provided on the bottom side of sleeve to permit escape of gases. A steel plug or patch is welded over the hole after welding is completed.

Before cutting a section of line for any purpose, if line cannot be flushed with water, block gates should be closed at the highest elevation first and the line drained before other block gates are closed. After draining the line is cut with pipe cutters, and if any oil then flows from the line it should be piped or carried a safe distance away. Interior plugs should then be placed about 18 inches

from the free ends of the pipe. Plugs may be of clay but shredded asbestos is preferable and this should be tightly tamped. After weld is completed pipe should be jarred with hammer to release plugs which can be shoved by liquid pressure to next scraper trap.

When any welding is being done on a line full of oil or gas, fire extinguishers of suitable type should be available for instant use. If the pipe is in a hole several feet deep a rope should be tied about the welder and handled by men on the bank who could pull him out quickly if necessary.

Taking up Lines

Taking up abandoned lines requires the same careful attention as laying or repairing. The line may contain pockets of gas or oil which might ignite if the line were cut with a torch. The foreman should see that the line is flushed with water and drained before any cutting is done.

Salvaged pipe is rougher than new pipe and better protection for the hands is desirable.

Reconditioning Pipe in Shop

An overhead carriage or crane and an adjusting stand to support the pipe in lining it up with pipe cleaning and threading machines should be provided for reconditioning pipe in shop and all gears or other hazards should be equipped with guards. Brushes should be used for removing cuttings, and while cleaning, chipping, or grinding, goggles should be worn to avoid accident from flying chips or scale.

WEDNESDAY AFTERNOON SESSION

October 13, 1937

Lessons from Marketing Department Accidents

By F. R. McLEAN

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There are two types of accidents which teach valuable lessons on Safety. One is the serious, spectacular accident, often unusual and of catastrophic proportions. The second is the constantly recurring relatively minor

accident which disables only one employee usually only for a short time, or causes small property losses.

An accident of catastrophic type occurred in a new station. The station was designed

with a basement in which the lube oil tanks were to be installed with outside fill pipe. The station had begun operations but the lube installation was not complete. A new driver began to dump a load of gasoline in what proved to be a lube oil line to which no tank was yet connected. A heating unit in the basement did the rest. The station was blown to bits and the station man killed.

This is not the only instance of the kind. Similar accidents have occurred because pump test men have dumped gasoline down lines installed but not used for air and water hoses leading from the basement to the island. Leaks in old tanks have let gasoline or vapors enter basements. Small containers of gasoline or naphtha have been stored in basements. Spills have gone into basement windows. All with the same result.

Let us see what "lessons" can be learned. From the construction standpoint, a safe policy would be to eliminate all basements or below grade unventilated areas in future station construction. In many cases we have eliminated hazards by filling existing basements. Incomplete lines should be capped *securely* at both ends and be marked or labelled and, if possible, locked. Abandoned lines should be removed or permanently plugged. Heating equipment and electric switches or motors not of explosion-proof type, located in basements, always bespeak danger to me. Some of these we have to live with but the lesson we should learn is to build no more of these ancient set-ups.

Safe practices to be followed in preventing such accidents include the driver always checking with station operators before dumping and the use of product identifying color codes on fill caps and pipes.

Rigorous inspections should be made. After one of these catastrophes in which two were killed and twelve injured, authorities found several similar situations where the tragedy had not yet occurred.

One more lesson from this last accident. This was a *new* driver that made the dump. No matter how much we or our organizations learn about safety, our new employees must begin back with the first fundamentals. Fatalities still occur in the operations of even the most safety conscious companies from such obvious things as washing floors with gasoline.

Another class of serious accidents where the cause is in faulty construction is found

in relation to vent pipes. Poor judgment in locating these or subsequent alteration of buildings without relocating vents have brought tragedy. An explosion wrecking a new station occurred where a contractor terminated vents inside an ornamental tower with an open top, not knowing or overlooking the fact that gasoline fumes are heavier than air. Excellent vents, but badly located above lavatory windows, have placed smoking customers in hospitals.

We have found several cases where dealers have built covered lubrication rooms onto stations and, in some cases, vent pipes and also fill pipes have been enclosed in the new structures.

We have acquired stations with vents terminating inside of pump housings. It took an explosion and fire, fortunately not serious, to impress us that we should take nothing for granted.

There is no "lesson" here from the construction standpoint not already known in detail to the industry, but the point is this—newly constructed, altered or acquired properties should be rigorously inspected. Drivers should be eternally curious as to where the 1000 gallons of vapor is going when they dump 1000 gallons of gasoline.

Another serious accident involved a truck tank with excellent equipment consisting of a self-closing valve to be held open by the operator while delivering gasoline. However, the driver placed a convenient hooked iron bar over it to hold it down and went elsewhere, having also failed to measure the contents of the tank into which he was dumping. A spill and fire occurred.

What is the lesson in this potentially tragic situation? Was this failure due to lack of supervision? We can only determine this by knowing if this human failure had occurred before or even frequently enough to have become an habitual unsafe practice. Was the failure that we had not aroused in this driver a sense of moral responsibility? Certainly we might hope to find the answer in checking our training procedure. Did we tell the driver how, show him how, and explain why? Did we have him practice the correct procedure and repeat to us what the correct procedure was and the reason for it? And, finally, did we check his actual performance to insure that safe habits only were being formed?

Two accidents to children occurred from abandoned gasoline tanks at stations. One

where a six year old dropped a match in an inadequately closed abandoned underground tank and was badly burned in the resulting explosion. In another instance, a contractor was removing a tank which was not entirely empty and it was laid on the ground in a way that permitted some gasoline to run out. A youngster lit it. He was burned seriously and will be permanently disfigured. The end of the tank blew out, fortunately striking no one.

Safe procedure would be to remove all liquid gasoline from any tank to be either abandoned or dug up, by means of a pitcher pump and, if necessary, adding water. Then, if it is to be abandoned, fill it with water or sand and remove the pipe connections and plug them at the tank. If the tank is to be used again or removed from the ground, a quantity of carbon tetrachloride equal to three times the gasoline content (either liquid or vapor) will produce a non-explosive and at least slow burning mixture, even with proper air mixture, and would probably effectively exclude oxygen so no fire could occur. Tight capping is necessary to retain this relative proportion as the carbon tetrachloride would evaporate more rapidly than the gasoline if air was circulating through the tank.

A wholesale department accident illustrates how, in spite of outlined safe procedure and good physical equipment, accidents can occur from human failure. A foreman and four men were given orders to empty and clean a steel tank which contained gasoline. Nothing unusual occurred in the draining operations and the tank was opened at all manholes, and left open and hosed out with cold water three times from the outside, during a seven day period. At that time, the crew entered the tank and scraped, swept and carried out scale at intervals, a total of about one and one-half hours out of four, at which time they considered the job complete. On the night and day following the job, the whole gang showed signs of gasoline vapor poisoning and were confined to the hospital from three to seven days.

The point is, that contrary to exact orders on tank cleaning operations, a gas indicator was not used. It was claimed that the gas indicator was out of commission, but that does not alter the fact that there was human failure.

While I am not directly acquainted with the further circumstances of this case, it points to the lesson that outlining safe procedure

alone is not enough but that foremen particularly must be fully aware of the *reasons why* such procedure is necessary.

Turning now to the second type, the recurring or repeating industrial personal injuries:

No station accident is more common than slips and falls. A particularly dangerous place for these to occur and a place showing a high frequency and severity of injuries from this cause was the old fashioned lubrication pit and particularly the stairs and ladders into them. Here grease, oil and moisture on shoes and steps, frequently poor lighting, stooped position, hurry to render service all combined to produce accidents.

Cleanliness and care alone did not eliminate these accidents but when these were combined with the engineering development and installation of a special non-slip stair tread with abrasive surface and self-cleaning grooves and perforations, accidents from this cause dropped enormously. These safety treads are now used to eliminate similar accidents on steps of trucks, tank stairs, and for stairways, ladders and walkways around plants and oil tankers.

When the study of accident records revealed a high frequency of minor injuries to eyes and cars from battery acid, lubrication procedure was changed so the battery was serviced last instead of first and the trouble disappeared.

A rather new problem is presented by pit lift jacks which straddle pit and lift runways in the normally clear working space. One division where a large number of these are in use has developed a frequency of minor but potentially serious injuries to the head. Analysis showed that employees were striking the bottom of the jack cylinder as that part protruded the farthest down and was central in the working space. A molded sponge rubber cap that snaps over these cylinder bottoms has been developed and while not preventing the accident, it does prevent the injury.

Present day lubrication procedure, especially on certain older drive-on hoists, has resulted in accidents from cars jumping over or pushing along wheel chock devices. A new type chock has been developed, giving greatly increased efficiency and eliminating all chance of failure except the human failure to use it.

Some accidents of this repeating type come purely within the range of those which can best be corrected in original construction. The

recent trend to metal sash has produced a hazard of this kind. Most windows of this type open outward from the bottom and on first floors, when opened, are at a most hazardous level. Instances in new stations have been found where they extend out at head height over the walkway to rest rooms. Such windows should be permanently closed or walkways relocated and shrubbery or other device used to prevent persons walking into them.

One accident which occurred with great frequency and considerable loss of time particularly interests me because of the combination of "lessons" the experience taught. It required construction and equipment changes, training, enforcement and special safeguarding. In the early days of the rapid change over of pits to hoists, our division had a number of broken great toes from operators working on cars while they were being lowered. Investigation showed that foot-operated safety releases were being blocked open and that instructions were none too clearly presented. Safe pro-

cedure was outlined and the men trained. Supervisors enforced the rule of no one approaching a descending car and of operators releasing the air only by means of holding the self-closing valve open with their hand or foot, according to type. Finally, as an ultimate precaution, all operators were urged to buy safety shoes. About the same time hoist manufacturers redesigned their runway supports so that it is now almost impossible to get toes crushed under the new type.

An interesting by-product of this "lesson" was that our tests to select safety shoes by subjecting the toe cap to the combined weight of a car and a hoist, and the publicity given the shoes for the protection of station men, led to their wide adoption among drivers, maintenance, warehouse, and refinery employees and toe injuries have virtually disappeared.

There is one other kind of "lesson" to be learned from a study of these accident frequencies. Not only do accidents from particular causes show a repetition but certain individuals are found who are repeaters.

Causes, Prevention and Control of Petroleum Fires

By JOHN T. HOWELL

Fire Protection Engineer, Union Oil Company of California, Los Angeles

Before we can have fire at all, we first must have something that will burn. We call it fuel.

I propose to carry out some experiments, and I will ask the reader to visualize these as I describe them, as though he were sitting before me and watching what I do.

On the table here we have a number of pieces of common fuels, things which burn every day somewhere. Yet I can take this block of wood and hold it over the flame of a burning candle and we see it does not take fire. Of course the block is heavy and solid but here is a piece of cloth. We substitute it for the block of wood and the results are the same.

Now let us try a liquid. In this bottle there is some kerosene. I shall pour some of it out in a pan. The pan is filled to a depth of about $\frac{1}{4}$ ". If we hold a match over the surface there is no burning. Even when we dip the match directly in the kerosene the result is the same. Complete immersion of the match

flame extinguishes it. If we substitute a lighter product such as Stoddard Solvent the results are the same. A match flame held directly above the liquid causes no burning; dipped quickly into the liquid, it is extinguished. The same with a burning card.

To carry this experiment further I shall moisten this calling card with a little of the liquid—just enough to form a thin film. If we hold a match to the card we find that it burns slowly. But again by dipping the card in the very liquid with which it is moistened, we can extinguish it.

Now we are beginning to learn something. When we held that match flame against the calling card, a tiny portion of the thin film of solvent was heated to the point where it gave off a vapor, and it was the vapor which burned. Because the solvent in the pan has not been heated it did not give off vapor so there was nothing to burn. We know now that *solids or liquids do not burn, it is only their vapors which do so*. If we heat all of this solvent

on a stove, then all of it will be at a temperature that will produce vapor. It will not take very long, for it needs to be heated to about the temperature of the water you use for shaving,—105° to 110° F.

Some oils will give off vapor at the temperature of the surrounding air. This may be as low as 40° F. Included in these are gasoline, naphtha, benzene, alcohol, paints and numerous other household articles. If we pour gasoline into a pan and hold a match flame above it the vapors will immediately burst into flame.

Here I have a jar of gasoline. On top of the jar is a sparking device connected to a battery. With it we can produce the same sort of spark we get in the motors of our automobiles. Notice that when a spark is produced beneath the liquid level there is no burning. Here we have a positive proof that the liquid does not burn.

But, we say the vapors do burn so let's move the spark up into the vapor space. Again we see there is no burning. That may be surprising. Let us try something else. This time we move the spark to a point just above the mouth of the jar and there burning occurs because that is the only point where the vapors, inside the jar have an opportunity to combine with *AIR*. So we establish another fact: *Unless there is air present, there will be no burning.*

What else do we need to build a fire? Here in this pan of gasoline we have *FUEL (Vapor)* above the gasoline and *AIR* all around that vapor—and yet we have no fire and won't have until we add one more thing—*HEAT*. When this is done we have a *FIRE* whether we want it or not. That combination will cause it regardless of what other condition may exist; whether it be hot or cold, wet or dry, makes no difference. Also, the fire will be the same whether the fuel was gasoline vapor, wood vapor, coal vapor, or vapor from any other combustible substance. This is good to remember—to save for the time when that fire is to be controlled.

The fires which we have seen here were relatively small yet they came into being and behaved in exactly the same way they would have had they been larger. The gasoline vapors, in the small pan, combined with air and ignited from the match flame in the identical way that vapors from a large body of gasoline would take fire.

The behavior of the spark in the jar of

gasoline, below the liquid, above the liquid, and in the mouth of the jar is no different from what would happen in a tank truck under similar circumstances. Fire exists solely because of an immutable natural law. For example, just because we are afraid a fire will occur does not cause it to occur.

Now that we have gone through the problem of ordinary fires let us take up another phase of our subject,—Explosions.

Every so often we hear of a tank truck "explosion." Did you ever hear of one exploding while it was traveling down the highway? While parked at the curb? Neither have I! We do know of trucks which have had fires on them because of burning brakes, flat tires, faulty wiring, collisions or overturning. You nor I have ever known of even one case where the fire originated in or because of its gasoline cargo. Yet in almost every instance we are told "the gasoline exploded." Let's see what is behind that statement.

Here I have an ordinary 100 cc. capacity test tube. The liquid in the tube is plain water. We all know that when plain water or any liquid is heated it expands, increases in volume. So if we hold the tube over this candle flame the water will heat up and expand. If we get it hot enough the expansion will be sufficient to cause the water to overflow the tube. I shall draw a crude picture of the tube on the blackboard. Alongside, I shall sketch a section of a tank truck carrying gasoline. Due to a collision, a spill or other reason, gasoline is burning underneath the truck.

Notice that the general conditions in each case are the same. Therefore, we have an identical situation to deal with; in the case of the tube, expanded water would overflow the top while in the truck the gasoline would overflow the dome. If we were to put a cork in the tube, which I will now do, we know that just as soon as expansion takes up all the vacant space in the tube a pressure will be built up. Eventually this pressure would increase until the cork would be blown out of the tube. The same thing would happen in the case of the truck if we were to place a tight cover over the dome.

But, if we drill a hole up through the center of the cork any pressure which tends to build up will be relieved through that hole. Likewise if we cut an opening in the tight dome cover of the truck (a pressure relief valve), any pressure generated will be relieved through that opening. Provided, however,

that the opening in the cork or the dome cover is large enough; certainly a pin-hole opening would not be sufficient for adequate relief. But so much experience and competent knowledge is at hand that calculation is easy. The most generally accepted data for emergency relief venting is found in the NFPA Recommended Ordinance.

Whenever adequate relief has not been provided and the truck is involved in a fire, accompanied by a rupture of the tank, we are told "the gasoline exploded." Such a statement is definitely untrue. What really occurred was identical to what happens to a boiler that has no "pop valve" or an air compressor tank whose relief valve is stuck. The presence of the gasoline had nothing whatever to do with it except to follow the natural law of expansion just as water, milk, or any other liquid might do. These "explosions" are no more than "boiler explosions."

Probably the greatest fear having the least foundation is the almost universal belief that a spark may get inside an underground tank and cause it to explode. Such fear is shared not only by the public and a large portion of their fire authorities, but also by some oil operators. No man in this room or elsewhere can point to a single instance where an underground tank, in service, has exploded. Let us look into the possibilities.

In the following diagram let the flask "A" represent an underground tank. Notice that it has a small quantity of gasoline in the bottom. I think it is fair for us to assume that any underground tank in service will never be completely empty. The funnel "B" can represent a compartment in a tank truck. Let line "C" represent a hose leading from the tank truck to the fill pipe of the tank. The tube marked "V" will represent the conventional vent pipe running to some point above ground. The space above the gasoline in the flask will naturally be filled with vapor, a vapor too "rich" to burn. Being heavier than air, as all petroleum vapors are, it simply lies quietly until something occurs to force it out of the tank. This is the condition which prevails during normal operation. Under such conditions a match flame or any other source of ignition may be produced at or near the vent terminal without fire occurring at that point.

Sooner or later a dump of gasoline will be made into that tank. As the gasoline fills the tank, vapor is displaced to make way for

it. This vapor is forced up the vent ("V"). Just so long as it is in the vent it is still too rich to burn. There is no air present. But as it issues from the vent air is supplied from the surrounding atmosphere and a burnable mixture is formed. This time if we strike a match, a fire will occur—there will be burning at the vent.

All this can be demonstrated by simply opening the valve on funnel "B". I do so and gasoline runs into the flask, vapor is forced from the vent, it combines with air and ignites from the match flame. Here we have an unfriendly fire burning, say at a service station. We do not, however, call out the fire department to make a \$25 run for a 25c fire. Instead we simply close the truck faucet, shut off the flow of gasoline into the tank. Vapor is no longer forced through the vent and so the fire goes out for lack of fuel.

Obsolete practice was to provide these vent terminals with a gauze-like screen to guard against flames or sparks entering the tank through the vent pipe. This is an unwarranted precaution. I dare say every man has seen a service station or garage fire in which the vents and even the vent pipe itself became so hot they practically melted and yet the tank did not explode—did not because it would violate all physical laws if it did.

Why not have vent terminals free and open in order to insure adequate venting of these vapors at a point where they are less subject to ignition rather than have the openings clogged with screens blocked with scale, paint, wrap nets, etc.

Now we come to the third type of explosion about which there is great concern but like the others there is little if any evidence to support the popular theory. The contrary is true. As a matter of record, there is no instance in the history of oil storage plants on the Pacific Coast where an explosion has occurred in a tank because of a spark or flame entering the tank. There have been two instances where tanks have ruptured from internal pressure ("boiler explosions" again) generated by heat from flames outside the tank. In both of these instances which occurred several years ago, the failure of the tank was caused by inadequate venting—a fault that has long since been corrected.

The storage hazard in a bulk oil plant should not be confused with the greater haz-

ard of tanks in a refinery or other processing plant. In the latter facilities a great deal of experimental work is carried on because of necessity. The development of the automobile has come along, hand in hand, with petroleum refining technique. The car manufacturer cannot build a better car unless the oil industry can make a suitable product with which to operate it. Because of this experimental work and its accompanying handling of what are sometimes unfamiliar products whose characteristics are not definitely known, as they are known in the finished products handled in bulk plants, explosions may occur.

Whenever they do, here is an illustration of what usually happens. This tube which I hold in my hand will represent the tank. I shall drop a few drops of gasoline into it and insert the cork in the top. Anchored at the bottom of the tube I have a piece of small chain. This chain serves to break up the drops of gasoline, causing them to vaporize, and the resultant vapor combines with the air already present in the tube. Now we fire the spark plug and we see the cork is blown from the tube. We have had an explosion—the same sort of explosion that takes place in a tank. In this explosion the cork was blown out. In the case of a tank the roof would have blown off. There would not be and never has been a rupture of the shell in a conventional vertical storage tank. After the roof is gone the tank stands until all its contents are burned out. Even a tomato can filled with gasoline will burn itself out without melting its soldered seams. Try it sometime—you will find that to be true.

Let us try again. This time instead of putting in 7 or 8 drops let us try 20 drops. We repeat the shaking process. Now we fire the plug and to our surprise, nothing happens. WHY? Because this time the tube is filled with a mixture too rich to burn, the same sort of mixture that was in the glass jar and in the underground tank; a mixture containing too much gasoline vapor and not enough air. We can prove that by inverting the tube and pouring out some of the vapor. It will pour because it is heavier than air. Notice that no liquid comes out.

Now we have changed the mixture and we replace the cork. This time we get an explosion. We learn from this that we not only need a combination of air and vapor to get a burnable mixture, we need an almost exact

proportion of both. In every 100 cu. ft. of mixture, if we have more than 6 cu. ft. of vapor it will be too rich to burn. If we have less than 1½ cubic feet, the mixture will be too lean to burn. This fact will almost entirely explain why explosions never occur in bulk plant tanks. Such a tank in service will probably never have an explosive mixture in its vapor space. So much for explosions.

We have learned much in the analysis we have made. We know a great deal more of the actual hazards. Perhaps we can sum it all up in one simple test. We have learned:

1. That the fuel for every fire must be in vapor form.
2. Gasoline will give off that vapor without heating.
3. These vapors are heavier than air and accordingly will seek a level as water does, and
4. exposed to the surrounding atmosphere will combine with air to form a mixture which will burn when
5. it comes in contact with heat.

Now let us demonstrate all these. We take a ball of cotton and place it in the upper end of a trough. At the lower end of the trough we place a lighted candle. We moisten the ball of cotton with gasoline. Vapor flows down the trough, combines with air and finally reaches the candle flame. There is a slight puff, flame travels back up the trough, and the cotton bursts into flame.

We are familiar with two types of fires in an oil plant. The first, and the desired type, is of course the friendly fire which may exist under a boiler or be a part of the necessary operating requirements of the plant. The second, and undesirable type, is the unfriendly fire which may occur in a tank truck, at a loading rack or in a pump hose. Naturally our first thought should be to encourage the friendly fire and discourage the unfriendly fire. The most effective means of discouraging a fire is to prevent it altogether.

In other words, we may have fuel (in vapor form), plus Air, without Heat; or we may have Air, plus Heat, without Vapor; or we may have Vapor, plus Heat, without Air—and still be on the safe side. We may have any two we like anytime we like but never all three at the same time.

The prevention of Air is a practical impossibility and yet it is not extremely difficult in our operations to prevent Vapor or Heat. Whenever in our operations it becomes necessary to produce Vapor, for example, by exposing gasoline to atmosphere because of drawing it off in a bucket or for any other reason, the obvious thing to do would be to ask ourselves first if we are producing the Vapor in the presence of Heat.

The reverse would be true whenever we were committing an act which produced Heat. By that I mean striking a match, throwing an open switch, striking a heavy blow with a hammer on some other metallic object, or doing any of those things which produce Heat. Before doing so we should always ask ourselves the question, "Am I doing this in the presence of Vapor?" These are simple illustrations but I am sure they convey the general idea.

Occasionally, and sometimes frequently, prevention fails. Prevention fails because men fail. Either the man who designed the equipment, or the man who operates the equipment, or the man who maintains the equipment has failed. With failure, comes fire.

Once a fire is under way the thing we need most is control of that fire, control of the three things which go to make up the fire, that is, Vapor, Air and Heat. In starting out to control a fire we first devote our efforts toward control of the thing which is most important to its existence, that is its fuel (Vapor). Inasmuch as Vapor is a product of the liquid, obviously this becomes a matter of control of the liquid in most cases; shut down of pipelines and systems which contain liquid. On the other hand, there are times when Vapor itself can be controlled, just as was illustrated in the discussion on underground tank explosions.

We have said that it was not practically possible to prevent Air but once the fire is underway the control of Air is sometimes relatively simple. For example, if we had a fire burning in a tub of gasoline and the tub was only partially filled, we might direct a stream from a foam extinguisher into the burning gasoline. This would result in very little effect insofar as extinguishing the fire was concerned for the force of the stream as it struck the surface of the liquid would naturally splash the liquid and expose more of it to atmosphere, thus creating more Vapor and

intensifying the fire. Also the foam would be submerged beneath the liquid and become coated with oil which in itself would burn and break down the foam as it returned to the surface because of its buoyancy. If, however, we were to direct our foam stream against the side of the tub, foam would then build up and of its own weight slide across the surface of the liquid and give us something which would be a substitute for a blanket.

Of course if at the beginning we had placed a wool blanket over the tub, the fire would have been extinguished because in this way we would have controlled the Air, controlled the amount of Air being permitted to combine with the Vapor, thus creating a deficiency of Air to support combustion. Air may be controlled in other ways through the use of gases such as are produced by vaporizing carbon tetrachloride fluid, from the small pump type extinguisher or the gases delivered from a CO₂ extinguisher. Both of these gases are much heavier than air and displace it in the burning area and, being inert, suffocate the fire.

One mistake often made in the use of a foam extinguisher is in utilizing it on a tank truck or tank car dome fire. Consider for the sake of our argument that a fire is burning in the dome of a truck, we could very quickly see the futility of directing a foam stream down onto the surface of the liquid in the truck. In doing this we are simply shooting the stream past the fire and attempting to cover what might be a large surface area, particularly if the truck was only about one-half filled. Even though we had sufficient foam to completely cover the area, we can readily see that the fire would still burn because of its being fed by the Vapors in the Vapor space above the liquid level.

The failure of a foam extinguisher in this instance, however, need not be a cause for great alarm as extinguishment of fires of this type is relatively simple. All that is required is some means of effecting a closure over the dome opening, which even in the case of a tank car is relatively small. This may be done through the use of blankets, sacks, articles of clothing, boards, or by any other means. If I were asked to recommend an extinguisher for this type of fire I would have no hesitancy in selecting the small size CO₂ extinguisher. I have repeatedly extinguished such fires in test trials.

THURSDAY LUNCHEON SESSION

October 14, 1937

The Petroleum Section met jointly with the Marine Section at a noon luncheon session.

A statistical review and forecast of the

petroleum industry was presented by H. N. Blakeslee, director, Department of Accident Prevention, American Petroleum Institute, New York City.

A Statistical Review and Forecast of the Petroleum Industry

By H. N. BLAKESLEE

Director, Department of Accident Prevention, American Petroleum Institute, New York

The Petroleum Section safety-contest report for 1937 indicates that the upward accident-frequency trend of 1936 has at least been checked. The frequency rate for some 230,000 petroleum workers who participated in the contest is 13.82, compared with 14.09 injuries per million hours reported for the 1936 contest.

Although improvement in injury frequency has been only 2 per cent in the petroleum industry, ours is the only one of six industries holding contests which does not show an increase in the injury frequency rate.

Departments which contributed to the improved injury-frequency rate are marketing, pipe-line, tanker, and drilling. Refining, producing, and natural-gasoline departments showed a slight upward trend.

Declining Accident Severity

Information on injury severity is not given for the period of the contest. Nevertheless, company records indicate that during 1937 the severity of injuries in the petroleum industry, as well as the frequency of fatal injuries, has probably declined; and so far this year no major catastrophe involving the lives of a large number of oil-industry workers has been reported.

It is true that circumstances over which we have no control influence the severity of accidents. A man may die as the result of having fallen only 4 ft.; on the other hand, he may not be injured at all after having fallen 10 ft. An increasing injury-severity rate, therefore, does not necessarily follow

an increasing injury-frequency rate. It is, however, the controllable circumstances which should enlist our attention and continuous vigilance. Reports during recent years have shown a marked reduction in the severity of injuries and in the frequency of fatalities. Credit belongs to the vigorous accident prevention programs within the industry.

Accident-Prevention Programs

Many accident-prevention programs are initiated by a first-aid training course. Men are taught how to care for an injured person, and how to expedite that person's recovery after an injury. They are taught to administer artificial respiration. This training has resulted in the prevention of some accidents, and has definitely saved lives and reduced the severity of injury through more intelligent care after accidents have occurred.

Another important contribution to the reduction of injury severity has come from the intelligent use of protective equipment. Let us mention just one item, goggles. It is true goggles do not prevent accidents, but they do prevent injury to the eye if, for instance, babbitt explodes or a rivet head smashes a lens. The trained oil-industry worker, fully conscious of the hazards of his job, no longer resists wearing goggles.

Other protective equipment includes hard-toe shoes—which do not prevent accidents, but which save many toes from being crushed. Hard hats now take the blow from falling objects which frequently used to

fracture skulls and result in death. Objects still fall occasionally, but the hard hats contribute to the improved record on severity.

Inspection of equipment is a most important contribution to safety. Higher pressures and temperatures in distillation processes necessitate constant check and close inspection of equipment. This care and vigilance have done much to obviate those equipment failures which sometimes killed or injured every man in the vicinity of the accident. Standardization, because it makes available to all equipment of known strength and capacity, plays a most important role in obviating equipment failure.

Does not the real credit for our improving record belong, after all, to the entire personnel of the industry? High wages, reasonable hours, and reasonable working conditions have made ours a most attractive industry to intelligent and ambitious workers.

With oil companies increasing their efforts in accident prevention, it seems reasonable to predict that the petroleum industrial-injury record for 1937 should compare favorably with the records of other industries having comparable operations. Constructive accident-prevention programs should produce even more gratifying results in the future.

Petroleum Section Safety Contest

Of the 206 units entered into the Petroleum Section Safety Contest, 20 completed the six months' period without a single disabling injury.

The average frequency rate for all contestants was 13.822. The wholesale marking division had the lowest rate, average 8.833. The drilling units had the highest rates with an average of 51.977.

In the six months' period 213,209 employees of the 206 contestants worked a total of 229,199,847 man-hours.

Twenty-six plaques were presented to first place winners; fourteen certificates were presented to second and third place winners. Awards were presented by John E. Long, Past President, National Safety Council. Winners of plaques were as follows:

Manufacturing Department, Group A (over 1,000,000 man-hours)—Continental Oil Co., Ponca City, Okla.

Manufacturing Department, Group B (50,000 to 1,000,000 man-hours)—Five tied for first place—Colonial Beacon Oil Co., Inc., Everett, Mass.; Pan American Petroleum Corp., New York City; Shell Oil Co. of Canada, Ltd., Montreal, Que.; Panhandle Refining Co., Wichita Falls, Tex.; Stanolind Oil & Gas Co., Tulsa, Okla.

Marketing-Wholesale Department, Group A (over 1,000,000 man-hours)—Continental Oil Co., Ponca City, Okla.

Marketing-Wholesale Department, Group B (50,000 to 1,000,000 man-hours)—Two

tied for first place—Indian Refining Co., Lawrenceville, Ill.; Panhandle Refining Co., Wichita Falls, Tex.

Marketing-Retail Department—Union Oil Co. of California, Los Angeles.

Drilling Department—Broadwater Drilling Co. of the Globe Oil & Refining Co., Wichita, Kan.

Producing Department, Group A (over 1,000,000 man-hours)—Continental Oil Co., Ponca City, Okla.

Producing Department, Group B (50,000 to 1,000,000 man-hours)—Three tied for first place—Hope Construction and Refining Co., Pittsburgh, Pa.; Texas Pacific Coal and Oil Co., Fort Worth, Tex.; Wirt Franklin Petroleum Corp., Ardmore, Okla.

Natural Gasoline Department—Five tied for first place—Shell Petroleum Corp., St. Louis, Mo.; Shell Oil Co., San Francisco, Calif.; Lone Star Gas Co., Dallas, Tex.; Hope Construction & Refining Co., Pittsburgh, Pa.; Gulf Companies, Houston, Tex.

Pipe Line Department, Group A (over 500,000 man-hours)—Stanolind Pipe Line Co., Tulsa, Okla.

Pipe Line Department, Group B (50,000 to 500,000 man-hours)—Four tied for first place—Tide Water Pipe Co., Ltd., Bradford, Pa.; Tidal Pipe Line Co., Tulsa, Okla.; Ajax Pipe Line Corp., Tulsa, Okla.; Barnsdall Oil Co., Tulsa, Okla.

Tankers Department—Lago Shipping Co., Ltd., Aruba, N. W. I.

THURSDAY AFTERNOON SESSION

October 14, 1937

The Art of Giving Complete Instruction

By RAY L. MARTIN

Director, Industrial Education, State Board for Vocational Education, Austin, Tex.

No man is educated who is not a continuous student. The kaleidoscopic changes in thought, in industry and in government make it imperative for each individual to be alert and refresh his store of knowledge from day to day. Progress is an inexorable law. He who pursues it will remain in the race. He who rests on his laurels will be outdistanced.

As industry becomes more complex, the need for new knowledge increases. Not only are there more things to be taught, but the task of teaching becomes more involved. The breaking in of new men, the inauguration of new company policies, the institution of new processes, the installation of new equipment, the inculcation of safe work habits all call for a high order of teaching. For the individuals charged with these responsibilities, the job of teaching looms big in their daily tasks.

No man with administrative or supervisory authority can shirk the responsibility of teaching. It is an essential function of his job. If he ignores it or fails to do it well, he will minimize his effectiveness as a leader.

It is idle to assume that formal schooling can prepare an individual for engineering, carpentry, machine shop practice, the law or business administration, and that once exposed to and indoctrinated with the ideas of the schoolmaster he will be able to discharge his chosen occupation without a further pursuit of occupational knowledge.

Adult education has come to be recognized as an essential part of all education, and industry is its greatest school. The world of industry is teeming with problems. Workers must face them every day. How well they cope with these problems depends upon how well the process of job education is carried on from day to day.

There was once a widespread notion that all knowledge was acquired during the formative period of childhood and that after

reaching his maturity a man could be taught little or nothing. We now know that adults can and must learn every day of their lives in the school of hard knocks. We know, too, that adult learning cannot be left to chance. It must be planned and made purposeful.

There is a modicum of truth in the facetious statement that 5 per cent of the people think, 10 per cent think they think, and the other 85 per cent would rather die than think. The masses of men in any organization will be found among the 85 per cent unless their bosses see that they acquire sound habits of thinking. These, like habits of doing, are developed by practice. Just as a person becomes adept at shifting the gears of an automobile by practicing the process, so may he acquire skill in thinking. It is a sound psychological law that we learn to think by thinking. "I did not think" is the feeble excuse of men who get into difficulty because they have not been taught to think.

Job instruction begins when the new employee comes on the job and continues as long as he remains as an employee.

Perhaps the most important instructional responsibility is that of breaking in new men. A new employee approaches a new job with fear and trepidation. He does not know exactly what he is supposed to do. He may be acquainted with few or none of the men with whom he is to work. His ideas of company policies are vague, and it is quite likely that he is uncertain as to persons from whom he is to receive orders and instructions. If ever a man needs a friend, it is during his first few days in a new situation. No matter how well qualified he may be for the job, he must have extensive instruction to enable him to get off to a good start, make friends with his fellow workers, avoid embarrassments and work safely.

It is foolish to assume that because a man has proved his ability as a workman he does not need instruction. First of all his superior should give him a complete analysis

of his job, preferably in writing. This analysis should include a list of duties, possible hazards to anticipate and standard procedures to follow. It should be accompanied by an organization chart, showing the line of authority and the place of each worker in the organization. Every pay roll job should be so analyzed.

It is impossible to estimate the appalling loss of life, the waste of time and materials and the ill will of personnel that is caused by poor instruction. Incomplete orders have sent many a man to his death or caused the wreckage of valuable property. When such things happen, it may be said with assurance that somebody has failed in his teaching responsibility.

A foreman in a large steam plant told a comparatively green man after a week-end shut-down to open a gate valve on an 8 inch line. The man had never been told how to admit steam to a cold line or the probable consequences of admitting steam too rapidly. Water hammer had never been explained to him. He spun the valve wide open. Water hammer started immediately, and the innocent offender took to his heels before the line ruptured and came down. A long and expensive shut-down would have been avoided by giving complete instruction.

While most instruction in industry is and should be given on the job, group instruction off the job is also necessary. Let us consider some of its techniques.

The average man with managerial or supervisory responsibilities is reluctant to undertake a teaching responsibility. Teaching, to him, seems a job for old maids and effeminate men, but not a part of the work of a busy executive. No wonder he shrinks at the idea of assuming the role before men with whom he is constantly associated in an informal way. He believes he will have to assume an artificial attitude and will appear ridiculous to his men. He fails to realize that in giving instructions to men he has for years been a teacher.

An instructor of industrial men, when he gives group instruction, should regard himself as a leader of a study group, not as a dispenser of abstract facts. He will succeed as a teacher in proportion to his ability to get his men to think about and participate in the topics of discussion. He cannot do this if he is too much on his dignity or tries to make the meetings with his group formal and stilted.

Men will look askance at any training program if the instructor does not show enthusiasm for it. Enthusiasm begets enthusiasm.

Men will attend a class because attendance is made compulsory; because it is endorsed by popular men on the force; and therefore seems the proper thing to do; or because they think that training will improve their work and enable them to earn more money. Only when a man can be made to feel a need for training is he in a receptive mood. Therefore, the first and most important job of the instructor is to sell the idea of training and make the men realize that they will benefit by attending the meetings. It is poor policy to announce that attendance is compulsory. The man who has to be forced to attend is poor training material, and the sooner he is replaced in any organization the better.

Experienced teachers all agree that we learn to do by doing. This is obviously true of manual skills. A man cannot learn to be a good golfer without practicing with golf clubs. Neither can he acquire skill in thinking without using the stuff with which he has been given to think. An instructor must use all the tricks of the teaching trade to get a man to think about the ideas he should absorb, and to think about them repeatedly until they become firmly fixed in his mind. Telling is not teaching. Mere exposure to information is a waste of time.

Some of the methods of teaching are lectures, demonstrations, and conferences. The device selected for a particular study will depend on the aim of the study. More often than not, more than one device is necessary.

The lecture method alone seldom accomplishes much in industrial teaching. A man does not fully appreciate ideas that are presented, then interpreted for him. It requires too little effort on his part, and it is very easy for him to relax and indulge in day dreams or peaceful slumber. Subjects can be well introduced and summed up by short talks, but the instructor should not do all the talking.

As a teaching device the demonstration method often serves well. For example, in teaching artificial respiration or the tying of a bow line knot demonstration is most effective.

Adequate preparation must be made in advance, however, so that the demonstration is given in a natural and serious way and

so that the men will not be standing around waiting for the instructor to get ready. Before starting a demonstration, the aim should be clearly explained. This will focus attention on what is being done.

In industry the conference method has proved to be the best tool of the instructor. Its object is to modify attitudes, promote habits of thinking and pool the best ideas of individual members so that the best thought on the subject will be available to all. The conference gives each man the benefit of the experience of others.

Ability to lead group discussions is a rare accomplishment. Men who are recognized leaders in their fields often fail miserably when asked to direct an open forum.

The conference method provides an easy way for a bashful man to become accustomed to presiding before groups of people. Its informality tends to inspire confidence and to create a sense of fellowship between the leader and his group. He finds it much easier to guide the discussion and record other people's ideas than to speak as an authority with a view of getting his own ideas accepted. Conference leadership

ability, however, is not easily acquired without a study of its technique and observance of some of its principles.

There is no better way to describe a conference leader than to say that he is like a suction pump. The ideas he wants presented are held by the group. It is up to him to draw them out and get them clarified and summarized. He need not necessarily be an authority on the subject under discussion, and if he is, he should not advertise it. Some of the men may know more than he does. His skill consists in getting others to talk.

To preserve the ideas developed and to keep the discussion on the track it is essential that there be a blackboard or an easel with large sheets of paper fastened to it in the conference room. The easel has certain advantages over the blackboard. The sheets may be turned over the top of the easel for reference when the leader wants to sum up a discussion. Also, they may be preserved if it is desired to furnish group members with copies of the ideas developed.

The following chart headings illustrate approaches to different kinds of problems:

TOPIC—ACCIDENTS		
Kinds	Causes	How to Prevent

TOPIC—APATHY OF PUBLIC TOWARD ACCIDENT PREVENTION	
Possible Causes	Remedies

TROUBLE SHOOTING—TO DETERMINE CAUSES OF INCREASED HIGHWAY ACCIDENTS		
Kinds of Highway Accidents	Probable Causes	Suggested Ways of Preventing

CASE PROBLEMS—ACCIDENT RESPONSIBILITY	
Facts Regarding Accident	Conclusions

JOB ANALYSIS—INSPECTING A BOILER		
Procedure by Steps	Hazards	Precautions to Take

Having set up his chart headings, the conference leader is ready to introduce his subject. Before he can proceed with the analysis, he must get the group's attention focused on his subject. He can do this by calling attention to the importance of the subject, or the immediate and pressing need for a solution to a problem. Or he may tell a humorous story and tie it up with his subject. Great care should be taken, however, to select a story whose point can be really applied to the subject. Sometimes the reading of a communication or news article, or recalling a recent order or incident, will direct attention to the subject.

When ready to call on the men for ideas, the leader must set an example of informality. Men will think best in an informal atmosphere. Big words and high sounding phrases should be avoided. The leader should let ideas be expressed in terms that would be used in casual conversation.

There are certain devices a conference leader can employ to bring out discussion. Analysis charts are the most reliable. Ideas should be written down promptly and in as few words as possible to convey the meaning clearly.

When it is desired to reach a conclusion by discussing the advantages and disadvantages of a topic, the leader must use his judgment as to which side of the question should be discussed first. For example, if he wanted to sell the idea of group insurance to a gathering of men, he would ask for their ideas as to the advantages first. By listing advantages first, the chances are that there would be so many good reasons for the plan that few objections would be offered in the

"disadvantage" column. So, without expressing an opinion himself, the leader can lead a group to sell themselves on an idea, which, if he tried to force on them, might cause objections.

Some conference topics can be handled best by developing the negative side first. For example, if a leader wants to develop the qualifications of a good supervisor, he might set up the following conference topic heading: "The kind of supervisor men do not like." It is easier for most men to point out faults than to see good qualities in men, and so a good long list will soon develop. It is easy, then, to set up the positive side of the topic, as the negative points will suggest the opposite.

Case problems, either real or hypothetical, are always calculated to arouse interest. A real case in which the men are interested at the time is best. It may be a case of an outstanding accomplishment or an unusual situation.

Questions skillfully used are the conference leader's most effective device. A good question will set men to thinking, and thinking is the object of a conference. A question which can be answered by "yes" or "no" has little value. It encourages men to guess instead of think about the problem. If a question is assigned before it is stated, only one man thinks. The same is true when the leader asks questions in alphabetical order or goes around the table in a regular order. Most questions in a conference should be overhead questions—that is, questions directed to the group rather than to individuals. Questions are valuable to draw out men who are not participating, or to get an ex-

pression from a man who the leader knows has a good answer.

Graphs and illustrations are also very useful. A crude drawing helps men visualize, and sometimes its very crudeness lends a comical aspect and attracts attention better than any other device used.

There are men in every group who have good, constructive ideas but who will be reluctant to talk because they cannot express themselves well. A good conference leader will be quick to catch a man's meaning and express his idea for him, thereby relieving him of embarrassment and encouraging him to talk more.

A good story at the right time is also a good device. When the conference lags, an appropriate story sometimes instills new life in the group. Another case where a story can be used to good advantage is when a bitter argument develops. A humorous story will relieve the tenseness of such a situation and avert personal clashes.

If a topic is to be discussed and the leader believes the group will agree at once, he may want to start an argument to stimulate thinking. An argument forces men to think to defend their views and is one of the leader's most effective tools. The leader may arrange with a member of the group to take a negative stand before the meeting opens. Of course, the other men must know nothing of the arrangement, and the device should not be used too often.

The following questions may be used to check one's ability to lead a conference:

1. Was the objective made clear in the opening remarks?
2. Were the chart headings worded so as to bring out the best discussion without confusion?
3. Was the proper attitude shown toward the group, and did the leader maintain his composure under trying circumstances?
4. Did the leader talk too much and thereby keep members of the group from participating in the discussion?
5. Was skill shown in questioning?
6. Did the leader himself become involved in arguments with the group members?
7. Was the discussion kept on the subject?
8. Was one man permitted to do all the talking?
9. Was the interest of the group maintained?

10. Was the leader quick to grasp and record ideas?

11. In summing up the discussion, were the high points emphasized?

The industrial teacher must be adept at job analysis. If he is a good conference leader, he can with the aid of experienced workers break each pay roll job down into its component parts and arrange operations in a logical sequence. Such an analysis will reveal teaching points and call attention to instructions which should be given.

As an example let us take the job of a machinist. An analysis chart will serve well here. The chart might have three columns with the following headings: What a Machinist Does, What He Must Know, and What He Should Know. In the first column the major duties of a machinist are listed. In the second column opposite each duty will be set down the knowledge that is essential for its safe, efficient performance. The third column is intended for recording knowledge which, while not essential for job performance, will make a man a better workman by creating interest in his job. Here will be recorded the sort of knowledge which will help him understand the significance of what he does.

In analyzing a work job to be done by a crew of men, some one must lay careful plans. In job planning, six definite steps should be followed. The first step is to spot the problem; the second to gather all facts bearing on the problem; the third to select the functioning facts which are pertinent to the problem; the fourth to formulate a plan of procedure; the fifth to execute the plan; and the sixth to check results after the job is completed. This orderly procedure will prevent many failures.

Before starting a job of major importance it is well for a foreman to go into a huddle with his men and take advantage of their experience in laying plans. Not only will this experience help in planning, but the opportunity to have a part in planning will raise the morale of a group and enhance interest in the work.

The conference procedure affords an excellent means of job analysis. We will assume that plans are to be made to pull rods and tubing from an oil well. Obviously, the foreman wants to carry this job through with the least possible expenditure of time, effort and materials and avoid accidents. A chart can be developed which will reveal all

the teaching points. In one column, the operations to be performed may be set down in their logical order, such as rigging up, taking the well off the beam, pulling the rods, stringing up the tubing block and so on. In a second column may be listed the tools and equipment needed for each operation. A third column may be used to list precautions for avoiding accidents for each operation. To make sure nothing will be overlooked in giving instructions and to discover things which should be taught to insure a thorough understanding of the job, a fourth column should be added. In this will be listed the trade mathematics, trade science, trade drawings, and trade terms involved in the performance of the various operations.

A good foreman or teacher with a fine background of industrial experience may be able to make an excellent job analysis unaided. To do this he must be able to enact in his mind every detail from the beginning to the completion of the work. He must see clearly in his imagination each step of the process, with each workman taking the part he is best fitted for. He must anticipate missteps and determine what instruction should

be given to prevent accidents. He must consider costs and make his plans accordingly. Knowing his men, he must think of the special instructions which should be given each one.

A common mistake of a foreman is to make tentative plans and then trust to memory in carrying them out. He believes he will give certain instructions at different stages in the progress of the work, but unless he keeps a written record of his plans he will likely overlook some information that should be given. A thorough job analysis which is carefully followed will serve a foreman in the same way that a blueprint serves a builder.

Much inefficiency and frequent misunderstandings arise from the fact that orders are not properly given. Foremen seem especially weak in issuing written orders. These have many advantages over oral orders, provided they give attention to detail. A good order will reveal *what* the job is, *where* it is to be done, *when*, *who* is to do the job, *how* it is to be done, *why*, and what *results* are expected. No one is prepared to issue an order for a job who has not first analyzed that job.

Habit Formation Through Supervision

By O. B. BADGER

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Every supervisor has three distinct responsibilities, managerial, supervisory, and instructional. As a manager, he makes plans; as a supervisor, he sees that his plans are carried out by those under his direction; and if there is some information or skill his men do not know, he is obligated to teach them.

Under these responsibilities he is charged with giving of safety information and supervising safe practices, a very important phase of his work.

The supervisor must know what information will function on the job: how to do work safely; and under certain conditions, furnish safety devices. After doing all these

things to prevent injury, he should be aware that the majority of accidents are due to mental reactions of the workmen. This implies, then, that he should know the laws which control the formation of mental and physical habits which make for safe work habits for the benefit of the workman himself and for those about him.

Four major factors are to be considered in acquiring new habits or breaking up old ones, maturation, motivation, the situation, and the opportunity for the learner to practice.

By maturation we refer to mental and physical development of the individual. On certain jobs there is required a physical

maturity where the muscles of the arms and the legs must be fully developed to insure perfect coordination. On the other hand the individual may be too old for the necessary coordination to perform certain tasks without danger to himself or to others. The nervous systems of some adults never develop to that of the average person. The supervisor should be constantly aware of those people, as they are extremely dangerous on almost any job. A person must possess a healthy nervous system to have normal muscular reactions.

Motivation

The second factor is motivation, such as the social approval of fellow workmen, ambition to succeed, money rewards, admiration for the supervisor, loyalty to the company, and similar incentives. A negative incentive is fear of disapproval of fellow workmen, fear of losing his job, fear of loss of income, and fear of the supervisor. The good supervisor will use positive incentives in the development of safe work practices. Occasionally he may be forced to use a negative one.

The rate of habit formation depends upon the interest in learning it. Arousing that interest requires initiative, tact, and often perseverance on the part of the supervisor.

Situation

Often the situation in which a person finds himself determines what he does. Some accidents, seemingly unexplainable, can be traced to the fact that the conditions and place are new and strange to the worker, or at least different from what they were the week before, the day before, or even the hour before. His financial condition or some emotional stress may be disturbing him. Again he may be musing over the hilarious time he had had the previous night, or thinking of the good time he expects to have in the future. An individual may be angry at his boss or angry at himself or at his tools. When this happens, accidents often occur. The supervisor can make the situation as congenial as is physically possible by having tools in good working condition and all necessary guards in place, but he cannot always control the mental condition of the worker.

The fourth major factor for the supervisor is providing adequate time for practicing a new habit. The practice should continue until the habit becomes fixed to a level of achievement satisfactory to the supervisor and to the workman. The workman must be taught the correct method of doing a job, from the beginning to the end, and the supervisor should see that the learner never deviates from instructions.

A habit should be practiced under actual working conditions if it is to be most effective. Sometimes it is necessary to give training under pseudo-conditions, which is better than to give no previous instructions before the employee enters upon his task. It is much better, however, for the supervisor to take his man out on the job and give safety instructions where he can see and experience what lies before him.

Depends on Satisfaction

Doing a job safely depends in a measure upon whether the worker derives satisfaction from doing it the safe way. Sometimes a short cut method gives greater personal satisfaction, but the results often are an injury to either man or machine or both. It is the responsibility of the supervisor to point out that satisfaction should come only when no one is in danger.

Many workmen are seldom required to do dangerous tasks. While the supervisor may have given adequate instruction the first time the job was done, when the task is repeated an accident occurs due to the failure of the supervisor to be present and see that safety precautions are observed. Repeating the job correctly will strengthen the right habits.

Progress Not Continuous

Progress in any habit is not continuously regular, but by periods of rest and advancement. Too often supervisors forget this fundamental law in training workmen. Frequently they become irritable, and the effect on the workmen retards the development of new skills.

Those of us who are supervisors must admit, whether we like to or not, that the best measure of trainer's efficiency is the performance of the learner, provided the worker has been carefully selected for the job.

Résumé of Safety in Natural Gasoline Plants

By G. W. McCULLOUGH

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Problems of safety in natural gasoline plants come under one of three headings: (1) new construction; (2) old and existing installations; (3) education of personnel.

New Construction

The designing engineer must comply with the various construction codes and all state and federal regulations, yet he must be willing to depart from tradition in the selection and care of materials, if necessary, to place the safety factor foremost during the construction period and keep it there.

Whether it be additions to existing plants or an entirely new or independent installation, we must know the service for which the equipment is intended and the properties of its materials. We must work with the manufacturer to see that the fabricating process gives uniform properties or characteristics to the material. And last, we must consider maintenance by operating the finished unit within the limits of its material and design.

The spacing of buildings and equipment is of vital importance with reference to fire, explosion and personal injury hazards. We certainly would not place boilers or other open fire equipment adjacent to tanks holding flammable material such as storage tanks, distillation, or treating equipment, nor would we locate these same units on higher ground than the open fired units where any leakage would drain into the fire zone.

The general plant layout must consider existing oil and gas wells, separators, tank batteries and ground terrain with due regard to prevailing winds, for the majority of natural gasoline plants are located in the heart of a producing field. Since well locations are fairly uniform and usually spotted in north and south lines, it will usually work out, and luckily for sound engineering, to locate the plant equipment similarly.

By drawing a plus sign on the proposed plant contour map, the plant can be laid out on two lines:

East to West—Storage Tanks, cooling towers, processing equipment, engine rooms, office, laboratory and camp.

North to South—Cooling towers, processing equipment, fire stills and boiler houses.

While it may become necessary to reverse the equipment on one line, operating experience has shown the desirability of such line layouts. A general inspection of existing plants, keeping these locations in mind, will impress on the most casual observer that while the layout being considered may have partially followed this plan, deviations have generally resulted in crowded equipment, objectionable piping and hazardous conditions and, in many cases, are responsible for poor operating performance from proved equipment.

Gasoline Storage Tanks

Tank requirements for storing natural gasoline can be classified into three services: raw material, finished natural gasoline (12# to 26# R.V.P.) and by products.

The vapor pressure of the material handled raises an economic issue requiring tank design for proper shell thickness but forcing the tank size to a minimum necessary to act as a flywheel to the process. Experience has shown that for raw storage in individual plants 5 x 18 or 10 x 40 horizontal tanks usually prove adequate; however, to competently cope with a large group of plants, it may become necessary to install as large as 12,000 barrel tanks.

Where past practices have been to place tanks underground, or under sheds for protection from sunlight and atmosphere, these developments in steel tank fabrication and the use of heat reflective paints, insulation, water sprays, now show it is economy to build tankage to withstand the vapor pressure of the product stored, at a location advantageous for operations of blending and loading yet creating the minimum hazards.

While there are considerable differences in opinion, it has been the accepted practice to space large gas-tight steel tankage at least one tank diameter, shell to shell, considering this spacing very reasonable and a safe precaution against exposure hazard.

The majority of batteries of small tankage (7 x 30 and 10 x 40) have been laid out with two foot shell clearances, with center line of tanks north and south to provide protection to the operator when reading gauges. This is most desirable on both aboveground or underground batteries and prevailing winds will normally prove adequate to maintain ventilation through the alley-ways.

Hydrocarbon vapors, particularly propane and butane are heavier than air and will therefore flow to low levels, hence, tankage should be placed so that should leaks occur or vapors be released, there would not be a direct valley for these to flow toward open fires. Drains from tanks or equipment containing a flammable liquid should not tie into drains from other tanks or buildings, nor into plant or camp sewer lines. While water seals and manhole vents are usually provided, these are apt to fail from lack of maintenance and the leakage of such flammable vapors presents a treacherous fire hazard.

All equipment, including tankage, should be built for the maximum operating pressure with a reasonable factor of safety, adhering to A.S.M.E. or other construction codes. In supporting any tankage, the foundation should be adequate and as precaution against breakage from settling or contraction and expansion due to temperature conditions, it is fast becoming common practice to provide swings in the connecting lines, steel gates and welded instead of screw fittings. The use of anti-freeze drains of inside tank construction, alloy trimmed gauge glass fittings and relief valves and vents will assure further protection particularly in cold climates and areas where corrosive materials are encountered.

On all liquid tankage, spring loaded vapor relief valves should be in duplicate, one set at slightly lower pressure than the other, vented to the atmosphere and with the discharge lines extending beyond any buildings. It should be emphasized that relief valves, vents and lines should be free of low spots or pockets to prevent freeze-ups in cold weather and of adequate capacity to relieve both pressure and vacuum that might exist in pumping into or out of storage. Where flame arrestors are to be used only Underwriters' Laboratory approved types should be installed.

Submerged inlet or blending lines in natural gasoline storage tanks that "breathe" air when being emptied or when used as standing storage are very desirable and will prevent

occurrence of static electricity that occurs from falling streams of gasoline. Providing the inlet or filling line with an automatic back pressure check valve and the outlet line with an automatic excess flow valve are added safety measures to prevent back flow in case either connection is broken.

The regulations of the N.B.F.U. for the liquified petroleum gas industry require the fill line to enter the top and discharge above the liquid level. However, since other connections such as thermometer well, vapor and liquid outlet lines and relief valve connections are usually grouped with the fill line in the manhole cover a conductor is in the vapor zone to effectively ground any static sparks that might be set up.

Similarly "grounds" should be provided on every steam hose used in the plant or for cleaning tankage, as this same static electricity is formed due to friction.

The corrosion rate of a storage tank holding liquid containing hydrogen sulfide and sulphur compounds is dependent upon the percentage of oxygen and water vapor present at the same time. Hence, we strive to eliminate these in the inlet gas and from all steps of the plant processes, including the storage tanks, thus prolonging the life of all equipment. The plant maintenance expense will be governed largely by this same corrosion angle. From experience we have found that adding $\frac{1}{4}$ " shell thickness over that required for operating pressure when purchasing new tanks will assure a factor of safety for at least eight years in sour gas areas.

One essential precaution in cleaning tanks used in "sour" or corrosive service, is to remove rust or other foreign matter found in the tank to a point remote from the tank being cleaned. Such material, if analyzed, will be found to contain free sulphur, organic sulfide, iron sulfide and iron oxide. When exposed to the air in the open, the iron sulfide, being pyrophoric, will absorb oxygen readily, heat to incandescence, burst into flame and ignite any vapor or combustible gas present.

The greatest fire hazard on large tanks is from open gauge hatches, manholes, defective screens or other non-gas-tight conditions that allow vapors to be ignited outside and flashed back into the tank. The increasing number of breather balloon and vapor recovery systems installed on standing and working storage indicates that not only are such systems

reducing the hazards of vented vapors but are economically sound.

An adequate fire wall with capacity for the contents of the tanks should be provided and any drains from tankage or fire walls should be diverted away from the plant, boiler house, office, laboratory, camp houses, incinerators or other points of open fires.

Provision of steam snuffing lines, open ended and free draining, around tank connections, headers, and pump manifolds, with the master supply valve located remote from the tankage has proved most practical for plant batteries. Water can be used to keep connections cool and possibly prevent breakage, but care must be taken to prevent floating the gasoline or other hydrocarbon products away from the point of fire or into an even more dangerous location. Foam type extinguishing systems work admirably where a smothering condition can be obtained and carbon dioxide can be used where the flames are small or confined to allow blanketing oxygen off the combustible material.

A large number of plants are now equipped with a remote control snuffing system with strategically located control valves throughout the plant, which in from 8 to 12 seconds will close fuel supply to boilers and fire stills and inject steam into the fire boxes to cool same down speedily and before a floating vapor can reach them. A check on this system every three months assures its reliability.

Cooling Towers, Transformer Banks, High Lines

In the Southwest, prevailing winds are either southeast, south or southwest, hence, cooling towers must run east and west to provide maximum exposures to air currents. In all cooling towers, the great mass of circulated water is cooled by the evaporation of a small part of its volume. This lost portion saturates the air as it blows through the tower, and, since the sides of the tower are open, as high winds are encountered, increasing quantities of water are mechanically carried out of the tower in the form of mist and small droplets unless the pit water is dumped occasionally. With continued make-up to offset these losses, the concentration of solids, salts, etc., will increase in the water and the windage will contain these solids resulting in incrustations on whatever the mist falls upon.

Since this entrained water will carry from 50 to 200 feet, depending upon wind velocity,

all plant equipment should be kept 50 to 100 feet away from cooling towers and under no circumstances should a transformer bank or high voltage line be located in this driftage area.

Ladders and walkways on and around every tower must be rigid, slip and skidproof, and provided with protected rungs and handrails to cope with the needs of cold, windy and freezing weather conditions. If water distribution is adjustable and practically every tower has such provisions, the mechanism should be installed on the ground with extensions to vital control points for every operator is human and on a cold night with a freezing rain necessary changes will be made convenient, if not, our operation and production suffers.

Processing Equipment, Spacing, Safeguards, Ventilation

Equipment should be so spaced that the operator or repairman can work conveniently. Physical safeguards and walkways are absolutely essential to moving machinery and electrical apparatus. Where new material and machinery is used, we should work with the manufacturer in designing and installing gear guards, rails or other protective materials, making them a part of the equipment and, as on old or existing equipment, take necessary precautions to see that the guards protect rather than increase the hazard already existing. Safeguards or rails should be installed with the original construction as there are more hazards when starting up moving equipment than after same is operating.

Ventilation should be given thought from the health standpoint as well as from its ability to keep buildings and manifolds clear of flammable gases and vapors or explosive mixtures and at reasonable temperatures.

Not only should hot equipment and lines be insulated for heat economy purposes, but surfaces that the operator or repairman may lay their hands on when making inspections or adjustments should be covered. Expansion joints in variable temperature lines and welded connections will largely eliminate line breaks, leaks and hot water drips.

Location of lines, headers and valve wheels or boxes should be watched to eliminate both stumbling blocks and overhead headache posts. The provision of a reasonable amount of concrete floor area, walks, steel grating and walkways will repay in better operation as the

result of easier and more convenient access to equipment and controls requiring continuous checking. A small increase in initial cost of recording and control equipment will often allow favorable location of adjusting points and reduce hazardous trips for the operator up ladders, on lines, etc.

Electrification, Transformer Banks, High Lines

Transformer bank locations must be kept clear of plant build up hazards and a clearance of 50 to 100 feet from other equipment is desirable. While pole leads can be used, power service to buildings and equipment, particularly within hazardous areas, should come from the transformer bank through lead covered cable installed in underground conduit thus giving free access around buildings and equipment without danger. A protecting fence with locked gate should surround all transformer banks.

The greatest boon to the "graveyard" tour men has been the adoption of lights with reflectors distributing light over the desired area without shadows. It is a proved fact that the nearer approach to natural lighting, the easier and better the operation and the less the attitude for neglect.

Lights with or without reflectors should be enclosed in vapor globes and conduit wiring, vapor tight or oil immersed switches and safety outlets should be employed. Swinging the entire conduit and fixtures on springs, cushion hooks or other cradle effect in engine and pump rooms will greatly reduce filament breakage. If possible, no fixture or bulb should be so located as to require climbing over moving machinery to adjust or change bulbs.

Engine Rooms and Auxiliaries

The engine rooms represent one of the large investment areas in a plant and should be given attention accordingly. All pipe and fittings should have a high safety factor over the normal and maximum working pressures. Cooperation should be given to State Department of Labor in their campaigns to safeguard equipment and personnel by insisting upon qualified welders performing such work. The lack of proper tie-downs and expansion joints to compensate for vibration and temperature differentials causes many line breaks. Scrubbers with mist extractors for removal of entrained liquid and foreign matter will

eliminate cylinder head breakage and increase operating life of rings and cylinders.

Spring loaded relief valves should be provided on the discharge of each compressor cylinder having ample capacity for each cylinder. These valves relieve on discharge into a relief header which extends past the compressor building or other equipment and ends in a riser allowing disposal of relieved vapors in a non-fire or non-hazardous zone.

While not imperative in sweet gas areas, it is essential to use closed top and packed lifting lever type relief valves on units handling sour gas or vapors containing hydrogen sulfide, for such units allow the operator to hand check the valve without creating the hazard of escaping vapors or gas at the point of operation. Such valves are tested once each month by the plant repairman or chief engineer by closing the compressor discharge valve and checking the pressure at which the relief valve operates.

Boiler House and Fire Stills

The insulation of both boilers, feed and blowdown lines covers both hazardous surfaces and saves heat and fuel to increase engineering efficiency. Expansion joints or swings must be supplied to all three lines and welded fittings, lines and steel fittings do much to eliminate leaks and line breaks.

Two spring loaded safety valves must be on each boiler and one safety valve on each superheater, the first two with capacity to relieve the maximum steaming rate of the boiler with a minimum rise in steam pressure. Placing the weight of the exhaust line entirely on the safety valve invites a simmering, leaking action after the first pop, for when up to operating temperature, the added weight of the exhaust line tends to egg-shape the valve and seat. Hence, each safety valve should be provided with a special drip all on the exhaust and support of the exhaust line independent of the valve itself. Correction of this point on old boilers will eliminate seemingly incurable troubles. The provision and use of both quick and slow opening valves on the blowdown line will add justified life to every boiler. The installation of automatic non-return valves on the steam line off each boiler, steel blowdown columns with high-low water alarms, dependable feedwater level controls, fuel regulators and pressure gauges will repay their cost in better operation and more satisfied personnel.

Ventilation should be provided in the boiler

house roof to remove both excessive heat and products of combustion that may be present and leaking from cracked settings, fireboxes, etc. Locating fire stills in the boiler zone and providing the same quality of fuel or firing control, snuffing facilities with an added fire-wall protection will reduce the hazards normally considered present with this type equipment.

Plant Laboratory

All plant and laboratory tests must be conducted fully in accordance with A.S.T.M., A.G.A., or N.G.A.A. accepted procedure, copies of these manuals included in laboratory library. Summary of laboratory highlights are:

1. Build Distillation room and blending, pouring, Reid Vapor Pressure testing room separate without inside doors requiring separate outside entries. The ceiling of both rooms should be provided with ventilator connections extending separately through the roof.
2. Provide adequate laboratory space, careful setup of equipment with minimum congestion.
3. Use A.S.T.M., A.G.A. or N.G.A.A. apparatus. Demand Pyrex glass flasks and connections with steel, iron or metal apparatus in laboratory at minimum while preferred for pilot scale operations recommend housing same apart from laboratory.
4. Limit open flame distillations to gasoline, kerosenes, and oils, utilizing indirect heating where feasible, flat top closed hotplates, coil and submerged electric heaters, steam, oil or sand baths.
5. Use fireproof wire reinforced screens or compartments with suitable "safety" pans of adequate size to retain volume of sample and prevent spread of fire. Provide outside accessible shut-off valve for fuel supply.
6. Limit size of laboratory samples and provide adequate storage facilities for same. Storing containers in cold room refrigerators or on open shelves, in glass or metal containers, depending upon vapor pressure of liquid handled, providing drainage pan for drop and leakage with outside container for residue from tests.
7. Provide dry or carbon dioxide fire extinguishers conveniently located in laboratory. These have proved more satisfactory than liquid or foam extinguishers for combating laboratory fires.

8. Require a written report of every fire and accident to determine cause and allow setting up suitable regulations to prevent occurrence.

9. Provide competent personnel in the laboratory, familiar with the hazards involved, the safeguards and the technique of testing.

Office, Laboratory and Camp

Safety measures must not be confined to the plant alone for an accident in the office, lab, or camp involves lost time and expense to both company and employee and has a greater psychological effect on the employee and his efficiency than if occurring in the hazards of the plant. The flagrant disregard for fire hazards in these two areas has required the rebuilding of many offices and causes very painful burns of face and hands to both the careless individual and to innocent workers.

A company house row should have its street separate from through highways or roads, cattle guards protecting its entrance, sidewalks at least of minimum amount from the camp to the plant. Provision of this last will promote cleanliness in both plant and home and when coupled with provision of a few trees, shrubs and flowers will tend to bring out the best in every man. Incinerators should have childproof guardrails and their shut-off valves out of reach, or locked. Care should be taken in providing community wash and bath houses to see that open fires or stoves burn with complete combustion and in sour gas areas, it will pay to provide treated gas and regular inspections to these conveniences rather than hazard the asphyxiation of a child or woman.

Loading Rack

While usually located remote from the plant, safety features must be considered on every loading rack. In the general equipment layout, if a steam heating boiler, rackman's house or other point of open fire be necessary, in conjunction with the rack proper, same should be located south of, and at least 200 ft. from the rack itself. Every rack, regardless of whether it has a vapor recovery system or not, should have a vapor disposal line which will allow loading the cars without dome covers on and conducting the vapor loss during loading to some point away from the rack and preferably being released from a riser at a height that will allow dissipation of vapors without creating a fire hazard. The best of

lighting is justified upon not only the runway of the rack itself, but on the underneath side of the rack where the rackmen are required to tighten any connections or install unloading cap. Since there is always some leakage from the unloading connection until the seat is ground in and the cap installed, drainage should be provided from the rack to conduct both water and other liquid away from the rack proper, but not onto the railroad right-of-way or towards houses or other point of open fire. Two or more carbon dioxide fire extinguishers and at least two blankets and one or more barrels of water should be provided on top of the rack for most fires around racks are flashes igniting from lighting and if extinguished immediately can be handled by the rackman without undue hazard.

Inspection and Employee Education

If the highest safety standards are to be maintained, there must be an adequate and regular system of inspection. No concern should leave the matter entirely to the state or insurance carrier inspectors. While a com-

pany's scope of operations may not justify a full or even part-time safety inspector, we have found that mechanical safeguards will not in themselves prevent accidents, but the men themselves must be made safety conscious.

The impulses, interests and energies of the workers themselves must be properly guided and some encouragement given them to put forth their best efforts. The inauguration of monthly operators' meetings, in which a combined program of safety, discussion of plant processes, both practical and theoretical, an open forum on safety needs of the individual plant, combined with the customary eats and entertainment will make every man look forward to these nights.

Favorable recognition by both company management and supervisors for the employees successfully pursuing the vocational training courses which are being supported by the U. S. Government would, no doubt, create more interest in this form of training. Employee sponsorship alone will go far to sell the idea that trained men who can do their work thoroughly, quickly but safely are building security into their jobs.

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The Power Press Section met jointly with the Automotive and Machine Shop Section. A record of the joint meetings will be found on page 225 this volume.

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 B. B. McCULLOCH, Bureau of Safety, Chicago, Ill.
 GEORGE OPP, Detroit Edison Company, Detroit, Mich.
 F. M. PEPPER, Illinois Bell Telephone Co., Chicago, Ill.
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 C. B. SCOTT, Bureau of Safety, Chicago, Ill.
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 E. S. BEAUMONT, The Peoples Gas Light & Coke Co., Chicago, Ill. (1930-31)
 C. B. BOULET, Wisconsin Public Service Corp., Milwaukee, Wis. (1932-33)
 G. A. DOELLER, Dayton Power & Light Co., Dayton, Ohio (1931-32)
 JAMES B. DOUGLAS, The Philadelphia Gas Works Co., Philadelphia, Pa. (1916-17)
 ROY M. GODWIN, Philadelphia Electric Co., Philadelphia, Pa. (1935-36)
 E. J. KREH, Philadelphia Co., Pittsburgh, Pa. (1934-35)
 WILLS MACLACHLAN, Electrical Engineer, Toronto, Ont., Canada (1919-20)
 B. B. McCULLOCH, Bureau of Safety, 20 N. Wacker Drive., Chicago, Ill. (1925-26)
 GEORGE OPP, Detroit Edison Co., Detroit, Mich. (1926-27)
 F. M. PEPPER, Illinois Bell Telephone Co., Chicago, Ill. (1933-34)
 C. J. RUTLAND, Texas Power & Light Co., Dallas, Texas (1927-28)
 C. B. SCOTT, Bureau of Safety, 20 N. Wacker Drive, Chicago, Ill. (1917-18)
 H. F. WERN, West Penn System, Pittsburgh, Pa. (1928-29)

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TUESDAY AFTERNOON SESSION

October 12, 1937

The opening session was called to order by John J. Barada, Laclede Gas Light Co., St. Louis, Mo., who introduced the speakers.

What Are We Doing?

By CHARLES B. SCOTT

President, Bureau of Safety, Chicago, Ill.

It would seem appropriate at this anniversary meeting of the National Safety Council to consider seriously what is being done in the work for which it stands and to measure the accomplishments of the past and look at the problems and objectives the future will bring.

No one can deny that the Council is largely responsible for initiating organized efforts for the prevention of public and industrial accidents and that it has been and is now recognized as the most effective agency in our country to stimulate interest, to correlate standards of procedure and to provide a forum of education so necessary in a cause which has become of such importance and of mutual interest to all citizens.

It has not been the privilege of many of those present to experience the conditions which brought about the safety movement nor to follow its successes and failures. Due to the nature of the cause fostered by the Council, its work has enlisted and has been dependent upon those who, without a selfish interest, were prompted to contribute to the welfare of society and to prevent a deplorable and useless waste of life and property.

The Council has been kept alive and active by the volunteer services of industry and citizenship, unselfish and earnest in their support. Whatever has been achieved has been made possible by such sincerity of purpose and freely given service. The compensation has been accomplishment in a worthy cause, designed to help mankind. Pioneering at best is slow, difficult and with frequent discouragements, and the cause of safety during the past twenty-five years has proved to be no exception to the rule. It is particularly discouraging, after so many years of faithful work prompted by unselfish motives, to contemplate the toll of lives yet being sacrificed to carelessness.

Unfortunately the measurement of success in safety work is usually made by the comparisons of records of failures rather than by records of successful attainments. These become less dependable as a basis because they cannot take into account the constant material changes in hazards and

risks brought about by the different conditions which come into life and industry as a result of scientific advancement. Statistics of this year are of little value for comparison with the records of next year and certainly even less value ten years hence. As an example, if it were possible to compile automobile accident statistics on an accurate basis of the number of cars and passengers, mileage, conditions of roads and weather and numerous other factors including the provision for increased speed, then such records would serve as a comparison. However, such accurate statistical information is impossible.

Also, in the field of public utility, construction, maintenance and operation, many changes are prevalent, making comparable records in accident prevention difficult and uncertain. If failures in prevention work cannot be accurately determined, how then can the successes be known without knowledge of the lives saved or property salvaged? If thoughtful consideration is given to the difference between the present life in public and in industry as compared with that of twenty-five years ago, and due weight is given to the hazards and exposure created within that period, then it is certain that the intensive efforts which have been made to conserve life and property and to prevent useless waste have not been in vain. From this logical point of view, the labors and expense of these years have more than been justified.

The public utility industry has demonstrated the value of safety work not only by the saving of life and limb but by the achievement of a more considerate management, an improved personnel, scientific application of safety measures to the improvement of equipment and mechanisms, improved employee relationships, and better and more courteous service to the public.

Underlying the present day methods for the control of accidents are certain essential fundamentals which have always been, and will continue to be, necessary of consideration and which should constantly guide those who direct safety work. They are so well known that repetition would

seem to be unnecessary and yet so important that emphasis is always justifiable.

These fundamentals are that working conditions should be made safe and that the earnest cooperation of competent managers, supervisors and workers should be secured. Everything necessary seems to fall within one of these two classifications and almost all of the accidents which occur seem to be due to the failure of one or both of these admonitions. The assistance of the management and engineers has been demonstrated by the improved material changes in plants and equipment. These improvements have much to do with the success attained in the public utility industry. It has been a slow and difficult process because it has involved new and experimental ideas and considerable expense and yet it has largely been done in the interest of safety and certainly altogether in the interest of safety, efficiency and an improved and economical service by which the public, the investors and the employees have been benefited. It is no mean task nor light responsibility to work for and accomplish such an attainment.

In the realm of public safety this point may be more readily comprehended by consideration of the wonderfully improved highways and cars which have contributed not only to safety, but to the whole scheme of better living and increased happiness.

The outstanding difficulty of accident prevention in the electrical industry is the control of the human element. No plan has yet been conceived nor panacea yet developed for such control, and it is doubtful if such discoveries or cures will ever be forthcoming. But other factors are involved, such as safe working conditions and practices, selection, training supervision and other elements.

It would be presumptuous to attempt to state the ways by which human behavior can be controlled, and yet it may be of value to give attention to some of the ways by which this element may be favorably influenced. There is perhaps no more effective influence than that of personal contacts upon which personal influence largely depends. No safety director can achieve any significant measure of success in his work unless he carefully utilizes his personal contacts with his fellow employees in building up a respectable and honorable association, always evidenced by a sincere purpose and

desire upon his part to contribute to the welfare of these associates. The establishment of such influence cannot be prescribed by any fixed formula because of the naturally great variance of personalities of safety directors and the similar differences in the personalities of employees. Each director must determine his own qualifications and the requirements of his associate employees and hence create the proper methods of procedure.

There are, however, certain qualities of mind and character which are necessary in any situation. Some of these qualities are sincere purpose, unselfish interest in fellowmen and the desire to contribute to the happiness of mankind. These are usually evidenced by friendliness, kindness, humility and a strong sense of right; all qualities which can be evidenced only if they are in the nature of the man, sincere and honest. Today, as in times past, safety work is most dependent upon enlightenment and an appreciation of personal responsibility. In the future, improvements in public and industrial safety will be attained by building up such an appreciation among employees and the public.

Objectives and hopes for their accomplishment are usually underestimated. It was impressive to read a recent article concerning the experiments completed for stratosphere travel and to note the carefully studied precautions developed for such experimentation. Scientific mechanisms have been perfected to overcome the hazards of extreme temperatures and rarefied air conditions. These path-finders are developing safeguards against dangers which would seem to be impossible of human endurance, and yet no one can say but what such marvelous precautions may enable these men to make possible safe transportation through the world of stratosphere.

It is just such faith and confidence that leads to a progress of civilization and supremacy of man over seemingly insurmountable difficulties. It is true that the conceived objective in great undertakings is hardly comprehensible until after their attainment, and yet the time will come when many of the visions now had with reference to the safety of the public and of employees in industry will be facts rather than visions.

It is the duty of those now engaged to contribute their part toward this perfection.

Such objectives should not only contemplate the gradual improvement of records of accidents and the elimination of tragic waste, but should also take into account the

service being rendered to mankind for a better and happier life and for a citizenship which will ultimately enjoy the fruits of present labors.

Safety in Connection with Flood Emergencies as It Relates to Electric Operation

By R. J. SALSURY

Superintendent of Operations, Duquesne Light Co., Pittsburgh

We ordinarily think of safety in the operation of an electric utility as a somewhat formal setup of rules and procedure to cover the operation of switches and the repair of machinery. We may begin to take it as a matter of course. Only when it is put to the test of a great emergency can we judge its real value. Such an opportunity was presented to the safety organization of the Duquesne Light Company, which serves the Greater Pittsburgh Area in Allegheny and Beaver Counties, Pennsylvania. The entire company met the greatest emergency in its history with no disabling injury during the anxious days and nights when its power plants and a number of its substations, transmission and distribution lines were completely out of commission and during the weeks of reconstruction which followed.

Pittsburgh experienced the most disastrous flood of its history on St. Patrick's Day, 1936. It came almost without warning and was four and one-half feet higher than the legendary flood of 1763. So far as the power system was concerned, we were prepared for floods beyond any ever before experienced, but this one was so great that all of our power plants, one third of our substations, and many of our lines and cables were inundated, forcing us to shut down completely. For several hours we had no power whatever for a community of more than a million people.

We had very little power for three days. Most of the city had no water. It had no street car or street lighting service. Food was stored in warehouses which, even when they were not flooded, had no elevator service. Gasoline stations had plenty of gasoline in tanks under ground but they had no power to operate their pumps.

Neighboring companies, even though seri-

ously crippled and with major problems of their own, extended such sources of power as were still in operation. They curtailed the supply to some of their own customers so that as much as possible could be transmitted to Pittsburgh.

It was considered that the most essential service was communication, civic function such as water service, hospitals, dairies, and bakeries, followed by street services, newspapers, domestic lighting, commercial and industrial power. It is interesting to note that service was reestablished in the same order in the cities flooded along the Ohio River this year.

The first available power was brought into the city in a novel manner. A 22 Kv interconnection was available at the southeast corner of the system. It was brought into the McKeesport Substation, then to Dravosburg Substation where it was stepped up to 66,000 volts. All the normal load switches along the way were opened so that no power was taken from the line, not even for lights at the substations. From Dravosburg it went to Woodville Substation, where it was again stepped down to 22,000 volts to Chess Substation, where it stepped down to 11,000 volts, to Grant Substation and then to the Main Telephone Building to be used for the batteries and the telephone system.

Meanwhile from the westerly side of the system a 66 Kv line was available except that it had a tap to the Ambridge Substation where the oil breaker was under water. To open it, the operators had to cross a creek which was then 200 feet wide. When a boat was finally obtained, it was necessary to detour it in a truck for 15 miles over country roads. The men had to maneuver the boat around the switches, transformers, and steel structures, to get to the breaker. They

tried to reach the tripping lever down through the icy water but it was too deep. They finally located it with a hook stick and operated the breaker. Imagine the Supervisor's relief when they had reported safely back at the station and the line was energized into the northern part of the system.

As soon as the waters subsided the magnitude of the tremendous job of rehabilitation became evident. Speed was essential, and so it was decided to dispense with many of the routine forms such as "Request for Equipment Outage" which in normal times are necessary for the orderly procedure of work.

However, some features were insisted upon. All crews were accompanied with a qualified electrical man familiar with the layout. No work was to be done without getting in communication with System Operator, no matter how difficult that might be. No work on electrical equipment was to be done until it was proved to be dead and had been tagged out of service.

All feeder and distribution cables where either end had been under water were immediately tagged out of service. Station equipment was tagged as crews reported to work on it. The real danger was in restoring service.

Some large customers had turbines of their own connected to our system. They picked up load to the limit of their capacity. This further complicated the situation and increased the danger to the men on account of "feed backs."

At one time we had seven separate radial systems in operation. Most of the men in the field did not know what was "hot" or where the feed came from. We learned later that no matter in what substations the men worked, they tested for voltage and in most cases applied protective grounding before working on equipment. Their training had taught them to do it.

No line or equipment was placed in service until all crews had reported "off" by telephone, in person, or by written note with messengers, and not then until a qualified switchman had personally patrolled the customers' stations in a loop.

As soon as service was approximately normal, it was decided again to use the regular operating procedure. For our ordinary work we believe our safety routine to be conservative. During the flood we let the bars down, but not too far—the record proves that.

In all this rush and confusion, where was safety? Frankly, it was coasting, but it coasted through. For the duration of the flood the entire company of about 2,000 men and women had *not one* disabling injury.

How was such a remarkable record possible? How could 2,000 men and women working day and night restore a system of over 300,000 Kva load in eight days practically without supervision or telephone communication? How could they do it without a single lost-time accident in the field, not only during those eight days but during the months of reconstruction which followed? Beyond any doubt, the answer is to be found in two short sentences:

1. The attitude of the management regarding safety.
2. The previous training of the men.

The management was particularly concerned with the welfare of the employees. A department store executive was routed from bed at 3:00 A.M. to get cots, bedding, and blankets to place in offices, substations, power plants, and shops. Some of these were taken in boats to the station where I was working. A section of the William Penn Hotel was taken over completely for a dining room. At the Manchester Headquarters, which is the location of the general shops and general storeroom, the employee's restaurant which normally served five lunches a week, was open 24 hours a day, seven days a week, for more than a month. Girls ordinarily occupied with filing records and typing letters put on aprons, peeled potatoes, and served at the counter.

The employees required no urging. Rather, orders were sent from the Vice President that no one was to work more than sixteen hours consecutively. Before we could get word to all the men in the field by messenger, many had worked 24-30-48 hours. We sent them home for at least 24 hours. Orders were issued to stop wading in water in basements. Transformers and cables were hastily repaired and energized during the first few days. Some of them failed. Management's concern was, "Did anyone get hurt?" Invariably, the answer came back: "No!" Messages were broadcast over the radio assuring the employees' families that they need not worry. All possible care was being provided. In the event that an employee became sick or injured, the family would be immediately notified. Not one such notification went out—it was not necessary.

Although we did not realize it, we had been training the men for a number of years for this emergency. This training developed along four lines:

1. The training of additional workers due to the adoption of the 40-hour week.
2. Job training of personnel.
3. Strict enforcement of the safety rules.
4. The adoption of a clearance permit.

In common with other electric utilities, we adopted the 40-hour week at the time of the N.R.A. To do this, certain departments (particularly among shift workers) required additional employees. Some of these were former employees. Others were young technically trained college graduates. These had been absorbed in the operating departments. They had thus become familiar with the equipment and with operating practice.

During the emergency, every employee of the company worked up to the limit of his or her endurance, taking time only for essential rest. This was approximately at the rate of 100 hours per week per employee. This was the equivalent of adding instantly the normal output of 2,500 additional trained, experienced workers familiar with all the details and hazards of our company's particular problems.

To illustrate, all of the substations are operated by four or more men on a 40-hour basis. By placing most of these on a 12-hour basis per day, some 50 men were released for duty in the rehabilitation of equipment. Many had had experience in electrical maintenance, construction, wiring, and other crafts. Those, together with office boys, clerks, statisticians, draftsmen, engineers, brick layers, plasterers, plumbers, carpenters, and salesmen were organized into crews under an experienced electrical maintenance man.

With buckets, brooms, mops, and hose, they cleaned out the mud. With solder, tape, wire, and tools, they rebuilt the stations. With enthusiasm and high spirits, they restored the service. Seven hundred temporary men, most of whom were former employees, were more adequately supervised at the shops and power plants.

For some years our company has made extensive efforts to train not only the new men, but also those already on the job. This has served to stimulate the interest of the men in their every day duties. Each major department has carried on its own program

of training under conditions best suited to the type of work carried on in that department. As an illustration of the general program, the one used in the substations and shops department may be of interest.

This program, while intended to cover primarily the work of the substation operators, was extended in some degree to maintenance employees as well. It was designed along three separate lines of procedure:

1. A class in practical electricity.
2. Reviews and examinations.
3. Lectures and demonstrations.

The class in practical electricity is conducted by a member of the operating force at a time convenient to the majority of the members. About twenty attend for an average of 1½ hours' instruction per week from November to May. As soon as they have completed the work, another group is started. The attendance is voluntary, on the men's own time.

Four or five times a year a more elaborate meeting is held, when written lectures and visual demonstrations are presented to as many members of the department as care to attend. The average attendance last winter was about ninety. The lectures are mimeographed and a copy given to each man who attends. Enough have now been prepared to serve as a rather complete library of operating practice and maintenance routine. Subjects discussed are of general interest, such as transformer fires, relay applications, welfare subjects such as life insurance and budgeting of income.

As a man is promoted or his duties change, he is given an oral examination to determine his experience and qualifications for the contemplated change. A substation operator is not permitted to take over a station shift until he has been approved by an examining committee.

Beyond any doubt, the safety record of the company during the flood was achieved because of the use of the clearance permit. This form is used universally in the substations and power stations. It is not used on line work, but its procedure is followed most carefully. The clearance permit is somewhat elaborate. It is essentially a contract between the persons operating equipment and those who repair it. Even though a foreman opens and clears a switch, then repairs it and returns it to service, he makes out a permit designating himself as operator and as

repairman. The permit itself does not provide the greatest value—it is the procedure which must be followed when electrical, mechanical, or steam equipment is taken out of service.

We make it somewhat of a ceremony. If it is electrical, the open points of clearance must be visible. The equipment must be tested for voltage, and generally protective ground cables applied. Finally, all points of clearance are posted with red "danger" tags. When the work is done and the equipment is to be returned to service, these tags are removed only after the foreman in charge of the work has communicated directly with the operator through the system operator as a third party monitor.

This, in brief, was our system of clearing and blocking prior to the flood. When the

water hit us, we had about 12 hours' warning that probably we would go down. The power plants went out completely; so did most of the 11 Kv cables feeding the downtown district, and most of the telephone circuits. Fortunately, a greater part of the outlying stations retained their telephone communications, although the two most vital points where interconnected power was available lost contact for a time with system operator.

For years our men had been accustomed to doing switching only on orders of one central dispatching office. Suddenly, they were on their own with no one to direct them. Then did we receive dividends in the form of a perfect safety and accident record, paid by the years of supervision and training in safe procedure and proper working conditions.

Safety in Connection With Flood Emergencies as It Affects Water Utilities

By HAROLD F. WEBB

General Safety Director, American Water Works and Electric Co., Inc., Pittsburgh, Pa.

The American Water Works and Electric Company has some eighty subsidiary companies under its management, many of which are located on some of the largest rivers in the United States.

These water companies have, in the course of numerous flood emergencies, gained much knowledge and experience from the standpoint of safety during periods of inundation. I might almost say that our organization has developed a technique of operations during periods of high water from minor rises to floods of major proportions.

Low service pumping stations and other water supply works must be located on banks of the rivers from which the raw water is drawn. Thus, in extraordinarily high waters, pumping stations must be shut down and service temporarily interrupted. It would not be economically possible to provide protective facilities of sufficient size to guard against floods of the height which occur once in only a hundred years or more.

Complete stoppage in water supply occurred in and around Pittsburgh in the

spring flood of 1936. The city's own water supply plants were forced to shut down, as was the low service pumping station of the South Pittsburgh Water Company, one of the properties with which I am connected.

Fortunately, the great majority of our customers live on high grounds, so that their homes were not damaged and there was no danger to life from the flood. The chief discomfort was caused by stoppage of vital utility services.

Realizing the plight of thousands of homes without water supply, yet entirely inhabitable in every other respect, our company organized a house-to-house delivery service of pure water, by means of trucks and containers. The water used for this purpose was drawn from the clear water basin, where a sufficient quantity had been retained against this eventuality.

The utmost care was taken in this house-to-house service. Containers were sterilized with live steam and our men used gloves and generally exercised all possible sanitary precautions in the handling of the job. Sufi-

cient water was delivered to each home, twice a day, for all drinking and culinary purposes.

Danger of Epidemics

One of the greatest dangers of a flood is the menace of epidemics caused by the use of polluted water. Water works officials, knowing this, are careful to warn the residents of a city when it becomes necessary to take precautions with the water in the supply mains, as when a dislocation occurs in the normal purification processes, or when the possibility of seepage exists.

From a safety standpoint there are many do's and don't's when dealing with flood conditions. As in any other emergency, probably the best advice is to keep cool and use common sense. However, I should like to list a few of the more obvious precautions:

1. Don't drink any water but assured supplies.
2. Watch the newspapers, if they are published, or keep your radio tuned in for advices on this matter.
3. If you are not sure of the safety of your water, boil every drop that is used for drinking or cooking purposes. Don't just bring the water to a boil, but allow it to boil for 10 or 15 minutes. This longer boiling period will almost assure the elimination of injurious bacteria.
4. Stay out of the water as much as possible. Floods usually occur in the early spring when the weather is still cold and the human body, unless it is exceedingly tough, is apt to suffer from frequent wettings, with the possibility of pneumonia or severe cold.
5. Another good don't is to avoid wading where you are not absolutely sure of the topography of the ground beneath the waters. It is much better to use a boat, but if you must wade, use a strong stick, feeling your way in advance of your progress, much in the same manner as a blind man.
6. Another point to be stressed is the cleaning up after the flood waters recede. This is sometimes a seemingly hopeless task, but it must be done. It is essential that everything that has come into contact with polluted flood waters be scrubbed and then carefully dried.

7. One final point—BE CONSIDERATE. This is particularly important in the use of water. In those instances where water is rationed, draw only enough from your pipes for your absolute needs. Remember that thousands of your neighbors need water just as badly as you do and that if everyone tries to obtain all the water he can by opening every tap, the supply will probably run short. When floods are threatening and the possibility of a shutdown of the water works becomes apparent, don't turn on your taps and start to store water. This sometimes has placed an almost insuperable burden on water works pumping stations and has complicated an already difficult situation.

Storage of Water

You can rely on your water works officials or the city government health authorities to notify you in sufficient time to store water for drinking purposes. If this notification is sent out, don't try to store sufficient water to last for six months or a trip across the desert. A few gallons, depending on the number in the home, carefully drawn in clean containers and kept away from contamination will be sufficient. Water kept in small quantities for long periods is likely to become stale and flat, and the longer it is kept, the more it is subject to contamination. In serving this water to the members of your home and family be careful to keep your hands away from contact with the water itself and use clean glasses for drinking purposes.

Notwithstanding the severity of the 1936 and 1937 floods, we, as an organization, look back with some satisfaction on the results of our safety training. Our employees emerged from these great floods with no accidental injuries or disease epidemic sufficiently serious to cause loss of time from work. Working under emergencies, the chances for accidents increase greatly.

Many of our men had to work in water up to their hips, handling intricate machinery or covering territory with which they were unfamiliar. It seems almost a paradox that no one was injured during these periods of frightful strain and stress. We like to think that our constant safety training contributed in no small measure to this very satisfying record.

Safety in Connection with Flood Emergencies As It Affects Telephone and Telegraph

By T. D. LEDWITH

General Plant Employment Supervisor, Indiana Bell Telephone Co., Indianapolis

Floods are unique among public emergencies in the extent to which they disturb the human contacts which communication facilities provide. Rising waters place a premium on the maintenance of telephone and telegraph service which reaches into homes, offices, factories, and farms, tying them together and giving them access to physicians, hospitals, police, fire department and other agencies upon which the protection of life and property depends.

Local telephone service becomes in such an emergency the nervous system of an organization which must be swiftly set up to handle relief problems, safeguard health, and prevent further destruction. Telegraph and long distance service perform the same functions on a wider scale; provide the means of allaying the anxiety of friends or relatives of those within the flooded area; and permit the mobilization of a nation's resources to aid the suffering and needy.

With the very beginning of wire communication there was a recognition of its importance in time of emergencies, and many stories are written of voluntary acts of heroism and devotion to the service.

Late in January of this year the Ohio River reared its crest to new heights, spread its inundation on either side to miles of territory never before touched by the water of any previous flood. Immediately there was mobilized every means to bring aid to the stricken territory — National Guard, Coast Guard, Public Health Service, Army engineers, CCC and WPA workers, and the Red Cross.

Mobilized also, as matter of course, were the resources—the man power, the supply service, productive capacity, and operating, engineering and administrative capabilities—of the telephone and telegraph companies.

The men and women of these systems know that catastrophe places upon them a double responsibility. For the same forces that inflict damage and destruction on all other property are no more sparing of the telephone and telegraph plant, while bringing at the same time all the more urgent need for communication. Telephone calls and

messages within, into and out of affected areas by individuals, by industry, by the press, by rescue and rehabilitation forces were multiplied many fold, making abnormal demands upon plants battered by the flood. Crews swung into action on a front that included not only the flood area but such distant points as New York City, Chicago and New Orleans — operators, plant men, engineers, commercial people, and executives, the combined forces of the Western Electric Company, power supply and other specialists from the Bell Laboratories, as well as many from the headquarters of the A. T. and T. Company.

A systematic mobilization of man power and woman power was directed at these aspects of the one great task:

- (1) To take in advance every possible precaution to protect the equipment and the service against the flood.
- (2) If and when these precautions are unavailing, to maintain the service as long as power and the switchboard and a line were left to use.
- (3) And if the plant finally went dead, to restore the plant and resume service at the earliest moment possible.

Throughout the whole vast flood area, rapid surveys of damage were followed by the assignment of plant forces set up in special organizations to meet the critical necessity of restoring service.

Closely coordinated with this rallying of man power were the emergency shipments from Western Electric factories and distributing houses and other suppliers. Poles and crossarms by the thousands, line and pole hardware by tons, thousands of feet of cable and wire, pumps and other equipment needed were sped by truck and train to places in the stricken area where they were most needed.

For the full length of the Ohio River the flood story, as it affected telephone and telegraph, can be told in terms of damage done; of lines under water or washed away; of central offices inundated or even carried away; of service continued under the utmost

difficulties and often danger; of work carried on through utterly trying circumstances; of emergency generators which maintained power, where otherwise there was none; and of water being brought in tanks because the regular supply had failed.

So also can it be told in terms of ingenuity and quick thinking, of central offices kept in service with water deep on the frameroom floors, with the frames and test desks hauled up to the ceilings; of towns kept in touch with the outside world through magneto switchboards hurriedly installed in ice cream parlors and the like, when the central offices went out of service. Most certainly the story can be told in terms of heroism and devotion to duty far beyond the strict requirements of the job.

No Major Injuries

In our Indiana organization, during the flood and during the period of rehabilitation, not a life was lost, nor was there an injury to a worker requiring more than ordinary first aid treatment. Some of the credit for this splendid accomplishment should properly be given to the men and women for strict adherence to the principles of safety. Most of it, however, should go to the vision and foresight of men who years ago laid the foundation of safety in any emergency by instituting the basic principles of safety into the everyday normal job—for the purpose of accomplishing in the end, "A safe plant, operated by safe workers, under any and all conditions."

To meet this high objective, the established safety policy must be accepted and followed by every employee. Safety in emergencies comes only from preparedness. By systematically applying the elements of safety into every phase of today's normal operations, we are prepared for the emergency of tomorrow. The standardization of safe practices, tools, and materials, the proper selection of employees, the use of accident data, the thorough training of employees, and the provision of adequate, competent supervision, all contribute to the safe and efficient restoration and maintenance of vitally important service at the time of an emergency.

Also important are:

Tools, materials, and equipment manufac-

tured to specially prepared specifications, with safety features incorporated.

The selection of men and women who will accept and carry out the principles of safety, and who are physically and mentally qualified to perform satisfactory work under any and all conditions.

The training of each employee so that he will know how to perform safely each task to which he will be assigned; so that he knows how accidents are caused and what to do to avoid them; and so that he will exercise good judgment in meeting abnormal conditions likely to be encountered.

Competent supervision that will carefully analyze and plan each undertaking, guard against hazards, and see that only safe and sane practices are followed.

Health Protection Needed

There is one other safety problem, however, which invariably presents itself during flood emergencies. With business operation at a standstill and the normal life of a community entirely disrupted by a flood, protecting the health of workers in the devastated area is of major importance.

In our own experience, before the flood had reached its crest, arrangements were being made to house and feed the army of telephone workers to be sent to the various locations to aid local forces in reconstruction work. On the Jeffersonville-New Albany front in southern Indiana, a former night club was obtained for this purpose. One room was used as a mess hall, while 150 cots placed in another provided sleeping quarters. Every employee before entering the territory was inoculated against typhoid. Drinking water was hauled in five-gallon cans from a filtration plant fifteen miles distant until the local supply could be analyzed and found safe.

Carefully selected food was shipped from Indianapolis and prepared into wholesome meals in the kitchen of the temporary barracks. Medical headquarters were set up for treatment of minor illness or possible injuries, and strict sanitary regulations prevailed throughout the establishment. Only three cases of sickness were recorded during the entire reconstruction period, each of which was immediately isolated to prevent the spread of any possible disease.

THURSDAY AFTERNOON SESSION

October 14, 1937

Public Utilities Section Safety Contest

The outstanding facts in the 1936-1937 Public Utilities Section Safety Contest were presented by Charles S. Bowden, General Safety Chairman, Ohio Public Service Co., Alliance, O., and statistics and contest committee chairman of the Public Utilities Section.

Nine of the 148 companies entered in the Public Utilities Section Contest went through the one-year period without a single disabling injury. During the year, 169,450 employees of the participating units worked 361,944,767 hours and experienced 3,774 injuries.

All divisions had an average frequency rate of 10.427. Combination gas and electric companies had the lowest frequency rates, averaging 9.729. Gas companies had the highest rates, with an average of 11.490.

The number of companies enrolled and the number of hours of exposure were higher than for any previous contest.

Thirteen plaques were awarded to winners of first place; eight certificates were

awarded to winners of second and third place. Awards were presented by C. B. Scott, President, Bureau of Safety, Chicago, and past president, National Safety Council. Winners of plaques were as follows:

Combination Gas and Electric Division, Group A—Wisconsin Public Service Corp., Milwaukee, Wis.

Electric Division, Group A—Ohio Edison Co., Akron, O.

Electric Division, Group B—Six tied for first place—Laclede Power & Light Co., St. Louis, Mo.; Fall River Electric Co., Fall River, Mass.; Mississippi Valley Public Service Co., Winona, Minn.; Worcester Suburban Electric Co., Uxbridge, Mass.; Houghton County Electric Light Co., Houghton, Mich.; Gloucester Electric Co., Gloucester, Mass.

Gas Division, Group A—Hope Natural Gas Co., Pittsburgh, Pa.

Gas Division, Group B—Dallas Gas Co., Dallas, Tex.

Activities of Public Utilities in the Prevention of Accidents to the Public

By F. R. JAMIESON

Publicity Director, Public Service Co. of Colorado, Denver

Utilities have attempted both by publication and by example to impress upon the public the importance of safety.

First-aid classes are conducted for the community and cooperation with the local Red Cross is maintained. Safety precautions and information are published and otherwise disseminated. Company automobile fleets are driven with care, that they may serve as examples of safe driving. Street excavations

and installation work are performed with a maximum number of safeguards, both for the public and for the employees. In the manufacture and design of appliances the utilities confer with manufacturers to incorporate safety features in the construction of this equipment.

Under the leadership of our own safety department, more than 2,000 men are carefully trained and adequately equipped to

render first aid emergency treatment, pending the arrival of the doctor. Among the women employees the same character of work is carried on.

At least a dozen specific cases appear on our records of suffocated persons who were restored to life by the timely treatment of one of our company crews. Cases of arterial bleeding, with the injured persons near death, are listed in even greater number.

We are also proud of the record established by our industry in times of great stress and disaster. Notable among such cases is the very recent Ohio Valley flood. The lives saved because safety-trained men and women were able to apply their training and knowledge in clear-headed, unflustered manner, have a value greater than any monetary estimate.

Utilities spend a great deal of time, thought, and money in protecting the public for purely humanitarian reasons. Quite naturally, we find that it is also good business.

Communication agencies and electric power companies share the dangers incident to their need for long stretches of wire either supported by poles or laid underground in conduit. Their pole lines are in danger from storms, from erratic motorists, and from disgruntled hunters with shotguns. These lines parallel city alleys, sometimes within reach of windows or roofs, and country highways where picnic parties try to climb poles and demonstrate the abilities of their arboreal ancestors.

If someone manages to reach the charged wires, it can hardly be characterized as an accident, yet the utility is summoned into court to show why it is not to blame for an injury or death. It is no wonder that a very considerable amount of thought, ingenuity, and money have been expended by utility engineers to render poles and towers as hard to climb as possible.

A wire down in the street or highway is something to be feared and avoided. It may be a telephone wire, but it may also be draped across a high tension power wire somewhere along its length. So the public utilities make a contribution to public safety in their maintenance of lines, in their frequent patrols, and in immediate response to cases of service failure. They also try to keep the danger of live wires in the public mind, sometimes with a certain degree of success.

People do not realize that they are constantly being guarded by the utilities. Why are electric plants and substations equipped with automatic circuit breakers, grounding devices and overload relays? Why are lines made doubly strong at crossings? Why are lightning arresters installed? To maintain service and protect equipment, certainly—but even more as a means of protecting the public. Utility meter readers remove pennies from behind fuses at customers' meters for the sole purpose of promoting safety to persons, appliances, and property.

Power lines must be protected from public curiosity and the urge for adventure. That is why we have danger signs on poles and transformer cribs, why visitors to electric plants are given a guide to show them through the plant, why utility men tell the danger of careless kite-flying to each new generation of school-boys. We try to keep our wires up and away from the public. We try just as hard to keep the public down and away from the wires.

Underground Hazards

Once underground, our wires offer little hazard to the general public. To be sure, there is always danger in the congested underground systems of large cities that communication circuits may accidentally be connected with power circuits or that some agency such as explosion, fire, or flood may send high tension currents through low tension networks, a danger from which the public is guarded by the continual vigilance and skill of utility employees. These things are the ordinary, expected, run of hazards, although the utility safeguards are more bars in the tiger's cage. But getting these wires underground is another matter. Construction problems run all the way from the careful excavation and cribbing necessary to keep tall buildings from sliding into our trenches, to the diplomacy needed to convince small boys that manholes are not desirable as pirate caves.

The gas industry has similar problems in the locating, laying and maintaining of its distribution systems. Here, too, the matter is complicated by the ease with which gas finds the smallest opening and escapes to fill a pocket somewhere and set the stage for a disastrous explosion. Gas companies meet this problem by continuous maintenance programs and frequent leakage surveys, carried

on not to save a few thousand feet of gas, but to protect the public. In addition they have contributed money, time, and ideas to find better pipe materials, better joints, and greater safety.

Once our service actually reaches the customer's home, we have a new set of dangers. The tremendous energy in the form of gas or electricity is still our caged tiger. Properly controlled, it will cook the dinner, wash the clothes, and sweep the floor. But it will destroy the house or the owner with equal nonchalance.

So utilities have worked hand in glove with the manufacturers of electric and gas appliances. They have designed, suggested, tested, and re-designed these appliances, largely with a view to rendering them more safe and satisfactory for the customer to use. Nor is this all. The utility is interested in the performance of these appliances long after the last payment is made; it has to live with them! So utilities in their merchandising programs are always trying to sell the best, the most reliable, the safest appliances. They work hard to have the appliances properly and safely installed, to have them inspected and repaired whenever they need it. To these ends, they have cooperated actively with city inspection bureaus and underwriters' agencies.

Speaking from my experience with my own company, I know that our gas department has done endless research work in adapting gas-burning appliances for operation under high altitude conditions. They have designed and perfected equipment used to introduce an odorant into natural gas, and carried on extensive tests to determine the amounts required to give the best warning of leakage. They carry on a regular schedule of inspection of theaters, schools, and other places of public assembly, using combustible gas indicators. These inspections, plus the odorizing of the gas and a constant program of distribution maintenance, go a long way to insure the public against such disasters as recently occurred in a Texas schoolhouse.

Our company has also cooperated with the city inspection bureaus in drawing up codes requiring safe installation. Appliances must be properly vented and certain oxygen-consuming appliances are not permitted in small rooms under any circumstances. Installations are made with a view to eliminating fire hazards insofar as possible. These things are

not dramatic nor exciting, but they help to protect the public.

Employee Training

Another major contribution of the utilities to public safety has been through their training of employees in accident prevention and first-aid. Here again, the need for safety programs became evident as workmen's compensation laws were passed and as increasing complexities of employment have raised the cost of accidents. The utilities were early in the field in inaugurating such training and their efforts have paid handsome dividends in employee safety.

Out of these employee activities have come numerous contributions to public safety. Utility employees have come to be safety-minded and to see and correct hazardous conditions in places where the average person would have no idea of danger. They have given first aid in innumerable instances of drownings, automobile wrecks, and home accidents. In almost every city in the country the drivers of utility fleets have taken the lead in safe driving and in sponsoring automobile safety campaigns. Utility trained men have become scoutmasters and passed on their training to the rising generation. Women employees have done the same for Girl Scouts and Campfire girls. Utility first-aid teams have given their time and effort to demonstrations before Parent Teacher meetings and have assisted in training courses open to the general public.

When the C. W. A. was started, one of the first needs to be recognized was that for a safety program. Among the men drafted to design such a program and to start it off were an amazing number of utility men. These men with others drawn from other industries, built up a system of safety training which has carried on through the E.R.A. and W.P.A. with notable success. They trained other men to take their places as they returned to their own jobs. I believe that nearly everybody who knows the facts will admit that this was a good job, and that the utilities contributed more than their share toward making it a success.

So much for the past; now what of the future? During the past fifty years our business of daily living has become more complex, more crowded, more dangerous at an ever-increasing tempo. And this is a continuing process.

In the future we may expect immensely increased use of power, whether this is electric power as we know it today or some agency now unknown. We may expect vastly greater and more complicated communication systems. We can expect the expansion of radio into the fields of television. More and more homes and other buildings will be air conditioned. We may expect great changes in methods of lighting,

in the raising and preparation of food, and in means of transportation.

These changes will bring into being new dangers to the public. We will have new and difficult problems of generation, transmission and use of this greater power. To an increasing extent we will have to render these services fool proof, surround them with safeguards which will operate without the understanding or cooperation of the public.

Typical Public Utility Accidents

By A. B. TAYLOR

Superintendent of Construction, Kansas City Power & Light Co., Kansas City, Mo.

Some accidents we expect to have—we look forward to having them in the normal course of events. This is not, of course, because they cannot be prevented. As a matter of fact, most of them are prevented, because we know what to look for and what measures should be taken.

Pick up loose boards and no one will step on the nails in them. Wear goggles when grinding, and metal particles won't get in your eye. Pick up heavy objects with your legs bent, and you won't strain your back. Accidents from such causes have high frequency in spite of all precautions, merely because there are so many opportunities for them to occur. Prevention is a matter of doing everything in the proper manner.

There is another class of accidents, less frequent, but none the less serious. Because they seldom occur their prevention is overlooked more often than not. The rule, however, for preventing these "accidental" accidents is the same as the rule for preventing expected accidents. It is to do things in the proper manner.

Changing bits on a jack-hammer, for instance, is a relatively harmless procedure—one constantly done with no harmful results—as a general rule. One bit-change recently made in the course of our construction work, however, was at the cost of one human eye and nearly \$1,500.

At the Kansas City Power & Light Company's Grand Avenue Station a new turbo-generator unit was being installed last year. Foundation work on this job called for the

excavation of 100 cubic yards of solid rock. Drilling was done with Ingersoll-Rand jack-hammers, with hollow drill steel and the somewhat new removable bit. This particular type bit is joined to the stem by means of a tapered thread connection. Screwed up tight, this joint is solid as Gibraltar, unyielding to jarring, strain and vibration. When once started loose, though, it unscrews easily by hand.

The bit we were using was an Ingersoll-Rand "jack-bit," about 2½ inches in diameter, with four cutting edges which dulled from time to time, necessitating removal of the bit for sharpening. Naturally, the only problem in removing the bit came in getting it started, and the quickest way to do this was by jarring it loose with a hammer—the rest was easy.

Ignorance came into the picture here to some extent as a contributing factor. To the metallurgist, or to anyone with any technical knowledge of tools, different grades of steel and iron have widely different characteristics, ranging from tough and malleable to glass-hard and brittle. For the ordinary workman, however, these distinctions do not exist. If hammering one grade of steel is safe, it is then safe to hammer any other.

Consequently, these bits were often hammered loose with no misgivings. The danger factor was not recognized as being present in even the smallest degree, so naturally, no precautions were taken by the men doing the work.

Finally the inevitable did happen—a chip, fracture from the hard, brittle steel of the

bit, flew off and lodged itself in the eye of a helper who was steadying the shank of the drill at the time.

The bit was loosened satisfactorily and in good condition—the losing of the little broken fragment did it no harm. However, the joint efforts of a conference of the Middle-West's leading eye specialists could not restore vision to the helper's eye. A series of delicate surgical operations did enable him to retain his sightless eyeball, which was a help to his appearance and comfort, but small compensation for his loss of vision.

Offhand, there is no obvious reason why a driller should not have hammered this bit loose. Hammering is by far the easiest way, and had been done repeatedly without injury to either man or tool.

Looking at the situation, however, in an abstract way, without allowing ourselves to be prejudiced by considering what methods

actually are in use, the cause and method of prevention are apparent.

A screwed joint of this sort should be loosened by unscrewing, for which the proper tool is a wrench. Therefore a wrench, and not a hammer, should be used.

Basically, the prevention of such unexpected, out-of-the-way, disastrous accidents lies in the observance of the same rule that prevents the "expected" accidents.

That is, simply, to do things in their proper manner. There is a right way and a wrong way to perform every operation, and the difference between them is always obvious. Even though nobody is expected to walk by, the floor is not the proper place for a board with nails in it. And similarly, even though no apparent harm can come from its use, a hammer is not the proper tool for unscrewing a screwed joint. A wrench is. So use a wrench.

Typical Public Utility Accidents and the Lessons Learned From Them

By W. C. LOUNSBURY

Safety Director, Minnesota Power and Light Co., Duluth, Minn.

I will describe an accident which had no particularly serious results and in which no one was injured. Perhaps it isn't an accident at all according to your definition. But it illustrates our method of investigation and our typical approach to such an investigation.

At our regular district safety meeting the accident had been discussed freely, as all accidents are, without animus, with the men involved being present. No attempt was made to fix responsibility.

John Jones, one of our linemen, had a very narrow escape from severe, if not fatal, injuries. A special investigation was undertaken, and the district manager, the chief engineer, the superintendent, and I, accompanied by the entire crew involved, visited the scene of the accident. A preliminary inspection had been made by the chairman of our general safety committee and myself on June 8, and other investigations were made at the site by the district manager and engineer.

On the morning of May 31 a squirrel grounded the 33 kV power line. Both the

power and telephone circuits fell to the ground. Following the repairs, the crew moved along the line and found one telephone conductor broken near the insulator on another pole (a steel pole). Between these two poles the telephone wire was on the ground. The rest of it remained apparently undisturbed. The foreman, leaving his crew to replace the broken telephone wire, went further along the line.

Mr. Jones climbed the steel pole and fastened his safety belt. He wore rubber gloves. The lineman on the ground spliced an ample piece of telephone wire to the wire on the ground and Jones drew it up, doubled the end back on itself and then looped the doubled wire around the steel crossarm to hold the wire in an accessible position.

On the intact side of the pin insulator was a johnny-ball for testing purposes, and around it was a jumper. Jones unscrewed one end of the jumper leaving the jumper dangling. At this time the telephone wire was still properly attached to the insulator but the broken end was too short for splice.

ing. The wire down was described as having considerable slack, hanging at the top of the brush along the right of way with its end grounded on the crossarm by means of the double loop.

Jones started to attach his come-along to the secure telephone conductor to hold this wire while making the necessary splice. As he attached the come-along a flash occurred, burning his glove protectors and clothing at his waist and chest. The metal parts of Jones' belt were also burned. The flash was witnessed by the groundman and other linemen. None of those working saw any other flash.

The crossarm showed signs of burns, as did the three 33 KV power wires and telephone wires about 100 feet from the pole on the broken side. The telephone line also flashed to ground at the substation, destroying one of the cutouts at that point; the Johnny-hall insulator was punctured and the telephone conductor burned off just beyond the line insulator.

It is certain the telephone wire received power and that this power flashed to ground, in part through the temporary connection on the crossarm at the pole and in part through the telephone terminals at the Substation.

The position of Jones, leaning far back from the pole, and the grounding of the telephone on the steel crossarm at the pole, is apparently all that saved a most serious situation.

This episode makes very clear the necessity for grounding telephone lines on both sides of a repair job. It is good practice always to have a hand line over any dead wires likely to make contact with live wires, to prevent a wave or snap from carrying the wires together. To ground the telephone

wires as provided by the rules of the Company, should be the particular responsibility of the foreman and of the lineman before making repairs on such circuits.

You will note that the scene was visited by those in operating authority, with the entire crew present; all of whom were requested to take up their respective places held at the time of the short circuit. Many questions were asked, but no mention was made of discipline, nor was anything suggested to indicate blame, nor that anyone might be covering up facts which would clarify the problem. (Just how the telephone and power wires made contact was not ascertained).

Other safety departments may see our handling of this as an unsatisfactory investigation, but we believe it best not to argue and frequently not to try to fix specific blame. I think you will agree that in most cases the matter of blame is very involved, and seeking it may make embarrassing repercussions.

I believe it is important to save "face." It is important to retain the confidence of the men, and more important than all to prevent a repetition of a similar accident. Because of the kind of investigation made we believe with that crew a similar accident is highly improbable and through the open discussion of the facts, without prejudice or blame in our other district safety meetings, all our crews became more careful workmen.

Our company program is definitely the prevention of accidents, not a series of post mortems. Post mortems are essential in some cases, but with us the emphasis is not laid on the accident itself but on building into our men a desire not to have accidents of any kind.

Typical Public Utility Accidents and the Lessons Learned From Them

By S. C. DICKINSON

Safety Engineer, Pacific Gas & Electric Co., San Francisco, Cal.

My company buys annually about 12,000 poles. These are delivered to the various pole yards on flat cars and are unloaded by the line gangs. The lengths of the poles range from 30 to 70 feet.

A number of years ago the poles were unloaded as follows:

The car was spotted at the proper point. Brakes were set and blocks placed. The necessary skids were then placed and the tie

wires cut. All the car stakes on the unloading side were removed except two. Two men, each with an axe, would chop the two stakes to a point of failure. The two men would then run into the clear or duck under the car. But in many cases they were not successful in their getaway and were fatally or permanently injured.

Sometimes one stake would break before the other, and again serious injuries would result.

The first method we adopted in our effort to prevent injuries was as follows:

1. The car was spotted in the proper location, the brakes set, and the wheels blocked securely in both directions.

2. A $\frac{3}{4}$ inch by 150 foot guy wire was attached to the underside of the car, taken over the top of the load, and anchored to some suitable stationary object.

3. A $1\frac{1}{4}$ inch by 150 foot manila rope was attached to the car in a like manner on the opposite or unloading side, taken over the top and anchored to the track or to a truck or some other suitable stationary object. Sufficient tension was then taken on both the rope and guy tackle to bind the load together.

4. The necessary skids were placed, tie wire were cut, wooden car stakes removed, and then the rope tackle slackened off, allowing the poles to descend.

Although this method was an improvement over the old method, considerable trouble was experienced because sufficient tension could not be exerted to prevent the load from settling, and occasionally someone was injured because of this.

We then resorted to a derrick. This method is not satisfactory because it is very expensive and none too safe, as evidenced by a number of injuries. It takes a line gang about $5\frac{1}{2}$ hours to unload a car in this manner.

At present we are using still another method. During the past few years at least six men have been saved from fatal injuries and 15 from permanent disabilities by this method. Since its adoption only one em-

ployee has been injured. While standing on the end of the car, preparing to move one of the last few poles with a cant hook, he fell off the car.

The method is as follows:

1. The car is spotted in the proper location, the brakes set, and the wheels blocked securely in both directions.

2. Four car pocket fittings which are detachable from the binder are inserted in the car pockets, two on each side, each near one end of the car. Pins are inserted so that the fittings cannot come out of the car pockets.

3. Four tubular stakes, officially known as Cojo Binders, are attached to the fittings and bolted.

4. A short piece of chain is attached to the clevises on top of the two binders on the unloading side. Blocks and rope are then attached to the chains and to the clevises on the binders on the opposite side of the load.

5. Binders are raised to a vertical position with a hand line and locked. A strain is taken on the rope and blocks to bind the load together and sufficient to permit removal of the wooden shipping stakes on unloading side of the car. The rope is snubbed to a truck, the railroad track, or some suitable stationary object.

6. Two or more skids are hooked into the car pockets. The number placed is governed by the size and weight of the poles.

7. With the aid of a ladder the binding wires are then cut and the wooden car stakes removed.

8. Locking pins on the binders are removed on the unloading side only.

9. The blocks are then slacked off so that the load is allowed to come down slowly and evenly. The binders become skids.

10. Finally the load comes to rest. The blocks and ropes are then disengaged from the short chains, and the poles are rolled into position with the aid of cant hooks.

This method not only has eliminated injuries but has made it possible to unload a carload of 61 poles in 55 minutes. The old cut and run method required, if no one was injured, about two hours.

ADJOURNMENT

Quarry Section

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A. L. WORTHEN, The New Haven Trap Rock Co., New Haven, Conn.

Officers Elected for 1937-38

General Chairman—ALEXANDER FOSTER, JR., Warner Co., Philadelphia, Pa.
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S. WALTER STAUFFER, National Lime Association, Washington, D. C.
A. L. WORTHEN, The New Haven Trap Rock Co., New Haven, Conn.

The Quarry Section met jointly with the Cement Section. A record of the proceedings will be found on pages 249 to 270 of this volume.

Refrigeration Section

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Vice-Chairman—JOHN L. SPEERS, The City Ice & Fuel Co., Cleveland, Ohio.

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 W. C. WASHBURN, Sheffield Farms Co., Inc., New York, N. Y.

MONDAY AFTERNOON SESSION

October 11, 1937

General Chairman Harold M. Toombs, introducing the speakers and directing the discussion. Armour and Co., Chicago, president, intro-

Mental Causes of Accidents

By A. A. RALL

Safety Director, Kansas City Power & Light Co., Kansas City, Mo.

Did you ever meet persons on the sidewalk or probably while you were driving your car and not recognize them until they were completely passed by? Suddenly the thought would come to you, like an explosion: By George, that is old Bill Jones!

What actually happened was that you saw with your eyes but not with your mind, because your mind was somewhere else.

This truth has been brought out in recent years in the investigation of severe and fatal accidents. Trusted and normally careful employees, familiar with every hazard connected with the work to which they have been assigned, have been seriously injured or killed in a moment of inattention.

Those who were injured and have lived to tell the story truthfully state: "I forgot." Many of those who have been killed would say the same thing if they could speak. To devise ways and means of protecting "a man against himself" is indeed a tough problem.

The good teacher "Mother Experience" will certainly tell you that personal follow up of all new employees and beginners is necessary. Remember your own experience at the first job you ever had, or your change to another and different type of job. Do you remember how clumsy you were? That is to say, you were all thumbs until you got the "hang of things." This must be kept in mind with the new employee.

It is not every new employee that will fit into the niche you want him to, although, he may have many fine qualifications. Any job needs a man who will not injure himself or others.

It should not be said of those who made a sacrifice that they did think and it was all their fault. It may be that their burdens were too heavy. A foreman must use thinkers on hazardous jobs but a foreman who allows himself to be interrupted and fails to concentrate on his thinker's safety is headed for sorrow. Then too, a foreman who does the most hazardous parts himself without insisting that his best man concentrate on his protection will suffer from misplaced self-confidence.

Faulty Habits

In the field of accident prevention, the business of breaking bad habits and substituting good habits may be sifted down to four rules.

1. Rule of intensity.
Clear the mind of everything else except the problem on hand.
2. Rule of repetition.
Know every detail operation. Example: Did you ever notice closely the

operator of a bus or trolley who brings you down to work? Every movement is almost mechanical.

3. Rule of invariability.
No variation in doing his operation. If the motor-man was not instructed to do his part of the job in a particular manner just think what might happen in an emergency.

4. Rule of Satisfaction.
Some feeling of satisfaction by giving an award or some praise. So few foremen and very few supervisors fail to give even a little praise when it could pay such large dividends.

From experience and from reviewing accident reports for a period of years, hurry has been the cause of many a serious accident. The hour before quitting time and the hour before the lunch period are two fatal hours. Watch them.

While closely allied to "hurry" the short cut to perform a piece of work without the necessary tools or equipment seems to head the list. Substitution of a box for a ladder, a pair of pliers for a wrench, etc. Carefully plan out the work. Know the tools necessary to perform this job safely and use them.

It should not be necessary to bring to the attention of the foreman that standard methods of doing work are necessary. To safety engineers "every job can be done safely." Reports show that not following a job in a standard method causes many unwarranted accidents.

Sense of Defects

How many of you can recall individuals who drive a car but cannot see well, and also some who cannot hear well? Do you feel secure if they are driving and an emergency vehicle such as an ambulance, fire truck, or police car is coming at full speed? How many of you have friends who have other physical defects? Do you know what their reaction time will be in an emergency? Right here I wish to add a word about the wonderful blessing of a physical examination once a year.

Much has been written on the subject of worry but let me add this. Many an accident was caused the day or night previous by a disturbed mind filled with worry over personal matters, quarrels, financial affairs, and business matters.

Disease

Poor eyes and other physical defects make many an employee unfit to do certain types of work safely.

Have you ever stopped to think that the more you know about the dangers from disease today the quicker you are to react and go to a physician or to a clinic for advice and for treatment? The earlier a person goes the less chance there is for disease to get its hold.

Naturally, there are persons today, just as there have always been, who have a mentality which causes them to imagine they have every disease they read about; this cannot be helped.

But take any normal, sane person and tell him that bleeding from any part of the body may be a sign of cancer, a disease usually painless at the start. When such bleeding occurs such a normal person will go to a physician or a clinic. If it should be cancer there is time to end it before it gets a start. If it is nothing of the sort isn't that person happier to know that his health is all right?

Do not guess. Find out, and remember that you can give out good health as well as disease, and in the meantime make everybody you come in contact with much happier. Find out—don't guess.

Interview the Doctor

One of the problems is to get men to go to the doctor in advance of trouble. But it is customary for men not to do anything about their health until definite symptoms appear. "We ought to change that." The

solution for him is to consult his physician while he is well. He should have a complete examination at regular intervals. If an employee of middle or mature years can only be induced to take this precaution, the problem of "degenerative" conditions will be materially reduced.

Correct Working Conditions

This is where the safety engineer should be alert and sympathetic. Glare from bad or uncontrolled lighting affects the employee. Will this glare protect him from danger of getting his hand into revolving machinery? The foreman should go about the plant or property to see if he can note any such conditions existing in your plant.

Fatigue

Many an employee must work in a stooped position most of the day. A rubber pad to stand on, a stool built just the right height would prevent fatigue before the day is even half over. His fatigue may cause him to let down on his safe practices and cause an accident to himself or some one working on the same piece of machinery.

Fumes and Vapors

An employee in the presence of fumes certainly, with, in time, be affected with drowsiness, which may even lead to a more serious state. Adopt a good ventilating system and see if it doesn't pay big dividends in the attitude of your employees. These are but a few of the simple points about which much can be done to lessen the toll of accidents due to mental causes.

The Human Element in Accident Prevention

By H. L. LINCOLN

General Plant Manager, The Union Ice Company, San Francisco, Calif.

This paper will relate 10 years' experience with a group of 83 rather small factories stretching 750 miles along the Pacific Coast, north from Mexico almost to Oregon. During the summer nearly 1,900 men are employed, thus creating enough exposure to form a worth while statistical record without concentrating a sufficient number of men at any one point to justify a personnel su-

pervisor or safety engineer, a condition that is representative of a great many plants throughout the country.

That there has been measurable success following the years of work is not only gratifying, but also makes it possible to outline what has been planned and to indicate that the accomplishment is attributable to two characteristics of human nature:

1. To learn, a man must have an idea register and this results if he contributes something to demonstrate the theorem.

2. The inspiration of competition induces in men an appreciation of what may be done.

The first has been prompted by using an investigation report as a tool for instruction; the second, by giving the result of the year's work in terms the average man can visualize rather than as mathematical statistics, then by comparing the performance of the several groups.

From observation of the conference method of study it seems clear that to produce an effective group it must contain at least 12 men and is cumbersome if over 30, nor can 100 per cent attendance be expected. Hence, if there are only eight men employed in a town, little progress or enthusiasm may be expected; consequently, interest is likely to fail. When, however, several such groups combined and made something of an event out of each meeting, attendance has been good, reports of plant hazards contained constructive suggestions, and the study of accidents proved an effective educational method.

That these meetings are seriously considered is evidenced by the attention given the reports of previous meetings and of the meetings of other groups. Then the safety committee presents its observations and recommendations, concluding with a formal report of any accidents that may have occurred, frequently starting lively discussions. When these have been disposed of, the speaker of the day is introduced.

The investigation itself has several definite objectives and may develop a discussion of several hours. As a reminder of things to investigate, a form of report has been prepared that provides a concise record and a standard form of investigation, featuring four essential items along with necessary routine information. The points emphasized are:

1. How the injured was doing his work before the accident.
2. How it could have been prevented.
3. Who was responsible.
4. Instructions given to prevent recurrence.

The day of the accident the local accident committee makes its investigation and starts to prepare the report. The injured man is

questioned, the conditions under which he was working examined, and witnesses quizzed. Then the report is reviewed by the district council which may call for help from the management. Finally, it is sent to the executive committee of the safety contest. A representative of the casualty company serves on this committee. The object of the meeting is to find a way to prevent or at least reduce the recurrence of like accidents, using such educational or disciplinary measures as may be appropriate.

The manner of studying the reports of investigations adopted by the several groups depends on the seriousness of the subject studied. Ordinarily, the discussions are very informal, and conflicting explanations are examined and often argued until conclusions are reached and recommendations decided upon. In case of a serious accident in which there is uncertainty concerning the true cause and a difference of opinion develops, a more formal procedure may be desirable. Then a committee of the most experienced men will listen to the report of the investigation, the "defense" of the injured man, call for expert opinions, and finally prepare the local council's report. Frequently, the manager will side with the injured man, contending that the foreman failed to give proper instructions or to train his men in a safe manner of doing the work.

It is not easy to develop skill in analyzing how a man was doing his work just before getting injured. This includes position and actual motion and often requires a demonstration, perhaps using a chair for a machine and a waste basket for a block of ice. Then it is not hard to obtain suggestions indicating how the accident might have been avoided, and with some skill or practice a group chairman can do very effective educational work.

When it comes to placing responsibility, there is likely to be a tendency to dismiss it by saying "injured man's carelessness." Sadly enough, there is usually a large measure of justification in so doing. Even so, those careless habits may well go back to inadequate direction by the foreman who perhaps limited his instructions to remarking, "Now, remember, we do not want any accidents. Be careful!" Not only should workmen have bad habits corrected when reporting to a new job, but the foremen and safety committee should watch for and correct unsafe practices that may develop.

During the year 1936 this method of study was applied to 384 accidents. Some were of a trivial or minor nature, and only 90 resulted in loss of time. While only the lost time accidents are posted in the safety contest, all accidents are reported. One reason is to insure a discussion that will bring to light hazardous conditions or potentially dangerous habits. For after all a serious accident resulting in long time disability is only a minor accident grown up.

As a matter of statistical information, it might be desirable to analyze all of the three hundred odd accidents, but we are not approaching the subject from that point of view even if such figures would be convincing. Therefore, I am only going to call to your attention a single group of accidents that amounted to nearly one-third of the total, those pertaining to sprains and strains. There were 109 investigated. The natural comment concerning many of them is, "Oh well, they are trivial and probably due to the injured man's own fault. He knew how. It was his carelessness." However, 48 or nearly half resulted in lost time.

An analysis of all of them develops the same background or contributing cause, easily dismissed as carelessness or heedlessness or with the injunction to "Watch your step." Going further back of that indicates the need for continuous attention by the workman to what he is doing. That means

where he steps, that he observe the conditions around him, and his position when undertaking to lift any weight, if only twenty-five pounds. The total lost time of these 48 accidents amounted to 566 days, indicating that this indifference of human nature or possibly the personal over-confidence of the workman is a contributing factor to the recurrence of accidents and presents a very definite problem to the safety engineer, far more baffling to solve than the design of guards for the machinery.

The hazard is so commonplace and so frequently recurring that it seems to have the same fundamentals as driving an automobile on the highway. Both seem to require continual education of the workman as he too often fails to appreciate the hazardous conditions around him. Hence, these investigations are considered more as a means of education than as a report to the management or statistical department.

We consider it the function of those collecting the experience to compile it in shape that it may be used collectively for educational purposes. Of course, the department management inherently carries the responsibility for reducing the cost of doing its work, but the man to man relation between foreman and workman should stress more greatly the personal hardships, suffering and possible after effects resulting from avoidable injuries.

Accidents Involving Carbon Dioxide and Their Prevention

By DR. J. C. GOOSMANN

Carbonic Engineering, Inc., New York City

Liquid carbon dioxide was commercially used in the U. S. in 1884 and was imported for that purpose from Germany. It has since become familiarly known as carbonic acid because of its slight acidulous tendency.

Carbonic acid is generally considered harmless by the public because it is largely used in the preparation of carbonated waters and other summer beverages.

But in cases of carbonation a certain element of risk is involved, in breakage of bottles. Thus, special precautions are required to protect the workers in factories where carbonic acid is handled.

The extent of such accidents increases

with the rise in the pressure at which carbonic acid is saturated into the water. Ordinarily a temperature of 50 degrees is sufficiently low to cause effective carbonation at 30 to 50 pounds of pressure, depending upon the character of the beverage.

Seltzer water is ordinary water saturated at a very high pressure of carbonation. At a temperature of 40 degrees a pressure of 100 pounds is necessary to carbonate the water successfully. With higher temperature, the charging pressure increases rapidly and, in consequence, the danger of breakage likewise mounts.

But accidents of this type now seldom oc-

cur because safety devices are being used which eliminate the danger of explosion and bursting.

Shortly before the end of the past century the carbonic acid refrigerating machine appeared in the U. S. Having none of the hazards associated with ammonia refrigeration, it gained rapidly in the favor of engineers, particularly in installations where large numbers of people congregate, as in hotels.

While the pressure of operating this system was considerably higher than was customary with ammonia machines, the only precaution necessary to insure safety was substantial and correct construction. The eventual leakage and losses of the gas hardly ever amounted to 10 per cent and as this is considered within the limits of permissible gas content in the atmosphere, it was a very simple matter to provide for the atmospheric air conditions by which the presence of the above quantity disappeared in the total volume.

High pressures do not affect the user, and the few safety requirements as to safety valves and volume of space to insure the necessary purity of the atmosphere were easily complied with, so that since the beginning of the century carbonic acid accidents have been practically unheard of.

Dry ice is carbon dioxide solidified. It is well-known in physics that each gas can exist in three phases or states: gaseous, liquid and solid. It is, therefore, a simple matter to produce a pure gas, liquefy it and by partial evaporation solidify it. In this condition carbon dioxide has found a ready market, and since its temperature is very low, -109 degrees F., it has found great favor for all manner of refrigeration where low temperature is a necessity.

Modern refrigeration requires a degree of humidity which many years ago was entirely neglected. However, such high humidity induces the growth of fungus, and to combat it, carbon dioxide is added in a controlled percentage. One of the beneficial actions of this gas is its strong bactericidal tendency which inhibits the appearance of spores and fungi, but it is necessary to control the percentage of the gas, varying with the character of the cargo. Moreover, it is necessary to provide for adequate means of ventilation of the cargo whenever the volume content of CO₂ exceeds 15 per cent, before

it is entirely safe for attendants to enter the hold or storeroom.

The percentage of this gas which can be endured by human beings for any length of time is 15 per cent. Higher gaseous contents result in increasing respiration which becomes successively more apparent as the gas content rises. At 30 per cent or over, the percentage of CO₂ gas becomes deadly within half an hour.

The effect of carbon dioxide is similar to that of drowning. If the victim is promptly removed from exposure and taken into fresh air, the symptoms are rapidly destroyed and no after-effects are encountered. Carbon dioxide tends to replace the 23 per cent of oxygen in the air. As the carbon dioxide increases, the oxygen is forced out until at high CO₂ content there is no more oxygen left. For this reason, the danger point has been fixed at 30 per cent, which can be endured half an hour, during which time plenty of warning will be experienced.

Children are naturally inquisitive, and since dry ice has become so widely used, they are anxious to see and feel its effect upon the skin. Often they gather where dry ice is distributed and pick up small pieces of it for experiments of their own. Cases have been recorded where a child placed small pieces of dry ice in a bottle, together with water, shaking the bottle vigorously to release the gaseous volume. The result was an explosion which grievously hurt the child.

A small piece weighing not more than a few ounces releases enough gas to break an ordinary bottle quite easily.

The only way to save children from this danger is to keep dry ice scrupulously from passing into their hands. Education is ineffective in such cases. Warnings are disregarded against the inquisitive desire to see what happens.

But the danger of asphyxiation can very well be guarded against, by educating those handling dry ice. Ignorance is a great contributing factor and can be very well overcome with the help of the dry ice manufacturers.

A case showing the need of intelligent information was that of the motor ship "Empire State," which was loaded with a cargo of frozen cherries at Traverse City, Michigan, about November 27, 1936, and proceeded toward New York Harbor.

The trip consumed five days. The boat

went through the Great Lakes and the New York State Barge Canal. In Phoenix a new supply of dry ice was taken on. The evidence showed that the quantity of dry ice spread over the load of cherries was much greater than actually required. It took three more days for the ship to reach New York.

Unloading of the hold containing the cherries started in the evening. No precautions were employed to ventilate the hold or to determine the percentage of carbon dioxide in the air and whether it was safe for the men to enter the space. The hatch of the hold was uncovered, and within two or three minutes a number of men started down to the bottom.

Cries of assistance from the hold were soon heard, but were at first ignored. When they continued, a rescue squad went down but did not get very far before the men also felt themselves overcome by the high percentage of carbon dioxide gas in the air.

A gas mask was then used, but since it had no connection with a new oxygen supply, it was of no value. When the police emergency squad arrived it was equipped with efficient masks and oxygen supply tanks, so that the men were independent of the air in the hold for breathing purposes.

Some of the men, meanwhile, had made heroic attempts to rescue their comrades, several of whom were lying at the bottom of the hold face downward—where, of course, the percentage of carbon dioxide was highest.

All the men overcome were bleeding profusely at the mouth. Post mortems showed that the lungs were highly congested with blood. The examination of other organs such as the brain, liver and kidneys showed no indication of poisoning. The men were simply drowned in an atmosphere from which the oxygen had been forced by very high percentage of carbon dioxide.

Test tubes of which a number were filled with the air in the hold at various levels and places showed carbon dioxide gas concentration between 35 and 60 per cent. No traces were found of carbon monoxide, hydrocyanic acid, ammonia, phosgene or sulphur dioxide.

Five men were dead when taken out. Three who were still breathing when they reached the deck were immediately taken to a hospital and have since entirely recovered. Another man who was partly overcome needed no attention and went home.

Simple means are now in existence whereby the percentage of carbon dioxide in the air is indicated by instruments located outside the hold. Warning signals are attached to these instruments, and it is even possible to start automatically ventilators which will evacuate the highly charged air and replace it with fresh air.

The holds of ships are particularly dangerous as points of possible asphyxiation because they are almost hermetically sealed and because air infiltration from the outside is practically nil.

WEDNESDAY AFTERNOON SESSION

October 13, 1937

Accidents in Delivering Refrigerated Products and Their Prevention

By G. L. GORE

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Accidents in the delivery of refrigerated products and their prevention opens up two distinct topics for discussion; namely, injury

to the employee himself and injury to the person or property of others through the use of teams and trucks.

In many plants, particularly the smaller ones, the deliveryman's hazard begins before he gets into his truck. For the unwary, the vault is a dangerous place. Floors are slippery because of chips of ice and natural frozen moisture. There is the hazard of falls caused by a cake breaking, tongs pulling out or the employee becoming overbalanced by improperly handling a heavy cake.

Floors should be kept as free as possible from chips and moisture. Many concerns equip their men with creepers fastened by means of a strap to the soles of the shoe. Toe injuries may be guarded against by safety shoes or metal guards placed over the toes and instep. Tongs should be kept sharp so that they will readily cut into the cake, thus preventing slipping.

To handle a cake of ice without injury is an art. No man should be permitted to do this work until some experienced man has fully demonstrated the safe way.

Very frequently the deliveryman is required to score his own ice. This materially increases his hazard. The scoring machine has been involved in some very serious accidents. The exposed side should be guarded so that one will not come in contact with the saws or permit his trouser leg to become engaged in the sprocket. Should a cake become lodged, the power should be shut off so that it can be safely loosened. To attempt to dislodge a cake by giving it a shove with the foot is extremely dangerous. I have known of many cases where the injuries have been serious enough to warrant amputation. In one plant of my acquaintance a driver and his superintendent each lost a foot on successive days due to this practice.

We all remember the old time ice deliveryman who carried his tongs suspended from his shoulder. Fortunately, most men now carry their tongs in their hands when not in use. A recent case coming to my attention involved an employee who had his tongs on his shoulder. He stepped on a small round stick which caused him to lose balance and fall. The point of the tongs punctured one of his lungs, the injury resulting in death.

Another dangerous practice is to carry the pick in the trousers pocket with the point up. A serious puncture or a severe scratch might be the result.

This brings up the matter of infection. The wound might heal in a day or two or it might

cause death. Medical authorities claim that an infection can develop in eight hours. This emphasizes the importance of carrying a small first aid kit on each truck or wagon. A small bottle of mercurchrome and a few adhesive tipped compresses will suffice. A whole fleet could be so equipped for a few dollars.

The coloring—red or yellow or whatever it might be—on the compress gauze is merely the result of sterilizing the gauze and does not make the use of mercurchrome on the wound unnecessary. The use of a pick scabbard will greatly reduce the possibility of a scratch or puncture.

The deliveryman, burdened with his product—weighing anywhere from a few to three hundred pounds, always is subjected to the falling hazard. This can be best eliminated by the eyes finding safe places for the feet to walk, but as an added prevention, shoes should be equipped with non-skid soles and heels. We have found these real aids in reducing the slipping hazard.

A deliveryman should wear shoes with what is known as the safety toe-cap. I prefer the metal toe because of strength and durability, although much can be said in favor of composition toe caps. Safety shoes have met with so much demand that today it is possible to get them in almost any weight, style and cost. Many present as attractive an appearance as a dress shoe or slipper.

As a matter of precaution, however, no deliveryman should become oversold on the fact that the toe cap will not break down.

The possibilities of wrenched backs and hernias are causes for considerable concern. Physical examinations are desirable. It is very dangerous work for a man with a tendency toward hernia or a weak back to be engaged in this work. All old employees should be periodically examined, and any defects coming to light should be repaired, or the employee placed in some work where his defects are not so likely to result seriously. No new employee, regardless of the fact that he might be used for only a few days, should be put to work unless he has passed a satisfactory physical examination before a physician designated by the prospective employer.

Portable ice crushers present a very serious problem. Here is a report of a typical accident:

"Our employee was feeding the crusher to fill an order. He was standing on the step

in the rear of the truck, bracing himself with his left hand on the left side of the bed. He was reaching into the bed of the truck with a pair of tongs in his right hand, attempting to drag toward him a 50 lb. cake of ice, when his left foot slipped off the end of the step causing him to lose his balance and throwing his left hand into the hopper of the crusher which was in operation at the time. For a time it was feared amputation would be necessary."

From time to time we hear of an ice man being knocked down simply because he failed to look in both directions before going across the street. Such accidents can be eliminated only by caution.

Dog bites are still somewhat prevalent. One company of my acquaintance has almost entirely eliminated this hazard through the "trial and error" method. Their men were instructed to report any bad dogs on their respective routes, following which their foreman made a call either in person or over the phone, asking that customer to keep his dog tied up between certain hours. Strange as it may seem, this plan met with little opposition on the part of the customer, although I must admit some of the customers were unreasonable. This simply meant no service to those homes for a few days. This firm also taught its men how to conduct themselves around dogs. There are many articles written by various authorities on the subject.

Insofar as the vehicle end of the ice industry is concerned, we can almost entirely concern ourselves with the truck; since the horse drawn vehicles are now the exception rather than the rule, their problem is almost insignificant. There is a great opportunity to effect many economies through a study of the accident situation in the fleet.

Some plant owners feel that they have fulfilled their obligations to their employees by fully guarding the plant. I have one such instance in mind. This plant is the last word in safety. The scoring machine was built with full safety in mind, on the owners' own design. Other machines were similarly developed. No one can be hurt by machinery in that plant, except almost deliberately. Brakes, lights, horns, etc., are inspected daily and the fleet kept in the best possible condition, and yet the vehicular accident frequency rate is quite high.

In that case the management simply has failed to recognize its accident problem in

its complete sense. The same degree of tireless effort directed toward truck accidents as was put forth in the plant would develop the best record in the country.

The problem of seasonal help is a serious one. Many companies have made a practice of hiring athletes to work during the summer months. The purpose is laudable and from an engineering standpoint satisfactory, providing the youth can drive a truck. Regardless of educational qualities, past history, or what he might say about his experience, no man should be placed in charge of a truck until he has gone through a series of actual tests, proving that he is a capable driver. Too often a prospective employee is merely asked whether he can drive a truck, and if he says he can, he starts out to deliver ice.

Giving human nature its due, we know that when a man is seeking a job, his eagerness quite often leads him to make claims with reference to his ability with the thought he can later learn or cover up after he has the job. We are left to luck as to what accidents he might have or people he might kill in the meantime.

The physical examination mentioned earlier should include tests for sight and hearing. The former should include tests for color-blindness. Many eye specialists are now equipped to give tests for depth perception—that is the patient's ability to judge distance—which are quite helpful in determining ability to drive a vehicle.

In selecting employees to be retained after the rush season is over, consideration should be given the accident record of each.

One company operated a fleet of 30 to 60 trucks in a principal southwestern city with 10 minor accidents in two years, none involving personal injury. That company religiously follows the practice of holding a meeting exclusively for the discussion of safety once a month during the off season, but weekly during the summer months. Bulletins and placards from the National Safety Council and the insurance carrier are used. As a means of further encouraging interest, a monetary award system is used. Each driver who has had no accident of any kind during the month is eligible for the drawing. Three awards are made each month for \$12.50, \$7.50, and \$5. The employer, of course, benefits many times the amount of expense in the way of lower insurance

costs, avoided damages to equipment, good will, etc.

Proper discipline and supervision are of the greatest importance. Trucks should be used only for their prime purpose, and when the driver is through with his deliveries, the truck should be returned to the garage and left there. Some companies follow the practice of permitting the drivers to take the trucks home with them, thinking that they will be used only as transportation to and from work. However, the temptation to use them for social purposes is pretty great, and occasionally one will become involved in an accident while it is so engaged.

Drinking in any degree should be strictly forbidden, and the drivers' superintendent should interest himself in seeing that there is no drinking on the job. Since saloons, night clubs and taverns are heavy users of ice, a drinking man might be inclined to imbibe as he went along.

On December 25, 1933, there occurred an accident which appropriately describes what might happen in this respect. A theretofore reliable colored driver was delivering ice on his route. It being Christmas day, many of his customers left out various drinks to be taken after icing their boxes. He withstood the urge for the first several times, but finally his appetite overtook him. The first was the one he should not have taken, because it called for company, and it wasn't long until the driver himself tired of work and thought of companionship.

He quit delivering ice, took his truck and went calling. He picked up three Negro women and two men, and the six started out. All went well until late in the afternoon when it was necessary to descend a rather steep grade. He lost control of the truck,

which struck a coupe in which a young man and his lady friend were visiting, almost demolishing the coupe and severely injuring the occupants. The truck glided from the coupe, across the street, and head-on into a tree, killing three of the Negroes outright and injuring the other two. The driver escaped with little more than scratches. Such an accident is purely a supervisory problem.

The two greatest vehicular hazards are backing without making sure the way is clear and intersection accidents. The first hazard can be substantially reduced by the use of proper type of rear vision mirrors and educating drivers to the fact that they must know the way is clear before backing. Should the driver back into some object or person, responsibility, according to law rests absolutely upon him and his employer.

The second must be met by the realization that there is no recognized law of right-of-way. The best rule to follow is to educate drivers to the fact that they must always yield the right-of-way to the other party. There are three fundamental reasons for this: In the first place, in case of an accident between a car and a truck, the truck almost invariably receives the majority of the blame, regardless of the actual fault. In the second place, yielding the right-of-way will eliminate many accidents. In the third place, it creates public good will and good will means more sales.

An ice truck holds a certain attraction to children. I have seen trucks with several children riding on them. The driver should accept the view that this is a dangerous practice and keep children off. This calls for salesmanship on his part. He won't lose any friends by keeping them off, but he certainly will if one is injured.

Fatigue in Its Relation to Accident Prevention

By J. R. GARNER, M.D.

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While the provocative causes of accidents due to man-failure are numerous, one, *fatigue*, stands out preeminently.

Fatigue has been described as a physiological condition of the cells or organs of the body which have undergone excessive

activity with a resulting loss of power. More correctly speaking, however, fatigue should be considered from both the psychological and the physical aspect.

Psychically, one who has been active for a considerable time, either mentally, or

physically, or both, develops a condition familiarly described as "a tired feeling"; this sensation is truly a psychical phenomenon, conveying no comprehension of any physical changes in the body tissues although important material changes have, in fact, taken place. Physiologists have been given much concern in their endeavor to determine in just what these changes really consist, and even yet some are not fully understood.

Physically, the phenomena of fatigue within the living body are exceedingly complex; all organs and tissues must of necessity work to a greater or less degree in unison, and excessive work upon the part of one body structure will increase the functional activity of others.

Thus, the action of the central nervous system is demanded in order that any muscle or group of muscles may be brought into play, the muscular action in turn demanding increased work on the part of the heart and respiratory organs in order that the augmented demand for oxygen be adequately met. At the same time various glands are stimulated to increased activity, inducing more secretion and demanding an acceleration of function on the part of the eliminatory system.

The internal or inherent power which undergoes a loss following excessive bodily, mental, or nervous activity is described as "energy." Decrease in this energy is attributable to changes having taken place in those yet unknown energy-holding compounds of the body as well as to a reduction in the available number of such compounds.

This really constitutes the first etiological factor in the production of fatigue.

The other prime factor in fatigue production is the accumulation of poisonous waste materials within the body, these being the so-called "fatigue substances." We may only briefly outline here the changes which occur when muscular tissue is brought into action. Glycogen is the chief source of muscular energy. When muscular contraction takes place its available oxygen enters into a chemical combination resulting in the disintegration or combustion of its glycogen, followed by the formation of carbon dioxide and lactic acid, both of which are powerful underlying contributors toward the induction of muscular fatigue and constitute the etiological factors while the exciting factor is work.

Resultant upon fatigue, the individual's ability to perform is lowered, his output decreased, the quality of his production diminished, his mental aptitude lowered, his susceptibility to disease increased in a direct ratio to the lowering of his vitality, his liability to commit errors is heightened, and, last but by no means least, his liability to sustain personal injury is greatly enhanced.

In all body activity a certain degree of fatigue is developed which is harmless so long as complete recuperation occurs. That is so long as oxygen and glycogen are supplied in adequate quantities to compensate for the combustion that is taking place in the activated musculature, and the "fatigue substances" are promptly and completely eliminated. When these requirements are not fully met the condition known as fatigue reaches a pathological status.

While carbon dioxide and lactic acid have been mentioned as being the "fatigue substances" developed in muscle tissue as the result of work, there are, under similar conditions, formed and accumulated in the brain and nerve tissues somewhat analogous katabolic substances productive of mental and nervous fatigue.

Mental fatigue follows exertion which requires deep and prolonged thought particularly along some single line. Nervous fatigue is induced by the expenditure of nerve force and follows the prolonged enforcement of body exertion beyond that point where physical or mental fatigue has become manifest. The exhausted brain worker or one with an overly expended nerve force is in no condition to continue the performance of physical labor and his accident hazard is greatly increased.

To understand the relation of fatigue to accident prevention, attention must be directed toward the individual conditions known as being inductive of fatigue. Paramount among such factors are the following:

Environments

The workers' environments play so important a role in the causation of fatigue that his home surroundings and general living conditions become of as great importance as are those connected with his work. A workman, whose home is unsanitary and unattractive, whose family relationships are causative of anxiety, or who is continually harassed by the worry attendant upon some

severe illness in his family, becomes an active candidate for very early development of fatigue. Such a person is a hazard to himself as well as to others in close working relationship.

The physical status and mental bearing of his fellow workers reflects upon the individual to such an extent that it may become productive of fatigue and is therefore to be considered from the environmental standpoint.

The inadequate or improper delivery of heat, light, and ventilation in plants and offices add greatly to the rapidity with which fatigue becomes manifest. Such conditions are always remedial and may be readily detected during the progress of an engineering survey.

General Health

Those whose physical standard is impaired by poor health, with the consequential lowering of vitality, will exhibit fatigue in a much shorter period of time and with much less physical and mental exertion than do normal beings. They are, therefore, more prone to sustain accidental injuries. Attention to the physical status of employees will accomplish much toward economical improvement as well as accident prevention.

It is impracticable to deal here with all the ailments which might be recognized as being productive of fatigue; only passing mention can be made of those which are most important.

Tuberculosis, while affecting all classes, is unquestionably more prevalent among those engaged on the labor side of industry. Not only are tubercular subjects prone to present a lowered vitality which renders them more subject to fatigue and accidents, but the transmissibility of the disease makes of them potential hazards for fellow-workers. Regular periodic reexamination of employees will greatly aid in the early detection of incipient infections when they are most amenable to arrest.

Diabetes, another systemic disease accompanied by early fatigue manifestations, may also be readily detected during a physical examination. Not only is the accident hazard, through fatigue, greater in diabetics, but wounds sustained by these persons are slower in healing and convalescence may be very greatly prolonged.

Cardio-vascular-renal conditions include

all of the generally so-called heart diseases, kidney diseases, and circulatory disturbances—including blood pressure. Any one of these conditions will sooner or later be followed by an associated condition in the other organs, and are generally considered as a single syndrome for general purposes. The ease and rapidity with which these subjects become fatigued renders them of interest in this survey.

Syphilis stands out preeminently as the greatest industrial hazard from the standpoint of disease. It is in the first and third stages of syphilis that its industrial relation is of more importance. During the first stage a sense of shame, a certain amount of fear and anxiety, and a realization of the seriousness of the malady reacts upon the individual's mental faculty to such an extent that fatigue is more rapidly induced. Throughout the second stage the disease is usually sufficiently quiescent to produce little or no disturbance in the subject's mental equilibrium.

The third stage is most hazardous from the industrial standpoint since it is at this period that the brain and spinal cord become involved and neural manifestations appear. There is an actually diseased mentality. The subject becomes inefficient, manifests fatigue under extremely slight provocations and becomes exceedingly liable to sustain accidental injuries from which recovery is generally greatly retarded.

Until recently, syphilis has been under such a moral and social taboo that every effort has been exerted to keep its presence hidden and much irreparable damage has resulted. It is now becoming recognized as a physical ailment which requires intelligent handling and scientific treatment from its incipency. Detected in its early stages syphilis is curable and the catastrophes attendant upon the tertiary stage may be averted.

Adaptation to Work

By force of necessity many individuals seek any available form of employment without having regard for their own adaptation to the work. Any person unfitted for the labors he is required to perform will become fatigued with a remarkable degree of rapidity. Industrial heads, when considering the employment of men, should see that each individual is adapted to the class of work assigned to him. This will result in

the lessening of fatigue, increasing of efficiency and decreasing of the accident hazard.

Working Hours

Those who have had actual and practical experience know that in some instances shortening of the day's work has actually resulted in an increase in the amount of work done. One occupation will be found far more fatiguing than another. Our present interest is centered upon over-fatigue which is recognized as being causative of accidents.

There are in general use many labor-saving devices, the operation of which produce much noise and vibration and require high speed attention on the part of the operators. Such inventions unquestionably save much labor and yet they have a tendency to greatly increase fatigue.

Monotony, another cause of emotional fatigue, deserves consideration under this heading. Rest periods have been found to prevent and relieve fatigue when interspersed with the day's work. These rest periods may often be of no more than five or ten minutes' duration and their frequency governed by the monotonous nature of the employment. Actual experience of industries where such rest periods have been instituted has shown that fatigue has been lessened, production increased, and accidents minimized.

Noise

Though scientific experiment has not yet demonstrated that working under conditions of continuous noise is productive of fatigue, it is generally accepted as an axiomatic fact. Exceedingly loud noises, those of a droning nature rapidly repeated, and monotonous noises are particularly prone to induce fatigue. It would appear that the character and quality of noise is of the greatest importance and, where they cannot be eliminated, efforts at changing or supplanting the character of sound have met with remarkable success.

By means of loud speakers installed throughout many factories in Germany the rhythm of music has been used to overcome the hum of machinery. The practice is just beginning to permeate American industry; in English and South American factories it has been in vogue for some time.

Posture

Incorrect posture is a most important factor in the causation of fatigue and its attendant accident hazards. Man having assumed the upright position, all studies of posture must consider this as being his normal attitude. A perpendicular line drawn alongside of the standing figure should pass through the center of the ear, the center of the shoulder, center of the hip, center of the outside of the knee, and center of the external malleolus at the ankle. Such a posture requires the minimum of physical exertion for its maintenance since the parts of the body are so superimposed upon each other that the force of gravity replaces much muscular effort.

The correct seated posture maintains the above relation with the head, torso and hips; the thighs are at an angle of approximately ninety degrees with the body, while the knees are flexed so that the feet rest firmly and comfortably upon the floor. When work requires that the body be inclined forward so as to accommodate itself to a desk or machine, this position should be assumed by a pivoting at the hip joints and not by permitting a slouch in the spinal column.

The general ill effects of an improper sitting posture result from the disturbances of function of the organs of the body resultant upon a flattened chest, rounded shoulders, obliteration of the natural curvatures of the spine, protrusion of the abdomen, removal of the natural support provided for the heavy abdominal viscera by a natural shelving of the spine where these organs rest and are retained by the abdominal muscles, undue stress upon supporting ligaments, retardation of circulation, undue pressure upon that sensitive area surrounding the lower end of the spine and the coccyx, and undue pressure upon the nerves, arteries and veins passing through the popliteal space at the back of the knee joint. When, due to improper posture, the heart's action is impeded there is noted a diminution in both the quantity and quality of the blood's supply with a corresponding depreciation in available oxygen and glycogen accompanied by a retention of the "fatigue substances." The invariable result is a rapid manifestation of fatigue symptoms. The subject begins to feel sleepy, yawns frequently, responds but sluggishly to external stimuli, lags in the performance of work, becomes inefficient, and is far more liable to accidental injuries.

Many workers have been provided with no seat whatever, others with improper seats or chairs which do not admit of adjustment either to the individual's anatomy or to the work entailed. Due to the exceedingly inefficient character of such seats, piece workers can rarely be induced to use chairs of ordinary construction while doing their work.

Muscles will respond to an enormous amount of action before manifesting symptoms of fatigue. When, however, during

muscular action, oxidation has been incomplete and the supply of glycogen inefficient, a rapid increase of the "fatigue substances" will occur in the muscle cells and fatigue will increase in direct proportion to the reduction of muscular efficiency. Muscles that have become fatigued will not be accurate in directing movements; there will be incoordination of action with other muscles—this uncertainty of movement and non-concerted action increases the accident hazards of the individual as the elements of fatigue increase.

Safety Control In Air Conditioning

By A. G. HILLEN

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In our discussion we will deal only with the safety control which should be practiced in engineering design, which constitutes safety in material, safety in controls, and safety in physiological reactions of the occupants of the space. To obtain these safety measures the designing engineer must be selective in the materials used and lay out the system to produce comfortable conditions without hazards to the occupants. The engineer operating the system must maintain in the conditioned area the temperatures and humidities to produce comfort.

In comfort conditioning, refrigerating effect is required to produce cooling and dehumidifying of air, which in the majority of cases calls for a refrigerating machine. The refrigeration machine is used either for the direct expansion of the refrigerant in the path of air or for the cooling of water to cool the air. The types used today are absorption, rotary, reciprocating, centrifugal and steam ejector water vapor. Absorption systems are seldom used for air conditioning and the rotary type is seen infrequently.

The most commonly used refrigerants are freon, ammonia, carbon dioxide, sulphur dioxide, methyl chloride, water vapor and carrene. Due to their toxic or irritant values, in case of a leak, methyl chloride, ammonia and sulphur dioxide are seldom used in air conditioning. Carbon dioxide is used less and less, due to its high working pressure and the high temperature of condensing water found in some sections of the country.

This leaves freon and carrene as the most generally used refrigerants, and while they are similar in some respects they are quite different in operating characteristics within the cooling range required for comfort air conditioning.

Freon is used in a reciprocating compressor which produces the cooling at a differential in pressure, both high and low side above atmospheric; while carrene is used in a centrifugal machine which produces its cooling at a differential of vacuum.

Of course, water is sometimes used as a refrigerant. It is used in the steam ejector and water vapor centrifugal machines. To produce the refrigerating effect, cooling water to 50 degrees, a very low vacuum is required, approximately 29.2 inches of vacuum. Water, without a doubt, is the safest refrigerant which could be used, but has its limitations due to its refrigerating characteristics.

Freon and carrene are considered safe refrigerants. Both are considered non-explosive, non-flammable, and non-toxic. The National Board of Fire Underwriters has made an elaborate report entitled "The Comparative Life, Fire and Explosion Hazards of Common Refrigerants."

Due to the safety of freon, it is acceptable to use for direct expansion work, as under normal operating conditions the amount of refrigerant leak would be so readily diffused and diluted that it would not be harmful. Since with the use of freon the refrigerating

effect is produced by a differential in pressure, both high and low side being above atmospheric pressure, any leakage of the refrigerant is outward.

The centrifugal machine using carrene cools water or brine direct. This refrigerant is not especially suitable for the direct expansion in coils of an air conditioning system. With this type of refrigeration the refrigerant is kept entirely within the bounds of the refrigeration apparatus room and does not come in contact with the air being cooled or otherwise conditioned. The centrifugal machine using carrene is always at a vacuum on the cooler or evaporator side where the refrigerant is evaporating; hence any leakage, no matter how slight, is inward rather than outward, which effectively prohibits the escape of the refrigerant gas into the surrounding apparatus room.

In certain cases ammonia has been, and is still being, permitted for use as a refrigerant in air conditioning, such as in meat packing, breweries, and other industries, where the occupancy in relation to floor area is relatively small. It presents a definite hazard when used in direct expansion coils in the path of air, and certainly should not be used in any form as a refrigerating medium in an air conditioning system for auditoriums or public buildings.

In those industrial establishments mentioned, where ammonia is used for industrial and commercial purposes, it should never be utilized for comfort conditioning except by means of the indirect system, namely, cooling brine or water which in turn is used for comfort conditioning.

Must Adapt to Conditions

Controlling of sound level in air conditioning installations has become quite important. Such installations as broadcasting studios, sound stages, theatres and court houses require sound treatment. The engineer designing the system should make certain that the materials used in sound treatment in ducts are fireproof. There has been a tendency toward using an acoustical material inside a duct to perform the function of insulation and sound absorbing. This material likewise should be fireproof, otherwise a hazard is always present.

Air conditioning installations play an important part in plants where solvents with explosives are used in the manufacturing

process. In this type, explosion proof motors and starters must be used. The fans should also be equipped with copper scrolls to prevent the generation of a static spark.

The space requirements to permit adequate servicing of equipment is another detail requiring careful study by the designing engineer. He should exercise care and thought in the location and spacing of the apparatus. Conservation of space is sometimes over-emphasized, making it hazardous for the operating engineer to render the required service to motors, compressors, etc.

Safety control begins with the first nut or bolt that is manufactured for the apparatus, right on through to the rigging and installation of the equipment which necessarily must be regulated by insurance companies, underwriters and city ordinances, etc. One particular detail in the installation of refrigerating and air conditioning apparatus is often overlooked, and that is the safe working stresses of the floors upon which the equipment is being erected. In many cases it has been found that the floor load was designed for 100 to 150 pounds per square foot and not suited for the actual equipment of over twice that weight which was installed. Then too, suitable vibration absorbing pads of cork or rubber, or mechanical types using springs, should be installed to absorb the hazardous vibration that sometimes exists. Belt guards and pipe rails around apparatus have often been neglected due to lack of experience or "penny wise and pound foolish" economy.

Standard refrigerating apparatus requires the installation of certain safety devices to protect equipment against overload, breakdown and fire. Every installation should have high and low pressure gauges so that an inspector or operator can determine at a glance if the pressures are within the safe limits of operation. Likewise, every motor driven compressor should have the proper starting equipment with overload relays and under voltage relays to stop the apparatus in case of overload.

Where water is used for condensing purposes a positive supply should be provided. If this is pumped, the electrical hookup should be such that the apparatus will not operate unless there is sufficient and continuous supply of water to prevent building up of high refrigerant pressure beyond safe limits. A simple electrical hookup or a water

failure switch can be installed at nominal cost.

Then too, thermometers are important so that the operator or inspector can make proper check-up at any time. Safety relief valves of the pop type should be provided on the condenser and connected to outside; suitable plugs, set to relieve at a reasonably low temperature should be provided to prevent excess pressure and possible explosion of the condensers and receiver in case of fire. Safety relief valves of the pop type only should be installed between the suction and discharge connections of the compressors as well as combination high and low pressure cutout to stop the compressor should the discharge valve be shut off. Where shell and tube apparatus is used for chilling water, safety relief valves of the pop type should likewise be connected to the outside to prevent explosion in case of fire because of excessive pressure.

All motors on all air conditioning apparatus should be provided with suitable safety switches as well as overload and under-voltage starter protection. Where automatic temperature control is used, safety thermostats and regulating thermostats must be provided to safeguard the operation of the equipment as well as to prevent excessive heating or excessive chilling in either summer or winter time.

In certain manufacturing, process conditioning, special mechanical laboratories, theatre projection booths, and wherever duct work extends through fire walls, suitable fusible link dampers must be provided on both sides of the wall to automatically close off in case of fire, thus retarding spread of smoke, fumes, or fire.

Drafts Must Be Avoided

It is necessary that the designing engineer take precautions to distribute the air in the conditioned area so that drafts will not occur on the occupants of the room. The suggested maximum velocity over a person at rest is 30 feet per minute. The design of outlets and method of distribution should be such that this maximum is not exceeded. This is particularly true in air conditioning installations in hospitals.

Sufficient outside air for ventilation should always be taken through the air conditioning equipment to dilute odors and smoke which may occur in an air conditioned space. This

naturally requires reheaters and preheaters where the system is installed for year 'round air conditioning. In hospital installations, especially in operating rooms, the air supplied should preferably be all outside air. In apartment houses special precautions should be taken to avoid the contaminated air from one or more apartments being redistributed throughout the building; thus eliminating, or, at least minimizing the possibility of contagious diseases being transmitted.

The system of control for preheaters should be such that they will not freeze up due to low temperature outside air and the reheaters should be sized of sufficient capacity to heat the conditioned space to the desired winter temperature. Automatic control of temperature and humidity must be installed to obtain the correct conditions in the occupied space.

The engineer operating the system should be thoroughly instructed and competent to operate the air conditioning system correctly. The conditions maintained within the conditioned area should eliminate the spectacular over-cooling which is so often resorted to in conditioned spaces. A differential of 15 degrees with a relative humidity of 50 per cent, when outside temperatures are 95 degrees, are considered ideal conditions for comfort.

As the outside temperature increases this differential should increase slightly and as the outside temperature decreases the temperature differential should decrease. This is particularly desirable in public buildings for the comfort of the continuous occupants, as well as those who enter only to stay a short time before returning to outdoors. This will avoid the shock so often experienced due to the too great change in temperature.

From the safety point of view the record of the air conditioning industry is an excellent one, for the public interest in safety has in most cases been adequately protected. With the increased use of refrigeration for comfort conditioning, even greater precautions are being taken in the development of proper refrigerants and control.

Has Safety Value

There are a number of applications in which air conditioning has had a definite safety value. In the operating rooms of

hospitals where air conditioning is installed, the doctors and nurses are comfortable, which tends to promote a steadiness of the nerves. The freedom from perspiration avoids the possibility of a wound infection from that source. Since some types of anesthetics are definitely known to have explosive characteristics, it is important to prevent the generation of a static condition that may prove disastrous. This is accomplished by maintaining a relative humidity of 50 per cent at which condition static is entirely eliminated.

In mines, air conditioning has been beneficial to the health and well being of the men working. In deep mines, without air conditioning, temperatures and humidities are excessive, which frequently cause prostrations. In shallow mines the roof and walls are at a temperature of approximately 50 degrees the year round and in the summer, when moist air is induced for ventilation, rapid condensation occurs and accumulates on the shale rock which increases the hazard due to falls. By supplying dehumidified air with a dewpoint equal to or below the shale rock temperature, moisture condensation will not occur, disintegration and falls are minimized.

Many air conditioning installations have been made in industrial plants where excessive process heat is generated, such as enameling rooms where materials to be enameled are at intensive temperatures. Air conditioning has reduced the number of

prostrations and hence benefited the health and increased the comfort of the employees.

Another important application is the removal of dust and small particles of irritant chemicals, such as are found in unconditioned match factories, some departments of chemical, paints and pharmaceutical plants.

In the manufacturing of rayon, an acid solvent is required in the process. Unless an exhaust system is tied into the air conditioning system, the acid fumes contaminate the air, producing unhealthy working conditions. The fumes affect the throat and eyes in particular.

Fuse loading departments in ammunition plants is another application where air conditioning produces safety for employees. The humidity is kept high enough to prevent a static spark. Cooling and dehumidifying in summer eliminate perspiration from the worker's hands, which prevents the powder from adhering to the steel dies.

Some lacquering processes require a solvent having explosive properties. Since in some plants doing this type of work the solvent has explosive properties, and dehumidifying is required, an exhaust system is installed and sufficient outside air supplied to prohibit an explosive mixture.

Humidification in tobacco plants keeps down dust, which otherwise would be hazardous to employees. In the drying process of manufacturing matches, uniform drying, which requires air conditioning, prevents flaring or sparking when ignited.

ADJOURNMENT

Rubber Section

Officers 1936-37

General Chairman—J. M. KERRIGAN, U. S. Rubber Reclaiming Co., Inc., Buffalo, N. Y.
Vice-Chairman in Charge of Program—R. A. BULLOCK, Corduroy Rubber Co., Grand Rapids, Mich.
Secretary—R. W. MORSE, The Firestone Tire and Rubber Co., Akron, Ohio.
News Letter Editor—OLIVER HOPKINS, U. S. Rubber Products, Inc., Providence, R. I.
Engineering Committee Chairman—J. G. POLM, The Goodyear Tire and Rubber Co., Akron, Ohio.

Health Committee—

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Membership Committee Chairman—PAUL VAN CLEEF, Van Cleef Brothers, Chicago, Ill.
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JOHN J. LOGE, The General Tire & Rubber Co., Akron, Ohio.

JOHN E. LOVAS, U. S. Rubber Products, Inc., Passaic, N. J.

URBAN L. MOLER, Inland Div., General Motors Corp., Dayton, Ohio.

W. P. SPANTON, American Hard Rubber Co., Akron, Ohio.

C. W. UFFORD, Ohio Rubber Co., Willoughby, Ohio.

Past General Chairmen—

E. W. BECK, U. S. Rubber Products, Inc., New York, N. Y.

A. M. DIETZ, Pennsylvania Rubber Co., Jeannette, Pa.

C. F. HORAN, Hood Rubber Company, Watertown, Mass.

J. T. KIDNEY, The Goodyear Tire and Rubber Co., Akron, Ohio.

H. W. LOW, Miller Rubber Products Co., Inc., Akron, Ohio.

W. L. SCHNEIDER, The B. F. Goodrich Co., Akron, Ohio.

CHARLES F. SMITH, U. S. Rubber Reclaiming Co., Inc., Buffalo, N. Y.

Officers Elected for 1937-38

General Chairman—J. M. KERRIGAN, U. S. Rubber Reclaiming Co., Inc., Buffalo, N. Y.
Vice-Chairman in Charge of Program—R. A. BULLOCK, Corduroy Rubber Co., Grand Rapids, Mich.
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 H. W. LOW, Miller Rubber Products Co., Inc., Akron, Ohio.
 W. L. SCHNEIDER, The B. F. Goodrich Co., Akron, Ohio.
 CHARLES F. SMITH, U. S. Rubber Reclaiming Co., Inc., Buffalo, N. Y.

THURSDAY AFTERNOON SESSION

October 14, 1937

The session was called to order by J. M. Kerrigan, U. S. Rubber Reclaiming Co., Inc., Buffalo, N. Y., General Chairman of the section.

Rubber Section Safety Contest

Chairman Kerrigan briefly reviewed the outstanding facts in the 1937 Rubber Section Safety Contest.

Thirty-seven participating plants worked 63,696,394 man-hours during the six months' period of competition in the Rubber Section Contest and experienced 642 disabling injuries for an accident frequency rate of 10.079. The 37 plants employed 67,874 men. Both the accident frequency rate and man-hours of exposure were higher than for all previous contests.

Plants averaging 125,001 or more man-hours per month, composing Groups A and

B, made the best records in the contest with an average frequency rate of 10.05.

Groups C and D, composed of plants with 125,000 or less man-hours of exposure per month, had an average frequency rate of 10.424. Two-thirds of the plants in both divisions had frequency rates below the averages.

Perfect records for the entire contest period were made by four plants. Seven of the 22 large plants in Groups A and B had frequency rates below 2.00 for the contest period.

Five plaques were awarded to winners of

first place; two certificates were awarded to winners of second and third place.

Awards were presented by Lew R. Palmer, conservation engineer, Equitable Life Assurance Society, New York City, and past president, National Safety Council. Plaques were awarded to first place winners as follows:

Groups A and B—U. S. Rubber Products,

Inc., Saugatuck Footwear Plant, Saugatuck, Conn.

Groups C and D (under 125,000 average monthly man-hour exposure)—Four tied for first place with perfect records—Van Cleef Brothers, Chicago; Providence Insulated Wire Co., Pawtucket, R. I.; The Lobl Manufacturing Co., Middleboro, Mass.; U. S. Rubber Products, Inc., Fabric Fire Hose Co., Sandy Hook, Conn.

"Rubber Industry Problems" was the subject of a round table discussion which touched on the following points:

1. What is a workable plan for good housekeeping?
2. What are the outstanding fire hazards? How can they be minimized?

3. How can hand tool injuries be prevented?

4. What protective apparel is necessary for the workers?

5. What types of mill and calendar safeties are most satisfactory? Why?

6. What hazards are involved in molding small rubber parts? How can they be overcome?

Safety Device for Horizontal Heater

By K. C. LOOMIS

Manager, Runningboard Div., The Ohio Rubber Co., Willoughby, Ohio

The need for a safety device for locks on the doors of horizontal vulcanizers, commonly called open steam heaters, was impressed upon us last year when a door blew off one of our largest heaters. The door, weighing more than a ton, was shot through the air like a paper plate. Luckily, no one was injured.

The operator couldn't explain what had happened. He was thinking about the spoiled job in the vulcanizer. We were thinking in different terms—how much more serious this could have been and what could be done to the heaters so that the steam could not be turned on unless the door was properly closed.

Not Fully Closed

Examination of the door and the door locks exposed as the reason for the accident the fact that the door had been closed just enough to withstand nearly a full head

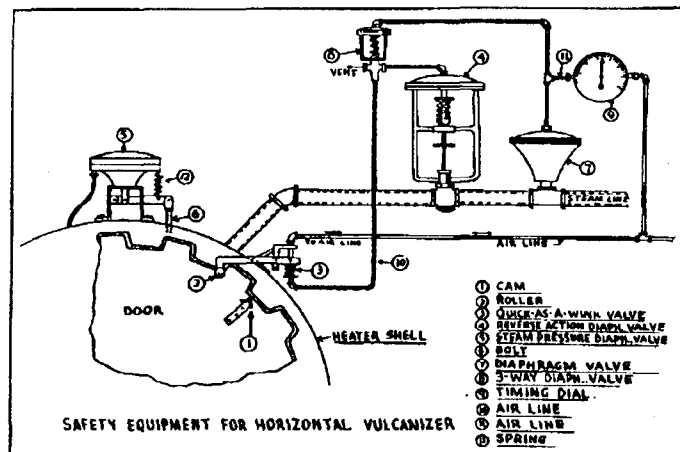
of steam. As the pressure built up to this point, the door lug slipped back and the door blew open and off.

Positive Device Sought

The engineering division was instructed to correct this hazard, and if we were unable to buy a safety device, to make one. We found that there was no positive safety mechanism available which would make it impossible to turn on the steam if the door were not properly closed nor to open the door before the steam had been completely exhausted from the heater after the cure.

A safety device that will do just this has been developed and is now in use on all heaters in our plant at Willoughby, Ohio.

(Illustrating with a large copy of the drawing shown here, Mr. Loomis gave the following explanation of the device.)



Part I. Door is moved into position on heater and locked by turning door to the left. Cam (1) operates roller (2) opening valve (3) which releases air pressure to line (10) which leads to lower inlet of three-way diaphragm valve (8). Operator then sets cure time on time cycle regulator (9). This regulator automatically shuts off air pressure on line (11) allowing direct acting valve (7) to open. Shutting off the air on line (11) also operates three-way valve (8) which opens lower inlet allowing air pressure from line (10) to enter reverse acting diaphragm valve (4) opening same, and allowing steam to enter heater.

Part II. When heater is in operation, steam pressure built up inside of it will operate the diaphragm valve (5) pushing bolt (6) down behind door lug.

Part III. When cure time is up, time cycle regulator (9) turns air pressure into line (11) closing direct acting valve (7), also closing lower inlet of three-way diaphragm valve (8) which shuts air pressure from air line (10) and vents air from reverse acting diaphragm valve (4) causing this valve to close.

Part IV. As steam is exhausted from the heater and the pressure has reduced to less than 12 oz. on diaphragm valve (5), spring (12) will pull bolt (6) up, and heater door can be opened.

Note. (a) Tension on spring (12) can be adjusted either to raise or to lower the 12 oz. factor.

(b) Steam line has two valves, one closing with air pressure and the other closing with air off.

ADJOURNMENT

Safety Equipment Section

Accident Prevention Equipment Manufacturers
Who Exhibited at the Twenty-Sixth National Safety Congress
and Exposition

Kansas City, Mo., October 11-15, 1937

Exhibition Hall—Municipal Auditorium

- Acme Protection Equipment Co., Inc., Pittsburgh, Pa.
Gas Masks.
- Advertising Displays, Inc., Covington, Ky.
Safety Education Materials in Display Form With Moving Messages.
- Aetna Casualty & Surety Co., Hartford, Conn.
Safe Driving Tests, Safety Educational Films.
- A. S. Aloe Co., St. Louis, Mo.
First Aid and Hospital Equipment.
- American Abrasive Metals Co., Irvington, N. J.
Safety Treads for Walkways and Safety Gratings.
- American-LaFrance and Foamite Industries, Inc., Elmira, N. Y.
Fire Protection Equipment.
- American Mutual Liability Insurance Co., Boston, Mass.
Insurance, Workmen's Compensation, Property Damage and General Automobile.
- American Optical Co., Southbridge, Mass.
Head and Eye Protection Products.
- American Safety Tank Co., Kansas City, Mo.
Automotive Fuel Supply Tanks.
- Arntzen, Inc., Chicago, Ill.
Auxiliary & Emergency Stretcher First Aid Equipment.
- Automatic Traffic Control Corp., St. Paul, Minn.
Traffic Actuated Control Equipment
- Bear Manufacturing Co., Rock Island, Ill.
Safety Inspection and Correction Equipment.
- Bendix Products Corp., South Bend, Ind.
Automotive Equipment.
- Black-Sivalls & Bryson, Inc., Kansas City, Mo.
Safety Heads, Tanks and Pressure Vessels.
- Bradley Washfountain Co., Milwaukee, Wis.
Group Washing Equipment.
- Brown Shoe Co., St. Louis, Mo.
Men's and Women's Safety Shoes.
- Stewart R. Browne Manufacturing Co., New York City.
Safety and Special Purpose Lights and Lamps.

K. H. Buhrke Co., Chicago, Ill.
Safety Equipment for Construction and Maintenance.
E. D. Bullard Co., San Francisco, Calif.
Personal Protective Equipment.
Burroughs Wellcome & Co., (U.S.A.), Inc., New York City.
First Aid Kits and Medical Equipment.

Champion Brake Corp., Chicago, Ill.
Hand Brakes for Freight Cars.
Chicago Eye Shield Co., Chicago, Ill.
Head, Eye and Respiratory Protective Equipment.
Columbus McKinnon Chain Corp., Tonawanda, N. Y.
Alloy Steel Sling Chains and Safety Hoists.
H. S. Cover, South Bend, Ind.
Respirators and Safety Goggles.
Crouse-Hinds Co., Syracuse, N. Y.
Traffic Signals and Floodlights.
M. E. Cunningham Co., Pittsburgh, Pa.
Safety Steel Stamps and Type Holders.

Davis Emergency Equipment Co., Inc., New York City.
First Aid and Industrial Safety Equipment.
C. H. Dockson Co., Detroit, Mich.
Head and Eye Protection.
DoMore Chair Co., Inc., Elkhart, Ind.
Posture-Health Chairs for Office and Factory.
Dual Parking Meter Co., Oklahoma City, Okla.
Parking Meter Equipment.
Donald F. Duncan, Inc., Chicago, Ill.
Parking Meter Equipment.

Eagle Equal Corp., Moline, Ill.
Traffic Signals.
Electronic Control Corp., Detroit, Mich.
Electronic and Photo-Electric Equipment.
Elliott Service Co., New York City.
Promotion of Efficiency and Safety.
Emerson Drug Co., Baltimore, Md.
Bromo-Seltzer.
Employers Mutuals, Wausau, Wis.
Fire and Casualty Insurance, Workmen's Compensation.
Enameled Steel Sign Co., Chicago, Ill.
Day and Night Steel Reflecting Signs.

Fairway Laboratories, Inc., Belleville, Ill.
Anti-Fatigue and Heat Exhaustion Antidote Tablets and Dispensing Equipment.

Harley-Davidson Motor Co., Milwaukee, Wis.
Police Motorcycles and Accessory Equipment.
Hercules Friction Grip Co., Kansas City, Mo.
Brake Dressing.
Hild Floor Machine Co., Chicago, Ill.
Electric Floor Scrubbing Machines and Vacuum Cleaners.
Holcomb Safety Garment Co., Chicago, Ill.
Industrial Safety Clothing.
Hoof Products Co., Chicago, Ill.
Motor Vehicle Speed Control Governors.

Huntington Laboratories, Inc., Huntington, Ind.
Disinfecting and Sanitation Products.
Hynson, Westcott & Dunning, Inc., Baltimore, Md.
Mercurochrome First Aid Antiseptic, Thant's Lozenges.

Indian Motorcycle Co., Springfield, Mass.
Police Motorcycles and Equipment.
Industrial Gloves Co., Danville, Ill.
Industrial Safety Clothing.
Industrial Safety Equipment Assn., New York City.
Association of Manufacturers of Industrial Safety Equipment.
International Shoe Co., St. Louis, Mo.
Safety Shoes.

Junkin Safety Appliance Co., Louisville, Ky.
Power Press Guards.
Juvenile Wood Products, Inc., Fort Wayne, Ind.
Automobile Safety Seats for Children.

The Karpark Corp., New York City.
Parking Meters.
Keystone View Co., Meadville, Pa.
Visual Safety Tests.
Walter Kidde & Co., Inc., New York City.
Fire Protection Equipment.
Kimball Safety Products Co., Cleveland, Ohio.
Industrial Safety Clothing and Supplies.

Lehigh Safety Shoe Co., Inc., Allentown, Pa.
Leather and Rubber Safety Shoes.
Liberty Mutual Insurance Co., Boston, Mass.
Automobile and Industrial Safety Service.

The Lima Cord Sole & Heel Co., Lima, Ohio.
Non-Slip Soles and Heels.
Lumbermens Mutual Casualty Co., Chicago, Ill.
Automobile, Compensation and General Casualty Insurance.

Macwhyte Co., Kenosha, Wis.
Wire Rope and Braided Wire Rope Slings.
The Martindale Electric Co., Cleveland, Ohio.
Dust Respirators and Highway Safety Signals.
McCloskey Torch Co., Toledo, Ohio.
Bomb Shell Torches and Truck Flares.
B. F. McDonald Co., Los Angeles, Calif.
Safety Hats and Respirators.
Metropolitan Life Insurance Co., New York City.
Life Insurance, Industrial, etc.
Michigan Malleable Iron Co., Detroit, Mich.
Traffic Stop Signs.
Milburn Co., Detroit, Mich.
Protective Creams for Prevention of Occupational Skin Diseases.
Mine Safety Appliances Co., Pittsburgh, Pa.
Safety Appliances and First Aid Materials.
Modern Engineering Co., St. Louis, Mo.
Welding Torches and Safety Goggles.
Murray Safety Sling Co., Inc., Pittsburgh, Pa.
Plated Wire Rope Slings.

National Bureau of Casualty & Surety Underwriters, New York City.
 Safety Service, Casualty Insurance.
 National Safety Council, Inc., Chicago, Ill.
 Posters, Bureau of Information, Research and Education Division.

G. H. Packwood Manufacturing Co., St. Louis, Mo.
 Soaps and Cleaning Compounds.
 Panther-Panco Rubber Co., Inc., Chelsea, Mass.
 Safety Soles and Heels.
 The Patent Scaffolding Co., Chicago, Ill.
 Safety Ladders and Scaffolds.
 The Plister Manufacturing Co., Cincinnati, Ohio.
 Fire Protection Equipment.
 Protectoseal Co., Chicago, Ill.
 Safety Devices for Hazardous Liquids.
 Pulmosan Safety Equipment Corp., Brooklyn, N. Y.
 Respiratory Protection and General Safety Equipment.

Railway and Industrial Engineering Co., Greensburg, Pa.
 Interlock Systems, Potential and Phase Detectors, Insulator Testers.
 Reece Wooden Sole Shoe Co., Columbus, Nebr.
 Wooden Sole Safety Shoes.
 Rich Signs Corp., Wichita, Kans.
 Highway Reflecting Traffic Markers.
 Rockwood Sprinkler Co., Worcester, Mass.
 Fire Protection Equipment.
 Rose Manufacturing Co., Denver, Colo.
 Industrial Safety Equipment.

Safeguard Electric Co., Inc., Brooklyn, N. Y.
 Shockproof Portable Lamp Guards.
 Safety Engineering, Alfred M. Best Co., Inc., New York City.
 "Safety Engineering," Insurance Publications and Reports.
 The Safety Equipment Service Co., Cleveland, Ohio.
 Goggles and All Types of Accident Prevention Equipment.
 Safety First Shoe Co., Holliston, Mass.
 Safety Shoes.
 W. H. Salisbury & Co., Inc., Chicago, Ill.
 Linemen's Rubber Protective Devices.
 Shepherd Safety Shoe Corp., Chicago, Ill.
 Safety Shoes.
 The Spencer Turbine Co., Hartford, Conn.
 Industrial Vacuum Cleaners and Dust Collection Equipment.
 Standard Safety Equipment Co., Chicago, Ill.
 Industrial Safety Equipment.
 Stonehouse Signs, Inc., Denver, Colo.
 Accident Prevention Signs and Tags.
 The Strauss Co., Pittsburgh, Pa.
 Safety Belts, Safety Hats, and Foot Guards.
 Sugar Beet Products Co., Saginaw, Mich.
 Industrial Soaps.
 The Surety Rubber Co., Carrollton, Ohio.
 Linemen's Safety Equipment and Synthetic Rubber Industrial Equipment.
 The Surly Manufacturing Co., Inc., Chicago, Ill.
 Dust Counters, Exhaust Units, Safety Guards and Shields.
 S-W Supply Co., Girard, Kans.
 Highway Railroad Signals.

Threeway Signal Co., Oklahoma City, Okla.
 Safety Signal Equipment.
 Traffic Boy, Inc., Canton, Ohio.
 School Zone Traffic Warning Signs.

United States Steel Corporation Subsidiaries, Pittsburgh, Pa.
 Steel Products and Cement.

Wahlert Products Corp., Brooklyn, N. Y.
 Industrial Safety and Fire Protection Equipment.
 Weaver Manufacturing Co., Springfield, Ill.
 Automotive Testing Equipment.
 West Disinfecting Co., Chicago, Ill.
 Products for the Promotion of Industrial Sanitation.
 The Western Union Telegraph Co., Kansas City, Mo.
 Communication Service.
 Wilson Products, Inc., Reading, Pa.
 Personal Protective Devices.

Steam Railroad Meeting

WEDNESDAY AFTERNOON SESSION

October 13, 1937

The session was called to order by W. W. Wood, Baltimore and Ohio Railroad, Baltimore, Md., who presided, introducing the speakers and directing the discussion.

The Past, Present and Future of Railroad Safety

By J. M. SYMES

Vice President, Operations and Maintenance Department, Association of American Railroads, Washington, D. C.

No industry in the world requires more diversified study and more exacting application of safety principles than the steam railroad industry. Picture a quarter of a million miles of railroad line covering in a virtual network the vast expanse of the United States. Over this network are operated a billion train miles annually. Vast yard and terminal operations are necessary to make up the beginning of the journey of passengers and goods, and to break up at the end of that journey the 12 million trains that accumulate that billion miles. These trains carry 500 million passengers and one billion tons of freight annually. It requires more than one million railroad employees to run the trains, make them ready for road movement, supervise and safeguard their movement and maintain the equipment and roadbed, as well as perform the many other duties incidental to the production of railroad transportation.

Safety has in the past, is today, and always will be the first principle in railroad operations. But it is within the past fifteen years that greatest advances have been made in railroad safety. During that period we have seen a complete remodeling and modernization of railroad physical properties. Roadbeds have been strengthened; bridges, trestles and culverts rebuilt; tracks have been laid with heavier rail and with treated ties of greater service life and de-

pendability; grades and curves have been eliminated or reduced; signal systems have been modernized and extended; other safety devices have been installed; new and more powerful locomotives, embracing all modern safety devices, have been purchased; new cars, both freight and passenger, have been installed. This capital improvement program has cost the railroads about eight billion dollars since 1923, and a large part, if not all, of that huge sum had a beneficial effect, directly or indirectly, on the safety of operations.

But the engineer's job is never done. As soon as new equipment, new rail, or other devices are installed the engineers go to work to develop more efficient and safer units. The railroads spend millions of dollars annually in research and laboratory work experimenting with engineering improvements. In all this work safety is of primary importance. An invention which might mean great economies to the railroads would not find its way to a single locomotive or car if its use in any way lessened the opportunity for safe operation. Conversely, any improvement, mechanical or otherwise, promoting safety of operation immediately commends itself to railroad officers and employees. The search for greater safety will continue so long as railroad transportation is used.

About a quarter of a century ago, the

Safety Movement had its inception in this country. From the first, railroads were a part of that movement, and no industry has applied itself with greater zeal or greater sincerity to that splendid humanitarian objective. Out of this movement grew understanding and knowledge of the basic causes of accidents, and it was found that a surprisingly large percentage were due to so-called "human failure," in other words, negligence, carelessness, or heedlessness on the part of individuals.

In the earlier years of the movement, various methods of combating that evil were tried out. Safety posters, bulletins, and other literature, designed to appeal to the emotional side of employees, were widely distributed. Then followed the use of safety rallies, safety talks, safety committees, and finally the appointment of safety officers who devoted their entire time to the matter. As early as 1915 a Steam Railroad Section of the National Safety Council was organized. Here railroad safety workers gathered periodically to exchange ideas among themselves and with representatives of other industries. Here, also, was the beginning of organized study of mutual problems.

By 1921, safety work on the railroads had come to be such an important function of operations that a Safety Section of the American Railway Association, now the Association of American Railroads, was organized. Meanwhile, the Steam Railroad Section of the National Safety Council continued its splendid cooperative work with other industries.

With the creation of the Safety Section, intensive and exhaustive study of the causes of railway accidents was pursued with vigor. At the 1924 annual meeting the Committee on Statistics presented a most comprehensive and thorough report on railway accident statistics. The committee concluded that most injuries to employees were chargeable to the human element and that "by improved training, supervision and discipline," which implied the enforcement of safety rules, a 5 per cent reduction in the casualty rate could be effected each year, which, by the end of 1930, would be equivalent to 35 per cent. By unanimous vote, safety agents pledged themselves to work toward that goal.

The concerted effort on the part of all railroad employees—from the highest to the lowest rank—to reach the safety goal gave a tremendous impetus to safety activities.

When final returns for the year 1930 were compiled, it was found that the original goal had been far surpassed, and instead of a 35 per cent reduction for the seven-year period the actual results were just short of 70 per cent. An equivalent reduction was made in the frequency of passenger casualties, and evidence was at hand to indicate that the increasing toll of grade crossing accidents was at least halted in spite of a steady year by year increase in motor vehicle registrations.

The railroads were not alone in reducing the frequency of accidents during this period. All major industries made similar reductions and it is through the medium of the National Safety Council that the experiences of each industry were made readily available to every other industry for such help as could be developed therefrom. This cooperative spirit has characterized the humanitarian side of the Safety Movement from its very beginning.

Reductions in the frequency of railroad accidents of all kinds continued pretty generally down through the year 1935, although the annual rate of reduction was not as great as during the period 1923 to 1930. This, of course, was to be expected, as the phenomenal reductions of earlier years could not be continued indefinitely.

In 1936, after six lean years of business there was a sharp upturn in volume of both freight and passenger traffic. This was accompanied by a slight increase in the frequency rate of accidents, when measured either by hours of work performed or by volume of business handled. Concern has been expressed in some quarters that this slight upturn in accident frequency rates reflected a general let-down on the part of the railroads in their safety work. This is not the case.

Railroad managements are more alive today to their responsibility in safeguarding passengers and employees than at any time in the history of rail transportation. The Safety Section, backed by 15 years of experience in the scientific study of accident causes and in the intelligent application of remedial measures, is more effective today than at any time in its history.

The sudden upturn in business activity was necessarily accompanied by the return of furloughed men to the service, and by the employment of new men. This tended to increase slightly the frequency of accidents,

but I have sufficient faith in the basic soundness of the carriers' safety organization to vision this slight upturn as of only temporary duration. Preliminary figures for the first six months of 1937 bear this out.

What about the future of railroad safety? We know, of course, that much remains to be done and that much can be done. In the first place, the frequency of casualties on all roads is not the same, and there is an opportunity on some roads to decrease casualty rates. Those roads that are lagging a bit are gradually being brought into line, and as the spread in casualty rates between the leading

roads and the lagging roads is narrowed there is an improvement in the rate for the country as a whole.

We may expect also continuing progress in engineering, with both direct and indirect benefits to operating safety. This applies to the design of locomotives and cars, the installation of safety devices thereon, improvements to rail and roadbed, better tools and machinery in shops, etc. These things are under constant study by the railroads, and the discoveries and refinements of one road are immediately available to all other roads.

The Dollars and Cents Side of Safety

By FITZGERALD HALL

President, Nashville, Chattanooga & St. Louis Railway, Nashville, Tenn.

Let us ascertain, if we can, how much safety is worth in money. Take the case of the railroads—what are the financial results of safety; what is the monetary difference between safety and non-safety?

By safety in railroading I mean those facilities, those practices and those acts which make possible the running of a railroad with the minimum of damage to life and property.

In 1920 unsafe practices, unsafe facilities, and the unsafe or careless acts of men were largely responsible for the American railroads' paying out for injuries to employees, passengers, trespassers, and others, \$56,237,476. These same factors in the same year were largely responsible for the railroads' paying out \$20,887,933 in clearing wrecks; \$10,048,734 for damage to property; \$7,168,579 for damage to livestock; \$120,643,409 for loss of and damage to freight and baggage; or a grand total of \$214,986,131.

Now the honest man makes no profit out of being hurt and compensated therefor; the honest shipper makes no profit out of being paid the exact amount he has been damaged because his property has been lost, damaged or destroyed. In other words, eliminating the racketeers, there is no profit to anyone because of unsafe practices, unsafe facilities, and the unsafe or careless acts of men. To put it another way, the American railroads, in paying out some two hundred and fifteen

millions of dollars in 1920, largely as a result of a lack of safety, created no new wealth, added nothing to national income, produced no taxable wealth. What they did was waste, and waste alone.

Realizing this, they took common counsel. They determined (I am using the year 1920 merely as illustrative) to turn this loss into profit, because money saved is money earned. They adopted "Safety First" as a mode of railroad life. But they did not stop with that mental decision. They knew that it would take years to replace carelessness with safety—they knew that it meant long, painstaking study and labor. So they went to work.

Incessantly they preached and practiced "Safety First." They bought safer machines and tools; they built safer equipment and facilities; they installed safer devices, from goggles to automatic signals; they held safety classes; they analyzed accidents, showing their cause and prevention. They kept this up for a decade and a half. What have been the monetary returns for their expenditures and labors? Let us look at the record again, taking 1936 against 1920.

They reduced payments for personal injuries from \$56,237,476 to \$24,218,508.

They reduced the cost of clearing wrecks from \$20,887,933 to \$2,965,079.

They reduced property damages from \$10,048,734 to \$2,631,735.

They reduced livestock payments from \$7,168,579 to \$1,563,027.

They reduced freight and baggage claim payments from \$120,643,409 to \$21,353,971.

To sum up, whereas the railroads threw away most of two hundred and fifteen millions of dollars in 1920 through carelessness, they so wasted only fifty-three millions in 1936. Safety in one year (1936 compared with 1920) produced for the railroads dividends in the sum of \$162,253,811, at a relatively small monetary cost.

Now it is true that there was some less business in 1936 than in 1920, but it is equally true that there were counter-balancing factors—notably, more automobiles and more grade crossings; and it is a fact that this saving was due, almost entirely, to safety work—and I emphasize the word WORK.

There were other results of this safety drive—financially valuable but not to be asayed with absolute accuracy; i.e., the safety of railroad travel is increasing the passenger revenues of the railroads; safe tools, safe places to work, sensible safety rules, enable men to produce more and better work; safe men, that is, uninjured men, have a higher esprit de corps, a greater loyalty, a greater efficiency.

Employee Training and Its Relation to Accident Prevention on American Railroads

By ISAIAH HALE

Superintendent of Safety, Atchison, Topeka and Santa Fe Railway, Topeka, Kans.

Safety and all it implies, regardless of where the stage may be set, begins, and all but ends, in Education and Training.

Since railroad time began we have all regarded injuries to railroad men as something that had to be and accepted them as a matter of course, through the years nursing the delusion that all injuries are due to accidents. While it is true that in these later years we have come to regard as an "accident" anything and everything that happens

I have not undertaken to point out each place where safety in the railroad field has paid monetary dividends. I have hit only the high spots.

But our work is far from finished. Consider one of the railroad safety problems alone, namely, the existence of some 234,000 grade crossings, over which run more than 28,000,000 automobiles.

Let us return to the council table. The railroads are again taking stock of their safety efforts. Of the many interesting facts disclosed, two bear public notice.

First, safety, as nearly everything else, has its racketeers. Beware of those preaching safety merely to obtain some wholly different end. Take the so-called Train Limit Bill as an example. Arbitrarily limiting the number of cars in freight trains for all railroads, under all conditions, will add nothing to safety, but it will add largely to railroad costs. It is, in point of fact, a political "make work" measure disguised as a safety device.

Second, safety, like liberty, is not static. Both may flower and wither. Eternal vigilance is the price of each. Rules, laws, edicts, even devices, are not enough. Automatic signals, automatic train control, any device, to function safely, must, in the ultimate, depend upon a trained, experienced, and careful man.

unexpectedly, we would be well advised to remember the original definition of the word as "anything due to an unforeseen or unavoidable circumstance."

Asked once how I would define what is commonly called an industrial accident, I said it is something that happened because there was permitted the hazard which eventually caused it. However, on the back of one of the monthly sheets of the National Safety Council calendar for 1938 is a far better defini-

tion. "A-c-c-i-d-e-n-t: A word used to excuse our neglect, to hide our weakness, ease our conscience and cover our failure"—decidedly more forceful, truthful and conclusive than using the word as is now so generally done, as fixing the cause of all industrial injuries.

On basis of either definition, the man who violates a rule and meets with an injury has not, by the widest stretch of one's imagination, met with an "accident." His injury is due solely to the fact that he was not a good enough soldier to obey orders. I am opposed to our present use of the word for the simple reason that if an injured man is permitted to feel his injury was due to an "accident," that he was the unfortunate victim of a combination of circumstances over which he had no control, I do not believe he will take from his experience the lesson he might have taken if he had been made to understand his injury was wholly due to the fact that he had done something not much to his credit.

"Excuse" for Injuries

We can prevent injuries, but neither you nor we can prevent an accident, because if it could be prevented it would not, it could not be an accident—if you get me. In a word, I am opposed to putting into the minds of men an excuse for their injuries when in 95 cases out of 100 there is no excuse for them.

A recent incident with us which may more clearly point to the absurdity of the "accident" alibi, was an injury to a laborer who was pushing a wheelbarrow; his nose itched; habit whispered "scratch it"; he let go of one handle of the wheelbarrow and kept on walking—but not far—and we made out an "accident" report covering the injury which followed. Absurd? Quite so, and about equally absurd is the self-pity in which the workman undoubtedly indulged because of his belief that misfortune had come to him through an "accident."

I hope we may eventually expunge the word accident from our safety vocabularies, and that we will be honest enough to quit kidding ourselves and each other and begin to regard a preponderatingly large proportion of our employee casualties as what they are—man-failures, self-inflicted and inexcusable. Psychology? A whole lot of it; and an intelligently directed campaign along that line will more promptly and surely bring about a re-

duction in our startling toll of casualties than is likely or possible through any other means.

Teaching Must Be Positive

Educators agree that any subject can be more successfully taught from the positive than from the negative side. When we stress "accidents," we stress the negative, so instead of stressing the dire results of so-called "accidents" to a comparatively few, why should not we stress the greater good sure to come to the much greater number through an increased safety in service?

We must never cease to be sympathetic with misfortune, but if we would make it plain to the men who incur them that their injuries were self-inflicted, I wonder if it is not possible that some of them might come to look upon injuries more as a mark of shame than as the glorified misfortune some now regard them, and might not then more successfully guard against them.

Supervision to Blame

I am not prepared to believe that many, if any, of our injuries are due to an irregularity being indulged in for the first time. I believe they are the cumulative result of long continued slipshod working habits, and made possible only by lax, or lack of, intelligent and efficient supervision.

It is a pity that too many supervisors today think they are too busy to give their men the personal attention which a systematic course of training must have. I ask our foreman, you might ask yours, if it is not quite possible that some of the things they are doing, which they regard as highly important, may not actually be of less importance than some of the things they are leaving undone.

A lot of foremen are functioning today exactly as did the foremen under whom they served their time twenty or twenty-five years ago, and are doing things in a certain way only because they have always done them that way. Anything that is being done today just as it was even five years ago needs an investigation.

Foremen Must Be Trained

As a prelude to any educational safety program we must recognize certain funda-

mental essentials: First, definitely satisfy yourself that your foremen are qualified to function as teachers. About the biggest fallacy in Safety work today is the thought that heads of departments and foremen do not need training but that all other employees do.

Second, no man can be taught *anything* unless he wants to learn it. The creation of desire in the minds of men is the toughest problem you will encounter.

The Big Stick should have no place in our Safety programs. Through kindness, through painstaking teaching and training, we must continue an honest effort to get workmen *wholeheartedly* to add their efforts to ours rather than do it *half-heartedly* through fear of discipline or discharge. One of our problems, which must be taken increasingly more seriously, is that of making men Safety-minded, *not* punishment-minded, because avoidance of an injury would automatically remove the need of punishment, either by man or Nature.

Visualize Results

Part of the training of men must be the effort to get them to see the picture too often found in the wake of the more serious injuries. I am a frequent visitor at our hospitals and see so many instances in which, while the men themselves are getting the best of care, well prepared food and such comforts as come with modern conveniences, their families, often left without a thin dime, show, and actually confess, not only their urgent need on their actual want.

Also, we must not hesitate to point out to supervisors the need of their education of self. A large proportion of supervisors have that prevalent human ability to look square at a thing and not see it, and remain unaware of regularities until something happens, and then, by raising a great hubbub, attempt to lay down a smoke-screen to distract attention from their failure to have noticed the regularity and correct it. The wise foreman regularly and often looks out over his department or gang and asks himself: "What is going on out there which I do not see?" That *is* something I can promise him.

Foremen are seldom or never eye-witnesses to an injury, their unfailing alibi being, "I was at the other end of the section," and in

any event "It is not possible for me to watch every man every minute."

For 25 years I have freely conceded that impossibility and never lost an opportunity to point out the absurdity of a foreman's lack of confidence in a workman's honesty and loyalty to think he *must* be watched. When a foreman tells me that much of his time is spent as a watchman, my sympathies immediately go out to his men, because I know they have never had any leadership worthy of the name.

If we will hire the right man and start him right by putting him at work for which he is physically and temperamentally fitted, and *keep him right*, we will be surprised to find what a short time he will have to be watched.

Lesson Needs Repeating

The average man is about as decent as heart as you or I; he is not indifferent to the value of human life, he does not know what *has* been done in the prevention of injuries, nor does he realize the need and the potential value of his interest and cooperation in what must still be done; and he does not know all this because he has never been told—and retold. Some foremen nurse the perfectly absurd idea that if they tell a workman a thing once, he ought to understand them and remember it forever after.

To emphasize I quote from the booklet "The Human Side of Safety in Foremanship," published by the National Safety Council:

"Intelligence is the ability to grasp, understand and use an idea. The person of less intelligence naturally must take more time to learn even the simpler things. Those people who are authorities on teaching and learning point out that the less intelligent people must be *trained* rather than *taught*. In Safety work, therefore, if you are dealing with a man who is not as smart as he should be, you must *show* him. He will remember the things he sees better than the things he hears. You must not only tell him and show him the danger spots, but you must do it painstakingly because what may seem to you an unnecessarily slow tempo may be too quick for his mind. One foreman, asked how often he repeated his Safety lessons to individual men, said: 'Just as often as I can figure out a new way of explaining and demonstrating the same old idea of keeping your eyes open and using your head.'"

THURSDAY AFTERNOON SESSION

October 14, 1937

Safety. An Executive Operating Problem

By R. C. WHITE

Assistant General Manager, Missouri Pacific R. R., St. Louis, Mo.

Safety is an obligation of management. Without the constructive leadership and day-to-day urge from the executive and operating heads, the movement would lapse into a perfunctory activity.

The safety movement is recognized by executive and operating officers as a medium for building up and maintaining that relationship, that fellowship, which broadens our views, enriches character, and brings the Golden Rule into practical application.

Management recognizes that our economic system must enable men to live on an increasingly high plane. It must enable them to fulfill their desires and satisfy their reasonable wants, and give them that feeling of security which is essential to happiness and efficiency.

Having made the decision that safety is an executive problem and responsibility—that accidents must stop—it is then essential that management promulgate, and follow through, a plan that will definitely fix this decision in the minds of all the individuals who collectively comprise the industry. The follow through must be such that department heads, superintendents, and every member of the supervisory force will appreciate the need for a constant, active interest in safety; will understand that passive interest will no more produce results than would the same interest in production. Supervisors must be made to feel that the prevention of accidents demands the same type of heads-up supervision that is given to the other problems affecting cost and service.

The executive must find a way to indicate directly that it is the responsibility of the department heads to carry out management's program, that authority is placed in each superintendent's hands to put accident prevention on the same basis as production.

A complete factual and descriptive report of each accident must be made. This must be

followed by a thorough analysis to find the direct and underlying causes and the procedure necessary to prevent a recurrence.

Proof of its sincerity will depend primarily on whether management will make the first essential move in the program—that is, authorize the expenditure of money necessary to make the maintenance and operating plant a safe place to work.

Safety and Efficiency

Analysis of the underlying causes of industrial accidents and preventive measures to be applied has made it increasingly apparent that those factors which are producing accidents are very largely the same factors which tend to lower the quantity and quality of production. Expressed in another way, safety and efficiency are as inseparable as though one word.

In coupling safety with efficiency I have not minimized it as an executive problem, but have endeavored to indicate that its solution is an executive responsibility, both to his individual industry and to the employees that make it a going concern.

Rail transportation is a scientific business in which laboratory research, expert engineering, trained builders, and skilled workers share a part.

One of the main factors is a group of employees who are loyal—who appreciate that their railroad must give the kind of service that will stimulate and accelerate the development of the territory traversed.

The successful solution of our problem demands the type of aggressive individualism in executive leadership that will attract and command loyal, collective, cooperative effort on the part of all who produce rail transportation.

Our major concern is leadership—leader-

ship that stands out four square when evaluated by some such specifications as these:

1. Basing employee relations upon realistic recognition of what man wants for his work.
2. Planning work so that in doing a routine task there may be some sense of achievement.
3. Making use of the implements that science and invention have developed, so that the man, through his work, may have the benefit.
4. Recognition of dominant needs.
5. Recognition that there is no more inspirational craving than a desire to know "why."

6. Recognition that there is no more fundamental craving than a desire for promotion.

7. Recognition that the basic urge is to feel that progress is being made.

8. Recognition that the foundation of all social ethics is consideration of the other person.

9. Recognition that constructive activity in prevention, rather than compromising or settling difficulties, is the essence of promoting understanding—building morale.

10. Recognition that the essence of leadership is promoting, inspiring, stimulating morale in those who are being led.

Stream-Lining for Safety

By C. E. JOHNSTON

President, Kansas City Southern Railway Co., Kansas City, Mo.

Both the streamlined vehicle and the streamlined safety program have at least one very important common purpose. That purpose is the Reduction or Elimination of Resistance and Friction.

During my experience in the railroad field, as a civil engineer and as an engineering, operating and executive officer, I have had frequent contact with safety problems. I remember the first organized campaign to coordinate and intensify accident prevention work on the railroads. Those pioneer efforts were largely directed at the outstanding physical hazards and unsafe practices then so common to railroad construction, maintenance and operation. They were, however, the necessary first steps toward a definite goal—the elimination of personal injuries—and they directed attention to the fact that there was a serious situation to be remedied, which deserved the careful consideration of everyone connected with the industry.

That was the genesis of the streamline idea in safety, for if the problem was one requiring co-operative effort, it involved the co-ordination of all of the varying human elements wherein resistance and friction tend to play so great a part if left without enlightened leadership and painstaking guidance. Thus the need for streamlining in safety work was recognized many years ago, and the process of overcoming the many forms of resistance

which have appeared to obstruct and retard the movement has been going on ever since.

In "talking shop" today with safety engineers, safety supervisors, or safety men of whatever designation, I venture you will find them of one mind in the opinion that what is needed most to more successfully promote this cause is greater co-operation and less resistance on the part of their superior officers as well as other officers and employees with whom they have to deal. In other words, the streamline idea is there all right, but the practical application of the idea involves the accomplishment of more than yet has been attained.

If I can offer any suggestions that might aid in overcoming the inertia or friction that tends to minimize the results of your efforts, the time spent may be productive of some progress toward the streamlined stage of safety. With that in mind, I shall first direct my remarks to the safety representatives themselves.

As Item One, I recommend that so far as practicable, you have a first hand knowledge of the physical property with which you are connected. Where unsafe conditions are reported to you, look them over yourself, if at all possible, or at least have them thoroughly explained to you. On a large property this cannot be done by one man, but a safety representative can save himself difficulty if he will

acquaint himself fully with the particular situation to be remedied and is in a position to offer definite and practicable means for correcting it. He will find that his associates are for the most part just as anxious to correct an unsafe condition or situation as he is. I am not suggesting that departmental officers should wait for safety officers to bring unsafe conditions to their attention before correcting them if they themselves are aware of their existence. There is no better way to educate a fellow officer or employee along the lines of safety than to direct attention to unsafe conditions or practices, explain the nature of the hazard and how it can be corrected.

Second: I recommend that you refrain from advocating a specific safety rule to cover any except the most outstanding hazards. This recommendation may be at variance with the views of many gentlemen. I am strongly of the opinion, however, that strict observance of relatively few vital rules brings about much better results than a continual enlargement of the rule book in the futile effort to cover every conceivable accident hazard. Furthermore, a multitude of rules is confusing to the average mind, and causes discouragement to the officer who tries to enforce them and to the employee who wants to observe them.

Third: I recommend avoiding generalities so far as practicable in spreading the gospel of safety. The old law—"have something to say; say it; stop talking"—is quite applicable to work of this nature. The safety officer commands more attention and respect when he directs his written and spoken remarks toward a definite subject applicable particularly to the person or persons addressed.

Fourth: Have before you at all times a "docket," "budget," or outline of important uncorrected safety hazards which should be given attention, arranged according to the degree of need. Assuming that most of them cost considerable money, you should be in a position at a moment's notice to offer your recommendation as to which should be taken care of first, and such an outline should be presented from time to time to your superior officer so that he may be in possession of your ideas when the opportunity comes to take care of some of them. In this I am assuming that the question of securing authority for expenditures on your property depends somewhat upon the funds available. If no such condition exists with you, it can be said that you are truly fortunate.

Fifth: Inform your immediate superior currently of your activities and your problems. Be persistent but not insistent. Remember, also, to be consistent. Naturally you will avoid burdening him with petty matters that are of little importance, but keep after him concerning features of the work in which his help is needful. The fact that your company employs you as a safety representative is evidence that the management considers there is a need for this service. Let them know what you are accomplishing and what you are failing to accomplish, and why.

Sixth: The safety officer must bear down on the importance of safety supervision on the part of officers and foremen. This is one of your most pressing problems. Never overlook a suitable opportunity to impress an officer or supervisor with his responsibility for accident prevention in his department. This may require an unusual degree of tact and diplomacy in some cases. It is so well understood in others that there is little need for a safety representative to stress the point.

Last, but not least, seek a way in which to have a voice in the selection of men entering the service. If possible, secure the power of veto in this respect. It is widely recognized that a sound body is necessary in the applicant, but that this is not sufficient. He ought also to have an acceptable family background, a reasonably good education, an alert and interested attitude, and an aptitude for the work in which he is to engage. Emphasis on this point applies, of course, to ranks above that of ordinary labor.

Visualize, if you will, a property manned entirely by individuals thus carefully selected. The lot of the safety representative would be immeasurably more pleasant and his activities more fruitful. Every other officer and supervisor would be similarly benefited. In this day and age it seems to me there is no adequate reason for promiscuous hiring. In fact there is no excuse for it. I should think it not an impossible job on the part of you safety representatives to sell the idea to the management of your property.

I am not unmindful of the fact that "safety" percolates down from the top. Sometimes, though, I think that a little heat applied somewhere down in the organization tends to help the percolating process. Certainly, if the safety man is content to assume an attitude of lukewarmness, he can't expect much support from the executives. You will recall there is also

a saying that "the squeaky wheel gets the grease"—and a squeak now and then from the safety organization will sooner or later attract attention.

You may harbor the opinion that the safety cause is bringing up the rear in importance so far as the organization of your particular property is concerned. One of the most important features of streamlining is the reduction of the vacuum suction at the rear of the moving object. If you want to be of real assistance in aiding your company to progress, your own efforts must be designed in such manner as to reduce the backward pull, and you will find that you are accomplishing just as much toward the successful operation of the enterprise as the fellow up ahead.

There are many railroad operating officials who have a sincere desire to aid in the cause of safety. May I say to them: It is freely recognized that you have many other important duties to attend to in the course of each day's work, and that there is a real temptation to consider prevention (other than collisions or derailments) as a side issue or as a matter to be left largely if not entirely to the activities of the safety organization. That is a natural outcome of failure to accord accident prevention its rightful place in economical operation.

For some reason there has seemed to be a general tendency to overlook or disregard the actual out-of-pocket loss to the company that is involved in even a minor injury. Get out your pencil some day and figure out every conceivable loss to the company, including loss of time of the injured employee and of his foreman and associates, disorganization of the work, compensation for no service, and so on, and see for yourself what it amounts to. Also, add in the value of your own time which you spend in looking over the situation involved in the particular accident, which you might have spent with more profit to yourself and your company.

Some of you gentlemen are familiar with the game of golf. You know what I mean when I speak of a mental hazard. Do you ever check up to see how many mental hazards you are harboring on your property in the form of sub-standard working conditions? You know what a mental hazard does to a golfer's game in many instances. Does it sound unreasonable that these imperfect working conditions have a very similar effect upon the character of service performed by your

employees who have these things to contend with?

The conditions I refer to need not necessarily be physical conditions. A misfit or unfit foreman or supervisor is responsible for many mental hazards having a direct bearing on safety. If you have ever worked under or around such a man, you know what I mean. It is the business of the operating officer to educate his assistants and subordinate supervisors in the art of directing the services of the men in the ranks so that the workmen will not have the distraction of an incompetent foreman to contend with.

Surely there is nowhere today an operating officer who looks upon the safety representative as a "necessary evil." Such a view implies a grave mistake, even if the safety representative does not handle his job in the way you think he should. Remember, his job is accident prevention, and if he is persistent in his efforts, he is at least attending to business.

If you believe his efforts are being misdirected in any particular instance, tell him so, but it must be borne in mind that he is merely trying to discharge the responsibility for which he is employed, and that the success of the cause he represents affects materially the question of economical operation. In some cases he may have thought it out a bit further than you have and might convince you that he is on the right track. Let us give him credit for sincerity, and, if we feel we have a better solution of the problem at hand, let him have it. The experienced safety man will certainly appreciate practical suggestions from practical operating men.

It is my impression that inertia on the part of some operating officers toward safety ideas is the greatest single obstacle in the pathway of a safety man's happiness. A classic form of torture for a safety representative would be—listen to all he has to say, read all he has to write, and do nothing about it.

As officers of the operating department, you wouldn't stand for that from one of your subordinates and I certainly do not assume there is an officer present who would intentionally do that, nor permit a subordinate officer to handle his affairs pertaining to accident prevention in this manner. Your safety representative should be able to give you a slant on this feature, and be glad of the opportunity to do so, in the event you have not checked on it recently.

In general, I would say to operating officers

—avail yourselves of the expert knowledge of your safety men. Give them suitable opportunity to talk to you, and if they don't come in occasionally, send for them. Let them know that you consider their job a worthy one. If they, themselves, are inactive, give them something to do—ask them to solve some safety problem that is confronting you. Above all, lend them your active co-operation in every possible way.

And now, to foremen I would say: You have heard what I have had to suggest to the safety representatives and to the operating officers. All that I have said to them has been in your own personal interest, for after all, you are the folks who suffer most of the injuries. Streamlined safety means more to you than to anyone else. And you, as individuals and through your safety Committees, are in position, through definite, wholehearted co-operation, to reduce materially the resistance and friction that may arise in the carrying out of a safety program.

You may think, sometimes, that the safety activities on your property are conducted in a spirit of criticism. Let us all bear in mind that constructive criticism is required in order to bring about successful accomplishment in any direction. Do not look upon the suggestions that are made to you as evidence of personal dislike or a lack of sympathy with your difficulties. If you were walking in a field with a friend who warned of a rattlesnake about to strike at you, no thought of personal unfriendliness would arise in your mind. Every safety rule and safety suggestion is intended as a friendly warning, which, if not observed, may result in bodily harm to yourself or a fellow employee. Alertness on

your part and a willingness to give and receive assistance in the cause of accident prevention are necessary and important contributions to a successful safety performance.

I mentioned, before, that safety must percolate down from the top. The executive, of course, realizes that this remark is pointed in his direction. To me, it hints of discouragement on the part of someone, and that someone is the safety representative. If we hear that remark repeated in connection with our own property, it may mean that our safety organization feels it is not getting proper support from above.

Suppose we decide to call in our safety men and ask them whether or not the well-known percolator is working. We ought to know without asking, but let's ask anyhow. We might get some constructive criticism we are not expecting, if our safety men are on the job and speak out plainly. The simple act of discussing the plans and progress and problems of safety occasionally with the heads of our safety work has a tendency to bolster up their morale. Inertia on our part is just as desirable, if not more so, than anywhere else in the entire organization.

May I also suggest that our long-run safety performance will respond favorably to greater attention in selecting and training men when they first enter the service. In this respect I feel there has been considerable laxity as a general proposition. I can think of no good reason whatever for not giving qualified safety men the right to veto the acceptance of an applicant after satisfying themselves that he is unfitted from a safety standpoint for the work in which he would engage.

Adequate Accident Investigation and the Need for Suitable Discipline Before the Accident Occurs

By P. F. BUCKLE

Superintendent of Safety, Burlington Lines, Chicago

Most accidents result from a combination of circumstances. Therefore, it is important that when making inquiry into causes of accidents, all of the circumstances be searched out and followed to the point where they came together finally and set the stage for the accident. We should have on record for each

case every single bit of information it is possible to obtain.

The greatest single cause of accidents and injuries, as we all know, is the human element, and the greatest weakness likely to creep into an accident investigation is that same element.

The human element has been and will con-

time to be the predominating factor in our safety problem. Therefore, it is my belief that our failure to properly reach all of our railroad employees with our safety message is one of the reasons why, following a number of years of steady decline in personal injuries, we have remained more or less static during the past three or four years. Some gaps remain to be filled between the top and the bottom; some gaps lacking in enthusiastic belief that Safety should come First. For that reason, we may find it continually more difficult to show progress in accident prevention than we have in the past, notwithstanding the fact that our records indicate, following careful investigation of each case, that more than 90 per cent of the personal injuries now occurring are preventable. Please do not misunderstand me. I am not attempting to justify my failure or the failure of other railroad safety officers to show greater progress. I most certainly do not believe it was necessary for 669 railroad employees to lose their lives, nor for 21,871 others to suffer injuries that resulted in incapacitation of more than 72 hours in one year of railroad operation, and that was the experience of the American railroads in 1936.

Admitting that greater difficulties are confronting us in our efforts to check the waste of man power resulting from accidents, it is up to us to put forth the additional effort necessary to improve this condition. We must be courageous in pursuing our tasks, making no attempt to conceal the facts but resolutely facing them, and putting in motion proper corrective measures.

First of all, the safety officer should be a good influence in building and maintaining a proper morale among the personnel of his organization. With a proper morale anything worthwhile can be accomplished, but without that spirit it will be found extremely difficult to promote anything of benefit to the organization.

It may be somewhat difficult for an officer to maintain an open mind while making an accident investigation. He is but human and it is quite natural that he should have to battle with himself to avoid:

1. Forming a conclusion in advance as to the cause—then attempting to shape the inquiry to develop the cause to fit his conclusion.
2. Omitting some essential fact in reaching the truth of the cause which if included in the record might cast some reflection upon

him or his superior, or some particular employee group.

3. Becoming biased.

A biased record of an accident or personal injury, or one which omits some essential detail for any reason makes that record valueless insofar as accurately reporting the experience and, therefore, cannot be used as a basis for the prevention of similar accidents or injuries.

Those who review accident investigation reports can be helpful in improving the quality of the investigation if they will call to the attention of the investigator the omission of essential facts—failure to develop all of the evidence concerning each circumstance that contributed to the accident, and where the investigator may have permitted himself to become biased.

If we are correct in the premise that 90 per cent of all injuries can be prevented, then is it not reasonable to speculate that perhaps 90 per cent of our railroad officers and employees are safety minded, and 10 per cent of them are not? I believe that we should seek to discover that 10 per cent and stop the gap altogether.

In order to do this, perhaps we should place greater stress upon self-discipline, and at the same time administer punitive discipline judiciously.

Discipline occurs in two principal forms. We discipline ourselves through practicing restraint, by ordering our existence and training ourselves to do or not to do certain things because we feel them to be good or not good for us. Then, in turn, we are disciplined because of the commission of some overt act or for our failure to perform some duty.

If we are to be successful in making further reductions in personal casualties, suitable action should be taken in every case of rule infraction or violation, regardless of the results of such infraction. In other words, we should be just as conscientious in investigating and taking proper corrective measures when those incidents occur *without* serious results as we would if disaster attended the event. Discipline administered for the results of a casualty and not for the cause has doubtful value as a corrective measure.

When the casualty does occur, usually the person responsible has suffered enough if he will but admit his responsibility, although sometimes it really seems necessary to administer discipline to bring home to the offender

the proper realization of his offense. How infrequently we hear a person who has been involved in an automobile accident admit any responsibility for the cause. Usually when two cars get together, each driver immediately attempts to absolve himself of blame and seeks to fix it upon the other.

Minor rule infractions that occur without serious results cannot be passed by lightly for such a policy will only lead to a contempt for the rules. Then, too, it is important suitable record be had of these occurrences if we are to guide the person in whose safety we are interested.

Train-service employees are given surprise tests on operating rules that their alertness may be determined. Similar tests might be made among all classes of employees to determine their knowledge of the Safety Rules.

Every member of the organization should be just as alert to detect, correct or report improper practices as he would unsafe conditions. This is self-discipline. The super-

visor, particularly, has a responsibility in this, but his responsibility does not rest alone in the matter of detecting rule violations. He must set a good example for his men and show continued interest in their welfare by teaching them, admonishing them when necessary, but never failing to praise them for worthwhile accomplishments. When it is found necessary to administer discipline following a casualty, it should be administered fairly to all who may be involved, regardless of position, and not for the result but for the cause. A policy should be developed by which it is understood that it is not so much a question of severity but of the certainty that discipline will be administered.

Those of us to whom is assigned specifically the responsibility for directing the safety work in our respective organizations must be inspired in our desire to do the job and do it well. We should have the ability to inspire others, and certainly we must have unlimited enthusiasm in our belief that we can reach our objective.

ADJOURNMENT

Textile Section

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Vice-Chairman (In Charge of Program)—E. A. ROBERTS, American Mutual Liability Insurance Co., Atlanta, Ga.

Vice-Chairman in Charge of Membership—WALLACE GILL, JR., Collins and Aikman Corp., Philadelphia, Pa.

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R. J. JENNINGS, Lanett Cotton Mills, West Point, Ga.

A. S. JOHNSON, American Mutual Liability Insurance Co., Boston, Mass.

R. J. DE LAMETER, Bigelow Sanford Carpet Co., Inc., Amsterdam, N. Y.

CARL E. LINDEMAYER, Forstmann Woolen Co., Passaic, N. J.

A. F. MCGARR, Simmons Co., San Francisco, Calif.

FORREST H. SHUFORD, North Carolina Department of Labor, Raleigh, N. C.

Officers Elected for 1937-38

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Vice-Chairman in Charge of Membership—W. R. MCCALLUM, South Carolina Industrial Commission, Columbia, S. C.

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CHARLES H. EAMES, Lowell Textile Institute, Lowell, Mass.

M. W. HEISS, Proximity Manufacturing Co., Greensboro, N. C.

FRANK E. MORRIS, Liberty Mutual Insurance Co., Boston, Mass.

MONDAY AFTERNOON SESSION

October 11, 1937

The session was called to order by General Chairman T. A. Wilson, North Carolina Industrial Commission, Raleigh, N. C., who introduced the speakers.

A round table discussion on first aid training and foreman responsibilities took place at the Tuesday afternoon session of the section.

Threads of Safety

By O. S. HARVILLE

Adams-Millis Corporation, High Point, N. C.

Safety programs must continuously reorient themselves to the new and everchanging industrial environment.

In our many experiences since the inception of our safety program we find that our most profitable experience has been in training each employee, getting them to understand and recognize what we are trying to do. However there is still much to be done along this line.

We have posted in each department our 10 safety rules or commandments as follows:

1. Be careful of yourself and your neighbor.
2. Do not clean machines while they are in motion.
3. Do not throw bottles, nails, or trash on the floor.
4. Watch out for moving trucks.
5. Pile all cases and goods so there will be no danger of their falling.
6. Paint all scratches and cuts with mercurochrome immediately.
7. No horse play.
8. Operators of machines should always give attention to work—not put hands on or near machines while attention is in other places.
9. Report to foreman any unsafe practices.
10. Report all accidents (large or small) to foreman immediately.

We also take advantage of posting all safety bulletins. Our weekly and monthly inspections are made and records kept and filed. Our plan is, as we go along, to use different employees from time to time on

these inspections, hoping always to keep the thought of safety work in their minds.

Posting in each department a placard stating just how long it has been without an accident is a good plan. These have served to stimulate interest and friendly rivalry between departments.

Recently we established our best safety record. An average of 450 employees worked a few days over one year without a disabling injury—approximately 670,000 man hours. What was directly responsible for this record? We explained to all our employees just what we were trying to do. We tried to keep their interest and enthusiasm aroused at all times.

After this record, of which we are very proud, we posted notices in every department, telling our folks that we recognized their interest and efforts and that we appreciated them.

We find, however, that there is still much safety work to be done. In my opinion one or two employees of each department, alternating from time to time, should attend our safety meetings. I also think a five minute safety talk occasionally in each department would do a lot of good.

Accident prevention is a most important part of the duties of management, and when accidents occur, management should accept the responsibility.

Under one of the Russian czars there were numerous revolutions in the provinces. The customary way to quell a revolution was to send the imperial army out to shoot up a lot

of the peasants. One of the czars issued a proclamation that when the next revolution occurred in a province he was going to shoot the governor. There wasn't a revolution for many years.

This story illustrates my point—that management can have, in respect to safety, just the kind of a plant it wants, but that it must want this particular kind of plant and must do something about it.

At all times we must have a trained supervisory force. We must grow safety supervisors by giving them responsibility and thus indicating our trust in them.

Those industries which operate most efficiently are the ones which are doing most along the lines of accident prevention. I think it is not going too far to say that a high accident record is evidence of inefficiency; and good management is now taking this point of view. When this attitude prevails, safety work in the plant is generally found as well organized as any other phase of the company's business.

In the safety organization of any plant certain persons must be assigned certain duties and responsibilities. The organization must be headed by a safety supervisor or

someone with a similar title. Selection of such a man is just as important as the selection of the proper individual for any other important post in the plant organization. Too many times in the past when safety departments were organized, the men picked to head them have been chosen because they were of no use in any other department. Failure resulted just as it would result if the wrong man were selected for any other position.

Everybody on the job must be made to realize that safety is possible only when every man makes an honest and sincere effort to be careful; to use safety appliances; to report or correct hazards where noticed; to get first aid immediately even for the slightest scratch in order to avoid infection.

And we must ask ourselves every day—are we intelligent, efficient safety supervisors? We must make every worker so conscious of safety that he is always asking himself, "Am I a safe worker?"

Safety is a habit. We must get it.

Threads of Safety! Woven into the program of any safety organization in any plant must be cooperation between management, the supervisory forces and the workers on the job.

Following the Plant Electrician

By R. B. WICKHAM

Superintendent, West Point Power Company, West Point, Ga.

Many men, employed today as plant electricians, were originally part of the mechanical department of plants having steam engines or water wheels as the prime source of power. These units were connected with the different floors and departments with rope or belt drives and then long lengths of large line shafts extending the full lengths of the plant building.

The changes that have taken place in the short time since that period have been remarkable and it has been a real problem for the plant handy man to keep pace with them.

The electrification of the textile plant began about the time of the World War.

Progressive executives soon recognized the advantages of electric drive and with the rapid strides made by the electrical industry in developing equipment suitable for textile

plant application there were many improvements in practically all plants until the depression years.

Then mill officials were faced with unusual and discouraging conditions. Hours of work were being regulated, wages standardized, competition developed to a high degree and cost of manufacture increased in many other ways. His problem was to increase production per worker and per square foot of plant space. High speed machines were introduced with individual drive, and present day conditions mean that these units operate continually and efficiently every hour the attendant is on the job. Electrical control of machines to stop them whenever trouble or defects occurred were developed and applied.

Today we find nearly every machine in a

textile plant with some sort of electrical connection or attachment. Each unit must be thoroughly grounded to help protect the operator.

Instead of the few large motors and controls driving textile machinery we now have plants with thousands of motors with all the necessary large feeder and branch feeder circuits.

The lighting requirements have multiplied many times, and where in the weave room we were satisfied with 3 or 4 foot candles we now expect 15 to 20. With the increase in hours of operation, in some cases three shifts being used, seeing conditions at night must compare favorably with conditions during daylight hours. Light that is necessary to see for efficient production is also of prime importance to safety.

Our organization uses approximately 65 million K. W. Hours annually as compared with 45 million in 1932. The demand has increased from 11,000 KVA to approximately 14,500 KVA.

The changing conditions also apply to the maintenance man. One type of maintenance man considered that his job is to keep things running, to make necessary repairs with the least interruption to production. He usually is hard working, diligent and capable of getting a machine back into production with a minimum of lost time. We call him the Temporary Permanent Man, and he will tell you that he intends to clear out the temporary repair work and do a permanent job the coming week end. Something nearly always causes the postponement and consequently the temporary work becomes permanent construction. It remains a hazard both to the maintenance crew and to other operatives. His argument is—"I keep up the production." And sometimes the plant executive is not familiar enough with good electrical construction to realize the chances which are taken.

The other type of plant electrician over a period of a year has less loss of production charged against his department even though he sometimes does have a unit idle for a few minutes longer than when handled by the other fellow. He considers that he is responsible for the protection of those who are not electrical men but who may operate machines or possibly otherwise become involved in case of a ground or exposed current-carrying part.

He appreciates the importance of continu-

ous operation of the productive unit—as it reflects in the plants costs and in many instances directly affects the pay of the operator. Also he knows his job is ever changing—new equipment is being designed by the manufacturer, and he keeps himself posted on these developments and is continually on the alert for apparatus which when properly applied, will improve the loss time problem. He thinks of the plant power factor and load factor. He knows that conductor losses or poor contacts cost his employer approximately \$40 for each K. W. increase in demand per year. He anticipates changes in machinery location and visualizes the necessary changes in circuit sizes and location and thus, by thoughtful planning, eliminates the necessity of the temporary work resorted to by the other group.

The plant electrician is responsible for the operation and maintenance of all electrical equipment necessary to run of the plant. He must be capable of handling any of the usual problems arising from the construction of a power circuit, lighting circuit, wiring of motors and controls and also the electric control equipment of the various productive machines.

He must see about cleaning the lint and dust accumulation from all motors, checking bearings and oil. He must know the proper relay heater element necessary for motor protection under peak operating conditions. He has blown fuse elements to replace with the proper amperage. He must recognize the unusual conditions which sometimes cause fuse troubles, such as poor contact or corrosion. He has feeder circuits to maintain—they may be cleated to ceilings of rooms and be 14 or 16 feet from the floor, and over machines, or in basements, or under floors; frequently they are near or over line shafting or water pipes, in damp places, boiler rooms, pumping stations, elevator towers.

The employer should recognize the importance of the electrical system of his plant, how it ties into practically every operation and is a part of nearly every machine, and is within the reach of almost every employee.

We use only approved electrical equipment, and we take every precaution to protect the workman from being exposed to any hazards that we can anticipate. However, engineering will not eliminate all accidents; there is still room for improvement.

We have recently put into practice a training class preparing young fellows to become plant maintenance men. We have given considerable thought to the outline of a practical course of instruction which will improve both their knowledge and their workmanship. They are being taught the necessary fundamentals and such theory as will enable them to figure conductor sizes, circuit loading, insulation values and necessity of proper spacing. We stress the importance of grounding of all dead metal machinery or any apparatus that may be responsible for the shocking of an employee. Many do not know when apparatus is properly tied in with a dependable ground.

We are also improving their knowledge of good construction methods, and we have as an instructor an exceptionally capable workman giving them practical ideas in the use of conduits, wiring methods, cleaning contacts, use of solder, and in fact all angles of actual construction work by using the materials actually used on the job.

We believe the proper training and selection of plant electricians will reduce accidents not only by the elimination of electrical hazards and the reduction of service calls for equipment in trouble but by the personal influence of the electrician. He is one man in a textile plant who visits every department, and often he knows every other employee by name and is looked upon as a fellow workman with privileges of contact sometimes not enjoyed by overseers or safety men. He often can do much good in developing safety thinking among employees. It is our experience that a plant with a good safety record reflects the desire of the mass of the employees to do their work in a manner which will protect themselves and others who might be affected.

Another feature we consider important is plant lighting. It pays dividends in accident prevention and employee good will.

In planning new lighting layouts in our plant, much thought was given the problem of servicing—location in an accessible spot. Circuit layout and protective devices were planned so that the service man would have little occasion to work on a ladder or in difficult or uncomfortable places. Protective devices were located that they could be serviced from the floor. This practice also helped eliminate the temptation to tamper with the adjustment of the elements. Since poorly installed lighting fixtures may drop

on the heads of those beneath, we used adequate anchorage and supporting means. We are working out a scheme to eliminate the use of ladders or stages in changing lamp bulbs and cleaning reflectors.

In power circuit layouts we follow the same practice, and we now know that much can be done for safety by the proper planning of the electrical systems in the location of any apparatus that may at some time have to be serviced. If the service man can get to the part involved easily and comfortably the employer will get a better job done, less time lost, and fewer chances for accidents. Charge the increased cost against these benefits.

We have a specially trained engineer who is required to make regular inspections of electrical equipment. He is primarily interested in the grounding of all machinery and the condition of insulation. Also he finds many troubles in the process of development, and thereby reduces the number of service calls by the maintenance man. The resulting saving in production pays his way.

I would like to comment on one of our chief trouble makers. With the increasing application of electrical apparatus mounted or supported on operating machines we believe the manufacturers of wiring devices should develop a more suitable protective conduit and fittings for the conductors than the present metallic conduit. We have too much trouble preventing the cutting of insulation by the raw edges of the metal after vibration has caused the conduit to work loose from the clamps. Sometimes the clamp does not securely fasten the conduit, because it is springy and will not hold its shape. A good workman has a lot to do with the manner in which the installation is made, but a better device would eliminate to a large extent this source of many grounds and open circuits.

Also, an employer with a liberal fund for the purchase of useful testing equipment is making a good investment.

Insist upon the use of proper tools. See that they are always in good condition.

The demand of continuous operation gives little time for servicing of motors or circuits. From the production standpoint as well as that of safety—train your men to not do temporary work, but to anticipate troubles and make frequent checks. Develop the thought that it is easier and cheaper to prevent than to repair or correct.

Safety in the Needle Trade

By LILLIE W. LINSTROTH

Weil-Kalter Manufacturing Company, St. Louis, Mo.

When safety in the needle trade is mentioned, many individuals and some managements immediately think of the hazards connected with the operation of sewing machines. This should not be the case, for if we stop to analyze the industry we find it is made up of three parts, namely: cutting, sewing, and finishing.

Since cutting is the first operation in the trade, let us consider some of the specific hazards found in this department.

1. The cutting machine, of which there are two types, (a) the rotary knife and (b) the straight knife.
2. Table tops.
3. Paper cuts.
4. Handling Materials.
5. Housekeeping.

It has been said that the rotary knife should not be much of a problem because the circular blade is protected by a cup-shaped guard, and if the operator is instructed to work with the guard down, most of the hazard is eliminated. This is true as long as the knife is in the lay, but if it becomes necessary to pull the machine back because of jamming, or to change the position of the knife, the guard remains in the same position, since it was adjusted for the height of the lay. We have been working on a suggestion from one of our cutters, and that is, to put a spring on the guard that will automatically adjust itself to the thickness of the lay.

As far as the straight knife is concerned, if the guard is properly used, then we feel that the hazard is reduced as much as possible from a mechanical stand-point.

Worn and splintery table tops are not only a hazard to the worker, but are also costly from a production angle. In the handling of rayon and similar materials this is a big item as far as cost is concerned, since spreading or dragging materials over a rough surface, causes pulls or runs. In replacing table tops we have used hard wood and Masonite. The latter is cheaper, has a very smooth surface and needs very little attention to keep it in condition, unless much punching or short knife work is done.

Regular inspection of table tops, plus the application of shellac when needed, assists greatly in prolonging the life of these tops. Even with the smoothest tops we find it necessary to use a spread of paper under the lay in order to cut without jamming the cloth. This, together with the spreading of the marker on top of the cloth constitutes another hazard, through paper cuts. Though not serious, paper cuts are painful, and easily become infected. There should be a prompt reporting of injury for treatment and a daily check until well. A good anti-septic should be applied and the cut bandaged to keep out dirt, dye and lint, and a report made of the accident.

In the sewing room there are many hazards from which accidents arise. To simplify things, let us classify them in two groups—the mechanical and the non-mechanical.

The mechanical group brings us to the sewing machine. Some thirty years ago when I started to work in a factory, the first thing the forelady told me was, "Don't put your hand on the wheel." At that time, this rule was in order because of a direct drive from the line shaft to the hand wheel on the machine. Although this belt was protected by a belt box, I might have grabbed for that hand wheel, as I did when I sewed on a machine at home. The result would have been a crushed hand.

Today that hazard has been removed through the installation of safety tables, individual motors, etc. Yet safety education is as necessary to the operator today as it was thirty years ago. Today the greatest hazard is at the point of operation. This point is, of course, where the needle passes through the cloth. The point of danger is the needle, but even this hazard can be eliminated through the use of needle guards on some types of machines. On others, hemmers, folders and special attachments eliminate the probability of injury.

What about the maintenance of machines? Is there a periodic check-up by your maintenance man? By that I mean does the machinist check up on screws in fly wheels to make sure that they are not worn or

loose? You may say not much of a hazard there? Not so long ago I saw a fly wheel on a machine come off while the machine was in motion. It flew across the table, how it missed hitting the operator on the other side of the table is still a mystery to me. Now all our machines are gone over weekly for loose fly wheels and similar hazards. Low line shafting should be guarded by skirt boards.

Another means of protecting the operator from coming in contact with the lower belt is an apron tacked on the front of the table top directly in front of the transmitter. This also eliminates oil spots on the material while in process.

It has been truly said that the best safety device is a careful person and while this may be true, there are times when conditions, over which we have no control, allow carelessness to creep into our lives. It is at such times that uncared for hazards extract their heaviest toll.

Of the non-mechanical hazards there has been considerable discussion as to the value of education. To me, it seems that educational effort which will produce the best results lies in improving the mental condition of employees. If a man thinks right, is it not reasonable to believe that he will do his work right? After all, the right way to do a job is the safe way, and it depends on trying to help our employees to help themselves. This will be accomplished through efforts which will improve the mental attitude of the men and women with whom we come in contact. If with continued work you are able to get the right thoughts into a person's mind, and you keep him continually impressed with those ideas, is there any reason why he should not practice safety in an automatic manner?

The non-mechanical causes in the sewing room are, rough table tops, caused by scissors digging into the wood, oily floors, accumulation of clippings and waste in the aisles, especially around machines that trim. The most serious and costly accident we ever had was one caused by an operator slipping on an oily floor, falling and breaking her hip. In changing machine heads, are they placed on the shelf where they belong, or are they left on the floor for some one to fall over?

Throwing empty spools and cones on the floor is another non-mechanical hazard. In what condition is the floor? Is it of soft

pine that becomes rough, worn and splintery from trucks having been pushed across it? If so, are the worn places replaced? We have found that it is cheaper and safer to repair and replace with hard wood flooring laid diagonally.

Then we come to the finishing department, which includes inspecting, trimming, pressing, folding, packing and shipping.

With inspecting and trimming there is no particular hazard but what can be corrected by proper supervision. Scissors and sewing needles are used but with ordinary care, few, if any, accidents occur. Once in a while, a cut finger, but that usually happens when the person is not paying close attention to her work.

About 50 per cent of our pressing is done on machines. The other 50 per cent with electric hand irons. In using the ironing machine, it is essential that the operator be instructed in safety before operating the machine, and that the instruction and supervision be of a continuous nature. There is a double hazard here because if her hand is caught between the shoe and the roller, it will be crushed as well as burnt.

We use a foot control machine which enables the operator to use both hands in handling the work. While the electric iron is a hazard, yet it is not nearly as great as the mangle or ironing machine, unless spraying is done, then there is a hazard caused by the mist dampening the electric cord, which very often causes shock.

Now you may say, who is responsible for safety education in the plant? The management, of course. The superintendent, mechanic, foreman or forelady should have no difficulty in recognizing a hazard. When it is recognized, no time should be lost in its elimination. In going through our various plants, it is not unusual to hear the remark, "Why, I've passed that day in and day out, and never thought much about it producing an accident." It is just the old story of familiarity breeding contempt. The unnoticed small detail will sooner or later bring about an accident.

To me, this impressing upon an employee's mind automatic safety is much like the child in school. Starting in the lowest grade, day after day as the child attends class, impressions and thoughts put in the mind have a deep and lasting effect. Without thinking the child in a short space of time is able to answer automatically such ques-

tions as "How much is two times two? or three times three? Etc."

We are trying to develop this line of automatic thought in the minds of our workers. In putting new people to work, we try to impress them with the need for closely observing rules which have to do with accident prevention, and we also impress them with the measures used when these rules are disregarded.

From the moment the applicant enters our

employ, he or she is impressed continually with the importance of working safely—thereby avoiding injury. Upon being introduced to the forelady or foreman, it then becomes their job to educate the employee in safe practices, which, with proper development will improve the mental condition of the person and produce, we hope, automatic safety.

Our company has long since realized that "The price of safety is eternal vigilance."

TUESDAY AFTERNOON SESSION

October 12, 1937

How Can the Foreman Most Effectively Meet His Responsibility?

By E. A. ROBERTS

District Engineering Manager, American Mutual Liability Insurance Co.,
Atlanta, Ga.

In order definitely to place the responsibility of the foreman in accident prevention, it is necessary to understand his authority and jurisdiction in the organization of which he is a part. I will cite what appear to be the limits of jurisdiction in the average manufacturing plant.

1. The foreman either actually employs his own help or interviews the applicant who is only employed on the recommendation of the foreman to the superintendent or employment manager. This puts within his control the placing of the man in the right position and it gives him an opportunity to determine the fitness of the man for the job to be filled. If heavy lifting is contemplated he can request a physical examination of the man.

2. He has complete charge of the cleanliness of his department unless the clean-up work is done after hours by a separate gang in which case there is seldom cause for criticism as far as departmental accident occurrence is concerned.

3. He may discharge employees for un-

desirability, incapability, or violation of instructions.

4. He supervises the instruction of all new employees in their duties, explains operating rules to them and cautions them against hazards pertaining to damage, either to material or to equipment.

5. He is expected to report all items requiring repairs or adjustments such as machines and equipment, flooring, runways and stairs, broken or weak ladders and scaffolding, broken windows, elevator gates broken or out of order, and all other items under the jurisdiction of the master mechanic. This latter, himself a foreman, carries his own responsibility for accident prevention in the same fashion as the departmental foreman. It will be understood that in a textile mill each overseer has, under his jurisdiction, loom fixers or the like for whom his responsibility is the same as for any other employee in his department.

Given, then, almost absolute operating jurisdiction indicated by the outline cited,

the foreman's jurisdiction in accident prevention is identical. Any curtailment of that operating jurisdiction implies a similar curtailment of his accident prevention responsibility. A man cannot be expected to accept responsibility where he is not allowed jurisdiction.

It is now possible to discuss the way in which these responsibilities may be met. The good foreman is a leader, not a driver. He achieves success largely through the cooperation of his fellow workers. Cooperation is only accorded him when the employees recognize:

1. His interest in their welfare.
2. His desire for suggestions from them.
3. That he will not hesitate to discipline recalcitrant workmen who endanger their fellow-workers.
4. His own obedience to plant rules.
5. That the rules have been formulated to help, not hinder, production and earning power.
6. His unflinching impartiality in his relations with his fellow employees.

This discussion assumes that accident prevention is a production problem. To produce good yarn or cloth, the overseer must know what causes it to be faulty. He must know how to adjust a spinning frame or a loom and how to keep it in adjustment. Such duties are, of course, normally delegated to the fixer but the overseer must know more than the fixer.

Likewise, to prevent accidents he must know what causes them, he must be able to recognize accident-causing conditions prior to the occurrence of an accident. Most of this information he can gain from the experience of others as exemplified in the printed accident prevention material. Safety conferences such as the one in which we are participating are another source of knowledge. All of us who are privileged to assist in these meetings are hopeful that we are helping to make some of this accumulated experience available to others. But, unfortunately, the time has not come when most foremen can afford to overlook the accident history which is being made in their own plants. I would like to urge the discarding of the commonly accepted thought that an accident, to receive study, must involve personal injury. The dictionary definition of an accident is "an event which is unexpected, or the cause of which

is unexpected." The foreman should inquire into the circumstances of each "unexpected event" in his department regardless of whether or not personal injury results therefrom.

Having thus accumulated some mass of accident data, its best use comes through classifying the accidents to bring out the responsibility, which in turn, indicates the action necessary to eliminate the causes. The most common way of classifying accidents into the two groups of mechanical and non-mechanical does not go far when it comes to placing responsibility for the accident causes. Classifying accidents according to whether they were caused by physical conditions or by unsafe practices produce two groups for which the responsibility for accidents rests largely with the foreman. However, in the first group management itself has not discharged its responsibility until the best and safest working conditions possible have been provided through the liberal use of physical safeguards.

Given working conditions which have been made as safe as is humanly possible through suitable equipment, proper safeguards for the hazardous parts of such equipment, proper plant layout, adequate light, then the responsibility of the foreman in those accidents due to unsafe practices cannot be overlooked or denied.

This statement may bring a protest from foremen that they cannot stop accidents when the employee is hurt the first time a rule is violated. If actual investigation showed that employees were injured the first time they violated a rule, then it would be a reasonable protest, but innumerable investigations have shown that rarely does an accident occur the first time an employee violates a rule. It is indicated that the employee frequently has been doing repeatedly the unsafe thing that caused the accident and usually such employees will state that they have not been admonished for their violation even though the foreman had observed their action. If the foreman stopped unsafe practices as soon as they commenced, there would be immediately a lessening of accident occurrence in his department.

Let us consider one example of responsibility for an accident. Because of a cable failure an elevator fell, seriously injuring a workman who was riding the elevator with a truck load of material. In addition to the cable failure there was a failure of

the safety device to operate. The plant safety committee met to determine the responsibility for the accident. The departmental foreman and the master mechanic each testified from his knowledge of the accident.

Since it was the master mechanic's duty to inspect the elevator equipment and keep the machine in a safe operating condition, he was held to be at fault. He accepted the responsibility for the equipment failure but pointed out that in keeping with the common knowledge that the elevator was old and not provided with the most effective safety devices, a plant rule had been issued prohibiting riding and a sign to that effect had been posted on the elevator. Consequently, it was the responsibility of the foreman to see that his men obeyed plant rules. The safety committee agreed with the master mechanic holding that it was just as much the duty of the foreman to prevent injury to the men under him as it was the duty of the master mechanic to prevent damage to the equipment under his control.

There are those who will say that a foreman cannot stop the unsafe practices of employees; that it is impossible to control them. The following is cited as an example of one way in which a seemingly unpreventable practice was stopped, though in a rather drastic fashion. The problem was that of keeping empty soft drink bottles off the floor.

After the overseers had expressed the thought that it was not possible to solve this problem, the superintendent jockeyed them into the proposition of promising to adopt any expedient which he might propose, which would be effective. Following

this, as the superintendent made his rounds of the mill, whenever he observed a soft drink bottle on the floor he picked it up, made a note of the time and the department in which it was found and handed the bottle to the overseer. Unless the overseer could find the employee who was responsible for leaving this bottle on the floor, he was required to carry it constantly in his hands until the end of the shift.

Being thus required to acknowledge publicly the failure of his department to observe the rule with respect to placing these bottles in the containers provided, it was not long before every overseer had, in his own individual fashion, discovered a way of ascertaining the guilty employee and thus putting an end to this unsafe practice.

Another example of what may be done to stop accident occurrence when the overseer really takes his job seriously is found in the record of a mill in eastern Alabama working approximately two and one half million man hours per year which, for the period January 1, 1934 to January 1, 1935 had 25 accidents with a frequency rate of 13.3. For the period January 1, 1935, to January 1, 1936, had 18 accidents with a frequency rate of 8.02, and for the period January 1, 1936, to November 1, 1936, had 11 accident with a frequency rate of 4. Encouraged but not satisfied by this progress, the management designated the month of November as a "No-Accident" month. They were successful in achieving the record hoped for during the month of November, and extended their campaign through the month of December. At the time this paper is being written, the plant has operated approximately two and one quarter million man hours without a single lost time accident being reported.

ADJOURNMENT

Wood Products Section

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 J. A. PURDY, Michigan Mutual Liability Co., Detroit, Mich.
 HARRY J. KELLEY, American Seating Co., Grand Rapids, Mich.

MONDAY AFTERNOON SESSION

October 11, 1937

The session was called to order by General Chairman Harry J. Kelley, American Seating Co., Grand Rapids, Mich., who introduced the speakers.

Combating the Dust Problem in the Wood Products Industry

By J. G. SISSMAN

Director of Research, Surty Manufacturing Company, Inc., Chicago, Ill.

The best protection against fire in wood working plants is dust control cleanliness, which means keeping the air dust-free, preventing the accumulation of litter on floors, benches, and tools, and guarding against the accumulation of dust on oily moving parts where friction will readily raise the temperature to the burning point. An adequate dust collecting system is the best protection against wood-shop fires.

Remember, a dust collecting system itself must be designed with this fact in mind; fire as well as air and dust can be carried through air ducts.

The fire hazards in wood plants are well known. A study of such hazards, made by the National Fire Protective Association which published a report in 1932, gives a full analysis of some 1,700 fires in wood-working plants and shows the proportion of danger in different parts of the plant and the ratio of fires of dust origin in comparison with others.

The explosion hazard also has been carefully surveyed. It is present when dust is sufficient for combustion to be instantaneous over a considerable area. Explosion hazards, like fire hazards are best controlled by ventilation which precludes the accumulation of dangerous dust in plant atmosphere.

Fire danger is present in wood working operations whether performed in open sheds or totally enclosed buildings. Explosion hazard is increased with enclosure of the process in closed buildings. Bulletins 562 and 617 U. S. Department of Labor, Bureau of Labor Statistics, and several pamphlets of the National Safety Council contain complete safety information for prevention of dust explosions. They sum up the collected, classified knowledge in this field and point out the close linkage between fire hazard and explosion hazard and show that either may be the cause of or the consequence of the other. These bulletins in conjunction with the rules or laws effective in your own state for removal of dust and gases, will enable you to work out a campaign against the hazard of dust explosion.

The nuisance problem in woodworking plants also requires dust control. Nuisance

problems fall into several groups. Dust may impair the value of the product by marring its finish. Furniture factories and cabinet makers suffer most from this nuisance. Dust may cause accidents by making the footing uncertain, by hiding obstructions on or defects in floors or the exact location of knives and cutting edges. Dust of any kind in the eyes is a nuisance and a dangerous nuisance. Nuisance dust, like fire hazard dust and explosive dust is adequately and satisfactorily controlled by ventilation.

Wood working dusts, with the possible exception of a relatively small amount of abrasive material which they contain, are bulky. There must be continuous removal of wastes of manufacture to leave room for men, machines and work in the plant. For many years this was the only aspect of the case considered. Broom and shovel methods, which once were standard in the wood working trade for removal of wastes, were sufficient and would still be sufficient, but, the presence of other hazards of wood dusts complicate the problem. Broom and shovel methods are no longer acceptable. Moving air is the one effective means of disposal of wood wastes because it does so in a satisfactory manner and because it fits into the scheme for guarding against other hazards.

The material so collected is frequently usable either as fuel within the plant or is salvagable and saleable which helps reduce substantially the cost of safeguarding the plant. This is the only phase of the dust control problem which shows a direct profit. The others are an immediate charge on the industry which must be met as part of general overhead. They show their profit indirectly in the prevention of injuries to men and the saving of the cost of injury to industry.

The last of the quintette, according to my classification, is wood dust as a health hazard. This quint has several characteristics: effect of wood dust on the human system; effect of abrasive dusts on the human system; effect of dust or materials other than wood or abrasive used in place of wood or in combination with it on the human system; effect of dust resulting from the finishing operation on the human system.

Wood dust is not dangerous in the sense of silica or lead dust; but wood dust is not innocuous. Any dust inhaled in sufficient quantities is detrimental to health and wood dust is not excepted.

The industrial bulletin of the state of New York for July, 1936, contains an article by Adelaide Ross Smith in which the relationship between wood dust and respiratory disease is set forth. Dr. Smith points out that wood working is a dusty trade and while the dusts are not primarily siliceous, more respiratory disease is found in the wood working plants than in plants where dusts are not present. She suggests that perhaps more silica dust is present than is suspected. Studies to determine which of the dusts present in woodworking are dangerous have not been made, at least not with sufficient detail over a long enough period of time. But statistical evidence definitely places wood working in that class of industry in which there is some exposure to silicosis, as shown by the high mortality from pulmonary tuberculosis.

In the study made by Oliver, in which the death rate of the agriculturist from diseases of the respiratory system was taken as a standard or 100, the rate for potters was 150; stone quarriers 261; cotton workers 244; wood workers 238; masons 215; wood manufacturers 202; and bakers 177. If this figure is a true picture of deaths in the wood working trades due to respiratory diseases, 238 as compared with 100 as the standard, it is obvious that wood dusts are definitely detrimental to health.

Reports from the Registrar General of England and Wales, show the same general situation. Under the English system wood workers are rated at 103 per cent, compared with agricultural workers who are rated at 59 per cent. Woodworkers rate 339 compared with the general population rate of 180. In the case of cabinet makers the rate is higher, perhaps because more dusts other than wood dusts are present in the atmosphere they breathe. One hundred and seventy-eight trades are listed in this report, rated from 1 to 178. Under the heading "respiratory tuberculosis" cabinet makers rate 117, other wood workers 81. Under "bronchitis" cabinet makers rank 121, other wood workers 64. Under "pneumonia" cabinet makers 51, other wood workers 28. Excepting under the heading of "pneumonia,"

cabinet makers do not rank well. Other wood workers seem to occupy a middle place.

Dust in wood working trades is therefore a definite hazard to the health of workers and of particular significance in the impetus which it gives to diseases of the respiratory system.

Of less actual significance, but of considerable interest because it is seldom considered as a hazard to wood workers, is contact with woods or wood dusts which are poisonous. Bulletin 616 issued by the U. S. Bureau of Labor Statistics, also the Handbook of Labor Statistics, 1936 edition, contain two interesting references to poisonous woods. The first of these, which appears on page 350, refers to an outbreak of dermatitis in a wood working plant employing 100 men. As a result of contact with Brazilian walnut wood dusts, 11 cases, a rate of about 10 per cent developed dermatitis of varying severity which, in some cases, incapacitated the man for several weeks. The inference was that a large measure of tolerance of toxins in that particular wood can be developed.

An extensive account appears on page 354 of the same bulletin. It is a reprint of a bulletin issued by the International Union of Wood Workers for September-October, 1931. This bulletin states that there are many woods, particularly those grown in the tropics, which contain active poisons.

The actual number of cases reported is relatively small. This is due to the slow action of the dust and the fact that many physicians are not familiar with occupational exposure or the resulting disabilities, and so do not associate the illness with patients' trades.

The most frequent symptom of wood poison is dermatitis which may be slight or severe. Other effects may be palpitation of the heart, shortening of breath, or dizziness. Such symptoms also come from inhaled dust. Repeated contacts do not confer a tolerance of these poisons; in fact they may make one super-sensitive, so that working on ordinarily harmless woods causes a re-occurrence of incapacity. The toxic substance occurs as volatile oils or alkaloids. Quite a number of woods are enumerated.

It is the good fortune of the wood working trade to be able largely to stand aside from the most serious dust problem, the problem of silica dust, since so far there is little to

show that silica is a substantial danger in the wood working field. This is true despite the reference to the report of Dr. Smith. While that danger is slight at present, it is a growing danger, due to the use of extremely high speed sanding devices for finishing operations, using siliceous material as abrasives, and to the growing use of products of non-wood origin in the woodworking shops. Many of the panels now being worked in wood shops contain high proportions of asbestos and other silicious minerals. Where this is done, the worker may be exposed to concentrations of silica dust sufficient to present a definite hazard. It is well to make occasional survey of your plant to determine exposure continuous or intermittent.

While perhaps finishing operations are not properly a part of the woodworking operation they do occur in so many plants that their existence should be pointed out. Changes in the stains, paints or other finishing coatings causing lead poisoning lessen that hazard compared to 20 or 25 years ago. The nitrocellulose and pyroxylin finishes which are displacing paints, are distinctly dangerous. Volatile materials comprise about three-fourths of the mass, which is then thinned by the addition of other volatiles to several times the original volume.

They are dangerous. In addition to health hazard, these finishes add to the fire and explosion hazard of the wood working plant. Acetone and acetates, ethylenes and alcohols are the principal toxics which enter the new finishes. Descriptions of these ingredients will be found on page 337 of Bulletin 116 previously mentioned.

It appears that, from the point of view of health hazards, these conclusions can be drawn: (1) Wood dust is dangerous to health and increases the incidence of respiratory disease. (2) Dermatitis is a result of contact with woods of tropical origin and their dusts, and will follow exposure. (3) Silicious materials are a factor in the high incidence of pulmonary diseases in the wood working plants. (4) New materials, particularly those having appreciable silica content, present new dangers which must be carefully guarded against. (5) The new surface finishes, to a large extent replacing the lead pigment paints, obviate one danger and introduce new dangers of their own.

Dust then presents five different problems to the wood working trade. A good ventilating system will solve all five problems, reducing dangers in four instances, and in the fifth reducing direct costs.

Good Housekeeping in Woodworking Plants

By JAMES C. WILSON

Vice President, Lumbermens Mutual Casualty Company, Chicago, Ill.
Chicago, Ill.

Good housekeeping is and always has been one of the most important features of a successful manufacturing program. Fundamentally it is the outstanding feature if considered in its broadest terms. It includes not only a sensible, intelligent handling of sales, accounting methods, packaging and shipping, but, more specifically, production methods and the habits of the men engaged in production.

It seems obvious to us that when a new plant is being designed of when an old one is being rebuilt, the plans should include and provide for good housekeeping through the following details:

A complete and efficient dust collecting system is a basic necessity, and once installed it must be serviced constantly to retain its efficiency. The removal of all waste material from floors and around machines is a full-time job requiring definite assignment to a clean-up crew.

In laying out the machine setup, good housekeeping requires an intelligent plan under which the machines are grouped so that the progress of stock being processed is such that there is a continuous flow towards completion, with no back-tracking.

In many of the older plants, the output has changed and new machines have been

added without re-arranging the old ones. This usually causes confusion and much costly rehandling of material—again poor housekeeping.

Proper safeguarding of machines, belts, gears and transmission should also be entered under good housekeeping.

The newer machines are, or should be, equipped by the manufacturer with exhaust hoods and complete safety appliances. In many instances, these are combined and are very satisfactory. However, the used machinery business is still flourishing and we constantly find old square head jointers, wide open rip and cut-off saws, planers and stickers being used. Plants using such equipment are always cluttered up with stock—generally are using broken trucks—have no exhaust system and certainly are dirty and dangerous from every standard.

The good housekeeper should consult his fire insurance carriers for suggestions on building fire walls—keeping sufficient clear space between buildings and piled lumber, sheds, etc.—installing and keeping efficient his fire doors, sand and water pails, fire hose and fire alarms.

With a good plant fully protected—with an intelligent plan in setting machines—installing dust collectors—safeguarding all points of operation and following with a regular "Clean Up" and "Keep Clean" program, we then come to the employee.

Is each employee physically fitted for his job? In our opinion good housekeeping requires an answer to that question for we know that many men with poor eyesight are running saws. Many with hernias and bad varicose veins are handling, piling and trucking lumber. This we believe is poor housekeeping. These conditions are the indirect cause of many costly accidents in the wood working class.

Why do we emphasize this housekeeping problem in relation to accidents and why is it so important, when after all accidents "just happen"?

One difficulty often met with in discussing accidents with an employer seems to be his consideration only of the actual cost of compensation and medical expense. To him the importance of loss frequency may mean little unless he understands the consequential or production loss which industry sustains and which is always several times the amount paid by an insurance carrier.

Let us take a specific accident where a loaded truck dropped one wheel through a broken board and a piece of dressed stock 3 x 3 inches x 2 feet dropped off the load on to the little toe of a workman tailing a resaw. Result: a broken toe; three trips to the doctor; an x-ray; three days lost time. The insurance loss was medical only, an expense of \$12.

Naturally the man yelled when his toe was broken and a fellow workman very thoughtfully threw the control switch and 40 machines were stopped while the entire force rushed over to see what happened. Ten minutes passed before the mill was operating again and at least 20 more before full production was under way. With 70 men at work, this cost around three full days' time for one man or about \$15. Two men helped the injured fellow out to an automobile—drove him to the doctor—waited while an x-ray was made—cast applied, then drove him home. Four more man-hours at 75c per hour or \$3. Because he was not entitled to compensation under the law, his boss paid him the three days lost time, which was another \$15. Work was delayed on the resaw while another man was being trained so there was an undetermined loss in production. Total cost to the employer: \$33; total to the insurance carrier: \$12; or \$45 for a broken plank in a trucking aisle—later repaired in one hour. Poor housekeeping.

This is typical of the confusion and loss following an industrial accident.

Let's take a look at some losses our company has handled during the last two years. These are not hand picked. We used the first 1,000 claims for the woodworking class, then divided them under eight principal causes as follows:

Handling Objects	327
Machinery	283
Particles in Eye	128
Hand Tools	87
Falling Objects	61
Falls of Persons	49
Stepping on or Striking Objects	57
Unknown	8

Because the machine accidents include the most serious and permanent losses, the 283 in that group, while but 28 per cent of the 1,000 considered here, account for 55 per cent of the total cost. There are four fatal cases from rip saw kick-backs; two cases where a hand was amputated, and 44 fingers were cut off.

For years the State of Wisconsin has required rip saws to be completely guarded and it is interesting to note that none of these serious saw accidents occurred up there.

It is our opinion that saw accidents are the direct result of poor housekeeping for in checking these 113 saw claims, we found guards had been provided in about 75 per cent of the cases but were not in use at the time. Whose fault? Management. Failure to enforce proper use of guards is not the laborer's fault; it rests squarely on the management.

The highest number of accidents under any of these eight causes was recorded under handling objects—327. Of these, slivers account for 148. This is one claim in every even which we checked. Of course, as a rule a splinter properly removed and cared

for does not have a serious result, yet these average \$51 each in cost. Some resulted in bad infections and amputations through faulty or careless handling—failure to secure medical attention in time.

Is this poor housekeeping? We think so. Leather gloves or leather hand pads, except for machine hands, are required of lumber handlers in most well-regulated mills. Immediate attention to splinter accidents is surely good housekeeping.

As a short review we suggest putting the house in order—plenty of aisle space around properly set and exhausted guarded machines. The selection and placement of employees—carefully trained—constantly and firmly supervised by a management interested in maintaining a safe, successful business. These are the foundations of good housekeeping.

Discussion

The following points were made in the discussion following the addresses:

How should dust caused by a high speed saw be collected?

Keep the exhaust hood close to the wheel and the wheel as completely covered as possible; have a vibrator and second exhaust outlet, if necessary, behind the wheel; have some sort of brush to contact the saw ahead of the exhaust; place an air-jet so that it impinges on the wheel, driving the dust from the wheel into the exhaust pipe.

How important is exhaust system maintenance?

The exhaust system is assumed to be satisfactory when first installed. There must be periodic inspections and suitable maintenance so that the system is kept continually at approximately "installation efficiency."

What is the danger of woodwork dust?

Primarily, it aggravates existing pulmonary trouble or other diseases.

How may the proper setting of shaper knives be determined?

They must be set by an experienced person, and the cut should be not more than 3/16 of an inch deep.

Is there any table showing the force required to cut wood?

It was agreed that this question would be referred to the Forest Products Committee for investigation.

Discussion also touched upon the following points: Method of setting cutters and knives; use of X-ray to study tools to determine whether they are crystallized; crystallization of bolts, chains and other materials; a comparison of the "old hand" and the "new man" who takes a chance; follow-up of minor injuries and first aid treatment; types of guards used on cut-off saws; kick-backs.

In connection with the last point it was brought out that kick-backs are generally attributable to one of three causes—improperly swedged or dull saw, poorly selected or prepared material, lack of "back turn on the fence."

WEDNESDAY AFTERNOON SESSION

October 13, 1937

Preventing Accidents at the Point of Operation on Woodworking Machines—From Log to Finished Product

By RAY L. WOODS

Safety Director, Fisher Lumber Corp., Memphis, Tenn.

On woodworking machinery the great majority of accidents occur at the point of operation. Logging, lumbering, and woodworking are closely related activities. Reviewing figures for 1936, the woodworking industry with a frequency of 13.39 and a severity of 1.64, ranked sixteenth in frequency and fifteenth in severity in a list of 30 major industries. Lumbering companies ranked thirtieth and twenty-ninth, respectively, in the same group, having a frequency rate of 57.29 and a severity rate of 6.36. The logging division of the lumber industry turned in the poorest experience, the frequency being 115.93 and severity 17.05.

The lumber industry in general has been rather backward in adopting adequate safety programs, which explains in part the poor safety record of the industry, as well as the slow improvement in comparison to industry as a whole. However, a great many companies have taken steps to reduce accidents to a minimum.

Over years of experience we have felt that most of our accidents are entirely avoidable, and I believe that it is hardly fair to characterize woodworking as extremely dangerous when experience has shown that no harm results when proper safeguards have been taken, i.e., abdominal fly backs have been practically eliminated by the use of leather aprons; eye accidents by goggles; foot injuries by safety shoes; flying shaper knives by the use of blind bolt slots and properly tempered knife bolts. These are only a few of the more important items of safety equipment that pay good dividends. Forms, jigs, and point of operation guards should also be installed. The value of any point of operation guard is decided by how efficiently it forces the operator to put his hand in the right place at all times.

The causes of accidents in the lumber industry are so diverse that detailed

mention is impossible, but I will try to consolidate the important factors, merely touching upon the ones peculiar to the various operations. The accidents incidental to falling trees, rolling and moving logs, handling chains, cables, flying fragments, power-driven saws, and so on, are endless. The men in this industry are usually exposed to hard work and inclemency of weather. The possibility of getting contaminated food, and unsanitary conditions in the camp, predisposes to typhoid, dysentery, malaria, and other diseases.

Everyone realizes how impossible it is to place mechanical safeguards around the men who are felling a tree and cutting it into log lengths in the woods. The safety of the fellers, swampers, and buckers rests squarely upon the shoulders of the feller, and unless he is highly skilled and thoroughly schooled in safety, many serious accidents are inevitable. As to equipment and safe practices in the woods, I refer you to the Bureau of Standards' handbook No. 5, "American Logging and Sawmill Code."

The loading of logs is also an operation that cannot be safeguarded mechanically. The loader trains his ground crew, commonly known as "hookers," as well as the top loading crew. He has signals that are understood by each member of the crew, and he designates one man in each crew to give all signals. The operator should never pull a log blind; they should be in sight at all times. Again we find that the safety of the entire crew rests with the man.

There are many types of sawmills, from the small portable to the large double band-mills. It is very difficult to guard the massive machinery of sawmill operation with mechanical safeguards. Few of these men ever get close enough to be injured by the saw itself. Most accidents occur in the transmission room, on conveyors, live rolls, or are caused by falling and flying objects. It is

important that as many mechanical safeguards as possible be installed, but the most important is close supervision and education.

The proper selection of men is one of the most important steps in accident prevention. It is necessary that the foreman give his unqualified cooperation and support to the employment man. When a foreman finds that he is in need of men, it is his duty to submit to the employment man a requisition for help, stating what qualifications in the man are needed to fill the requirements of the job. The foreman should make a complete analysis of all operations under his supervision, and be thoroughly acquainted with the requirements necessary to properly fill the job. The employment man should in turn make a careful analysis of every applicant for work, to be reasonably certain that the man he selects will fill the requirements of the foreman's requisition as nearly as possible.

Before leaving the employment office every man should receive instructions, together with a book of rules of the organization. The first impression the new man receives is usually the most lasting. If he is impressed upon the threshold of a new job by the fact that he is to work with a safe-minded group of men, he will, more than likely, determine to be as near like the man he is to work with as possible.

Another necessary step in accident prevention is the physical examination. No man should be put on the payroll without first submitting to a physical examination. The primary objective of the physical examination is to determine the employee's physical fitness for the job for which he has been selected. Physical examinations should not be made merely with the idea of weeding out the unfit. Men of inferior physique may have special abilities which makes them desirable employees in spite of their physical handicaps. The examination also acts as a guide to the foreman so that at a later date he will not put this man to work on a job for which he is physically unfit.

When the man has passed through the employment office and his physical examination, he is then ready to be turned over to his foreman. For any safety program to be successful, the foreman must be "safety-minded"; be able to absorb safety education; be able to perceive unsafe practices instantly; and be able to preach safety to the old men as well as sell safety to the new men. A

large percentage of the accidents in the woodworking industry are caused by improper placement by the foreman of the men available to him.

The most vital duty of the foreman is that of instructing the employees. While this may be generally recognized it is undoubtedly true that foremen know less about this work than any of their other duties. This leads me to believe that very few foremen realize how important their teaching function is to safety. Even those who do appreciate the significance of this work frequently are not inclined to give careful consideration to suggestions of the methods that should be followed.

More accidents are created in woodworking industries by the lack of proper instructions than by the lack of mechanical safeguards. Safety is so closely related to the other functions of the operation that it is impossible to divorce one from the other. When a man is properly instructed in the method of operation, it must necessarily include safety, for there is only one proper method of operation and that is operation with safety. Many foremen, for example, make the mistake of telling and showing instead of teaching. The outstanding qualities in a foreman teacher are patience, painstaking effort, fairness, and good will. Put the beginner at ease by showing a spirit of friendly patience and willingness to help him.

The value of follow-up is the most significant phase of accident prevention at the point of operation. No two men do any one thing exactly alike; every person who operates a machine is sure that his way is the best. When a man is placed on a machine he will invariably find many ways to do his work that seem easier than the way in which he was instructed, but in practically no instance are they ever as safe. It is the foreman's duty to see that his instructions are followed to the letter; the way he has the job planned may not be the easiest way, but it is the easiest way with safety.

Assuming that we have the employees properly selected, placed, and instructed, we then must take care of our physical properties. All points of operation should be guarded. The appearance of the guard or the way it is designed should always be put into the background, and the efficiency of it in the foreground. These guards not only prevent many accidents—to be specific the National Safety Council says 15 per cent of all acci-

dents may be prevented by physical safeguards—but they have an intangible value. Guards display the management's attitude toward accident prevention even though they play only a minor part in this respect. These guards have a psychological effect on the workers and supervisors, for when they realize that the management is interested in safety promotion 100 per cent, it is an easy matter to get the men to think in the same channel. But when these guards are not installed; when safety meetings are not held; when equipment is in poor working condition, the attitude of the employees is one of disrespect, which increases tremendously the task of accident prevention.

Education is the most valuable adjunct to accident prevention that I can think of. Without education accidents cannot be prevented. One would presume that man would just naturally be cautious about getting hurt on the job, knowing that his own life and limbs are at stake. No one really wants to get hurt, but unless and until you have extensive safety training in your program no man will really become safety conscious.

There are four fundamental steps in the safety training process:

First, the supervisor himself must be capable. He must make a thorough study of each job and be able to discern all possible hazards connected with it so that he can determine the preventive measures to be taken.

Second, the foreman must then develop in the workman an open mind, and a willing and receptive attitude if he is to successfully train the man in accident prevention. This second step can be accomplished only by impressing upon the man the seriousness of the accident problem. If he knows that his supervisor takes safety seriously, he is more likely to be impressed with the necessity of

learning the safety precautions of his job as thoroughly as he learned the operation he performs. This cannot be done hurriedly. When a man rushes about in an excited fashion attempting to point out one hazard, then another, and threatening the man with dire penalties should he be careless, he is doing more harm than good.

Third, if a supervisor expects to put over safety training, he must make extensive use of practical and intelligent teaching methods. Many supervisors are too eager to tell the man instead of personally demonstrating how to perform the operation. Here again I must mention the value of follow-up, for this is where many supervisors fail. They take for granted that after initial instructions are given, the workmen will follow them to the letter. We all realize that this is not true; that instructions are just as easily forgotten as what we had for dinner on Tuesday of last week.

The fourth and final step in the safety training process is that of enforcement. Enforcement plays an important part and it can be the most harmful and abused step in the whole program. Supervisors should give accident prevention their close supervision, but it should be the kind that will make the men realize that safety instructions are not being enforced through fear. Too many of us are willing to use the "strong arm" or "big stick" methods. Discipline, of course, has its place, but the type of discipline is important.

The least amount of discipline that can be used is an advantage and not a disadvantage, for when a man begins to fear that he will be laid off or discharged for breaking some safety rule or certain instructions, you fail to get the response you are seeking, i. e., his loyalty and voluntary support in accident prevention.

Safety Chips, an illustrated talk on safety kinks, was given by Clarence F. Otto, director of safety education, Employers Mutuals, Milwaukee.

Discussion revolved about the following points:

More accidents are caused by lack of in-

struction than by lack of mechanical safeguards. Five steps are necessary to instruction—training the supervisor; keeping supervisors and workers open-minded toward safety instruction; using practical methods of instruction; enforcing safety rules rigidly; applying to the National Safety Council for information when problems arise.

The session closed with a panel discussion on wood products mill safety.

Among the points mentioned were the following:

The need of educating the worker in

simple terms; the necessity of personal contact in safety education; giving reasons instead of simply orders; the seriousness of minor injuries; safety meetings of supervisors and employees.

ADJOURNMENT

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MEMORANDA



TRANSACTIONS

26th National Safety Congress

NATIONAL SAFETY COUNCIL, Inc.

KANSAS CITY, MISSOURI
OCTOBER 11 to OCTOBER 15, 1937
Municipal Auditorium

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THE Transactions of the Twenty-sixth National Safety Congress, 1937, are published by the National Safety Council in two volumes. In addition to this volume a larger volume, containing the general, the special subject and the Industrial Section sessions, has been distributed to Industrial members of the Council. The large volume is also available to other members if they are especially interested in industrial safety problems.

THE Transactions are published as a condensed report of the proceedings at the National Congress. The papers of each session or division of the Congress have been edited carefully to eliminate extraneous matter and to abbreviate the less essential portions because of space limitations. Thus the material herein presented is not a verbatim report of all the speeches presented at the Congress, but rather an abridged version made as compact as possible, yet without injury to the technical aspects of any address. The original manuscripts are on file in the Council's Bureau of Information, where they are available for additional reference. Where illustrations were sent by the speakers to the Council, these also are on file.

THE National Safety Council at its Congresses seeks to eliminate from discussion matters which are not pertinent to the aim of the Congress or which are contrary to Council policies. It cannot accept responsibility for the views expressed either in the papers presented or in the discussions based upon the papers.

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MONDAY AFTERNOON SESSION

October 11, 1937

VEHICLE SPEEDS AND ACCIDENTS

The opening session was called to order by William C. Knoelk, Chairman, Milwaukee Safety Commission, and General Chairman, Street and Highway Traffic Section, National Safety Council, who presided, introducing the speakers.

Traffic Developments of the Year

By WILLIAM C. KNOELK

Chairman, Street and Highway Traffic Section, National Safety Council

Safe driving is no mean accomplishment. Good traffic behavior is not like a coat that can be doctored or discarded at will. Good driving and good pedestrianism form a complex behavior pattern. It is the sum of many personality traits, some of them seemingly trivial. This becomes evident as one peruses the year's safety literature on driving.

We are told that four types of careless driving account for about three-fourths of

our motor fatalities. If these items were meaningful enough to the average driver so that he might modify his driving conduct through them, they would be a big help in reducing fatalities. When we examine the types—(a) exceeding the speed limit, (b) on wrong side of road, (c) did not have the right of way, and (d) drove off the roadway—no practical specific rule of driving appears.

Speed is a relative term; the precise speed at any moment must be determined by the driver after he considers the nature of the highway, the weather conditions, the degree of visibility, and many other factors. Even a legally established maximum is no infallible guide for all conditions. To the offending motorist, his speed may have seemed perfectly safe. So it is, too, with the other types previously mentioned.

It is all a matter of judgment. There is little agreement on the precise judgment that shall be taken as the standard. So many factors enter into the making of a decision that it is frequently impossible to put one's finger on the offending ingredient that caused the accident. Whatever detail it is that affects our judgment, that detail may be significant in our good (or bad) driving.

Two deductions may be drawn from such a line of reasoning. First, good driving is a highly personalized matter. General rules may serve but their interpretation lies with the individual driver. Second, our safety message must be aimed at the individual driver or pedestrian.

Need Traffic Judgment

Such an analysis carries with it the corollaries that personalizing the problem makes it imperative that "traffic judgment" be developed, and that the idea of personal responsibility be taught. This is true for the man on foot fully as much as for the driver. The corollaries that go with the second item are equally vital; the safety message must be revitalized, or made more vivid and convincing, to every individual in traffic. The presentation must be reasonably sound in its teaching procedure; the recipient of the message must feel himself in need of the proffered information and be eager to use it.

It must be understood that there is a difference between the larger topic *traffic improvement* and our theme, the traffic behavior of drivers and pedestrians. The latter needs improvement, too, but the task, though more limited, is a far more difficult one.

The traffic engineer must continue to build safe highways and to make them increasingly safer. He must provide definite lanes for the flow of traffic, regulated by the necessary signs and signals, illuminated to secure needed visibility. But the proper use of the highways by motorists and pedestrians is

so greatly influenced by the variable factors in human nature, that traffic behavior—traffic judgment—must be developed in all of us.

The enforcement officer must insist on a minimum ability with regard to the mechanical manipulating of wheel, brake and lever, and on a working knowledge of the rules of the road; but probably his broadest task is to aid in the development of the individual's traffic judgment. *Speed, visibility, curves, hills, pulling-out and cutting-in* are topics that show this essential interrelation of safe and properly policed highways, and the drivers' use of the facilities at any given moment.

No mention has been made thus far of the third E in the triumvirate of traffic factors—education. Obviously, the development of good traffic judgment is the job of education. However, this task cannot be allocated to any particular group. Good driving, as has been stated, is a highly complex achievement that takes much time to develop. Enforcement has a large share in this education. Newspapers, broadcasts, movies, civic organizations are all potential aids, together with the schools, in doing the work of building good traffic behavior. Not only is such a program of driver training difficult; it is, numerically, an extensive job. It is true, as is sometimes stated, that a small percentage of all drivers are responsible for the majority of all traffic accidents, the task would be simpler. As a matter of fact, a large part of traffic accidents occur to drivers that have had a good driving record for a number of years.

Just how to build up adequate traffic judgment must be worked out more satisfactorily than has been done to date. It is the definite responsibility of every driver and every pedestrian. With the wealth of publicity given the subject, we may well ask ourselves, why doesn't every motorist drive safely? It may be that he does not see himself in the picture as it is painted in "And Sudden Death." There may be other reasons for his seeming indifference.

Must Want to Learn

If a man wishes to become skilled or informed, he must have a desire to learn. This means most drivers must be inspired to want to assume the responsibilities of driving safely at all times, without the fear or threat of impending enforcement, through an understanding teaching process.

Reporting conclusions from his examination of the records of over 10,000 drivers and from talking with these drivers, Dr. A. R. Lauer of Iowa State college told a Washington meeting he was convinced half the population would rather trust themselves at the wheel than to ride with the most experienced chauffeur, that only 20 per cent of all drivers have a fair idea of their own weaknesses. He said also that fundamental traits necessary for safe driving are well developed at 22 years of age where they remain level until around 40, from which time there is a gradual tapering off to the age of 55. This is followed by a sharp drop in driving ability. He said there is a 10-year lag between manipulative ability and the development of mature judgment, good attitude, conscientious effort, and a willingness to abide by the accepted practices of good driving.

Work along the suggested lines is being done in some places. The Wichita Traffic Clinic, as reported in the August number of *Public Safety*, is typical. So important is the problem and so significant the trend that the program committee of the Street and Highway Traffic Section of the National Safety Council at its Kansas City sessions has arranged its meetings with specific appeals to the driver definitely in mind. Instead of relying upon the three-fold division of Engineering, Enforcement, and Education, the speakers will discuss those phases of driver performance which have a greater personal appeal: speed, night driving hazards, alcohol, and pedestrian problems.

Evidence of many kinds could be added. From all of it certain very definite conclusions are indicated. If one has the temerity to set down these conclusions, a list like this might result.

1. The trinity of Engineering, Enforcement and Education needs to be restated to be convincing to the normal driver and the usual pedestrian.

Report of Committee on Speed and Accidents

Harry H. Harrison, Traffic Engineer, Illinois Division of Highways, and chairman of the Committee on Speed and Accidents, briefly summarized the report of this committee. The report, with the exception

2. Responsibility must be placed definitely on the individual motorist and pedestrian.

3. Education extends beyond the schools into an adult program.

4. Because of the contradictory opinion regarding the effect of speed upon accidents, there is immediate need for some conclusive factual evidence study.

5. There is needed a comprehensive study of night driving with particular reference to the effects of visibility or the lack of it on accidents.

6. More intensive study of the pedestrian and of effective types of pedestrian protection is indicated.

7. Since opinions vary as to the prevalence of drunken driving, a study of the question would help to clarify the situation.

8. If the burden of evidence seems to show that the driver's attitude at any given moment is of more consequence than his skill in manipulating levers, what of the experiments being carried on at Lane Technical High School, Chicago, by William Sears, and elsewhere by Prof. Amos Neyhart? Is a six weeks' course in an actual chassis, or even in a car in real traffic, to be substituted for the "ten years" mentioned by Dr. Lauer? Is the short course to compensate for the longer period of training necessary for personal self-control, especially when there seems to be an obvious interest loss in the more humdrum process of building accident-preventing attitudes and traits? Additionally, will the burden of cost for all of this be a legitimate charge against highway funds, even though the work be administered by the schools?

Important questions, these! How they are answered will directly influence the traffic accident prevention program of tomorrow.

of the appendices, will be found at the end of the Street and Highway Traffic Section of this volume. The complete report in pamphlet form may be obtained from the Council's Bureau of Information.

What Can We Do About Speed and Accidents?

By E. RAYMOND CATO

Chief, California Highway Patrol

No council of men, entrusted with the responsibility of deciding whether their nation might be plunged into war, ever met with a more serious problem than we have in the field of traffic safety. My responsibilities in traffic safety work are exercised as the Chief of the California Highway Patrol. We have in our state approximately 6,500,000 persons and have registered 2,500,000 motor cars with approximately 3,500,000 licensed operators. A careful analysis of our traffic accidents will show our problem approximately the same as that of many other states. We are continually studying the problem and have many groups of civic-minded citizens who unselfishly give their intelligence, time and money in seeking a solution to this problem in cooperation with those officers whose duty it is to enforce law and order and regulate highway traffic.

We shall discuss briefly a few points that should be considered in our difficulty in order that we all may be more familiar with this problem.

Education—Human Element

To make motor car drivers more cognizant of their own human limitations is unquestionably very important. Without keen eyesight and a mind that understands what is seen and a body capable of responding quickly, no person may claim to be even a fair driver. Hence, it is very essential that "strict drivers' license examinations be made so that we may eliminate the incompetent.

Juveniles

Splendid work is being done by our State Department of Education, supported by the California Highway Patrol, in safety education in our elementary and secondary schools. A comprehensive manual has been prepared as the minimum content for the required instruction. We believe also that great good is being done through the work of junior patrols in the elementary schools.

Community Safety Programs

To reach those more mature persons, we look for some hope from the State Safety

Commissions, coordinating bodies that aid in planning and organizing local safety groups.

These community groups comprised of various influential leaders in civic, educational, and commercial affairs, occupy a strategic position, as they are most familiar with local problems.

Press and Radio

Our press and radio have been cooperating fully in spreading the gospel of safe and sane driving. While the benefits of their generous efforts cannot be definitely measured, there can be no question that many lives have been spared and incalculable wealth preserved by those influenced through these media.

Statistics

Since the creation of the system of pooling state-wide information in all traffic accidents in 1929, we have steadily accumulated facts of significant importance which must be fully understood before plans for a practical reduction of accidents can be intelligently laid out.

The primary function of our Bureau of Statistics in the State Department of Motor Vehicles is to assemble facts and make deductions. We try to present exact measurements only on such matters that lend themselves to most general improvement. We are not concerned in presenting entertainment or sensational data.

Engineering

Much has been done and more is planned by our highway engineering organizations.

In the general plan, grade and curves are being corrected, bottle-necks eliminated, underpasses built, highways widened, and progress continually made as funds are available. We strongly urge multiple line, divided highways with under or overhead passes. Many such roads are now in use and practically eliminate serious accidents.

Enforcement

Problems of enforcement are manifestly most complex, and the modern traffic officer must know more than speed laws.

It is necessary that he be honest, have good judgment, be competent to handle a motor vehicle, that he have a thorough understanding of the motorist's problems, that he be a psychologist, that he know not alone motor vehicle law, but the legal rights of citizens, the law of arrests. The traffic officer must know how to apply first aid, be courteous but firm, be fearless and know how to handle his accoutrements with discretion, and in numerous other ways be able to render service.

Speed

Under existing conditions, we find that excessive or uncontrolled speed causes a large majority of deaths on the highways. While we cannot truthfully state that speed is the cause of the greatest number of accidents, uncontrolled speed does enter into practically every serious accident.

A great and serious misconception still exists respecting the influence which high speed has in traffic crashes. A review of the statistics relating to the field survey made by the California Highway Patrol in the spring of 1936 tends to destroy some of the popular beliefs that most of the people are speed crazy.

This survey, conducted in 42 out of the 58 counties in the state, determined that only a small percentage habitually drives at high rates of speed.

Eighty per cent of all vehicles checked were found to be traveling under 50 miles per hour, and approximately 94 per cent of all drivers were within the range limit of 55 miles per hour. In other words, only 6 per cent of the motorists were driving in excess of 55 miles per hour. However, this small minority is still the dominant influence in motor vehicle fatalities. This fact has been true consistently during the last 7 years.

Of 16,456 drivers who were involved in traffic accidents in the first six months of 1937, there were 12.5 per cent definitely charged with excessive speed for the conditions under which they were driving. In addition to this, 20 per cent of the drivers are known to have violated the right-of-way at intersections, chiefly by driving too fast under the conditions of time and place.

Of the 6 per cent found to be operating on the wrong side of the road, or who were crowded off the road, the factor of excessive speed again played an important part. This fact is also true of another 6 per cent of the drivers who aggravated the accident situation by improper passing.

Of the 5 per cent who are recorded as having been following another vehicle too closely, it is definitely known that they were driving too fast for conditions then existing.

All of these segregations would account for approximately 50 per cent of the total number of accidents. There are other segregations of the accident data which also involve speed to a definite extent.

California has what is known as the *prima facie* basic speed law, with a *prima facie* maximum limit of 45 miles per hour. Mechanical speed traps are prohibited and enforcement officers are required to work in distinctive colored equipment and uniform at all times; otherwise their testimony is incompetent in court when a violator of a speed law is being prosecuted.

We have found it most difficult to enforce a speed regulation under these restrictive laws. However, effective on July 1, 1937, we issued an order requiring the officers to stop all motorists driving in excess of 50 miles per hour and if conditions at the time warranted to issue a notice of arrest, otherwise a warning. At the same time we instructed the officers to speed up the slow-moving vehicles or cause the driver of such vehicle to give way to the right, or if necessary to get off the highway and allow faster moving traffic to pass.

In connection with this part of the order, I would like to suggest that serious consideration be given to a regulation which would insure traffic being able to operate at a reasonable speed on the main highways, regardless of grades.

If a definite regulation could be worked out, establishing a performance factor for motor vehicles, it would be a step in the right direction towards the reduction of accidents.

A motor vehicle, whether it be a commercial truck with a trailer or a dilapidated, worn-out passenger vehicle, should be able to negotiate a certain given grade at a minimum number of miles per hour.

For instance, the regulation could be set so that every vehicle on the highway would

be required to be able to travel at 20 miles per hour up a grade to 4 per cent.

If this could be established, it would reduce the hazard which now exists in many states which have hilly country. How often do we see a commercial vehicle having a designed capacity for five tons but trying to negotiate a grade with a load of six to ten tons and then have attached to it a trailer to which there is an equal amount of load.

Again, how many times have we noticed a worn-out automobile trying to go up a grade and holding back twenty to fifty cars, these cars being unable to pass on account of traffic conditions.

This subject is one which requires the coordinated effort of the manufacturer, traffic engineers and enforcement officers.

Our order regarding uniform speed of vehicles caused a great increase in the activity of the Patrol and when the statistics were compiled for the month of July, we found this to be the first month in two and one-half years where a reduction in the deaths by traffic accidents on our highways occurred. In comparison with July, 1936, July, 1937 showed a reduction of 31 deaths on the rural roads of the state. (July 1936—172 killed; July 1937—141 killed.)

This undoubtedly is proof that by efficient law enforcement directed at the control of speed and eliminating the excessive and reckless speed, a reduction in accidents and deaths will follow. We realize this is unpopular with a few motorists, but isn't it a reasonable price to pay for the saving of 31 lives?

Among other points which should be corrected is the popular belief that the novice driver, or one learning to drive, or the accident repeater is the great menace of the highway.

When these factors are carefully measured, we find that the new driver seldom has an accident and is one of the most cautious.

Throughout seven years, the accident repeater has constituted less than 2 per cent of the total who have accidents. Very often the repeater who has had as many as five accidents has been the victim of rather than the cause of the entire series. The repeater as a rule does not have serious trouble.

It is the thoroughly experienced, often well trained and able driver, who has been well qualified in a driver's test, but who, in a moment of capricious experiment of an in-

sant of neglect, figures chiefly in our growing mortality totals.

Out of 12,000 drivers involved in accidents during 1936, over three-quarters of them had eight years or more of driving experience and never a previous accident. Safety education does not touch this individual, because he will pay little heed. Physical restraint exercised by law enforcement is the only thing that will awaken him to his responsibilities.

Drunken Drivers

The problem of the intoxicated driver continues to grow unabated. Since 1929, the number of drivers who had been drinking and who were involved in accidents, has been multiplied more than four times, and the number of pedestrians who had been drinking has multiplied five times in California.

The enforcement of the vehicle laws respecting intoxicated drivers and pedestrians is one fraught with difficulty. It is seldom possible to detect intoxicated drivers before an accident happens to them. This is particularly true concerning the rural accident situation in which there has developed a continuously growing number of drunken driving cases. We have found it advantageous to station officers at strategic points on the highway and stop each vehicle. In this manner intoxicated drivers were apprehended and where such a system is operated, seldom does an accident occur. It is observed that on the first night or two of an officer's work, numerous arrests for intoxication are made and unless they change their location, in a few nights no arrests will result, neither will accidents occur.

Courts

Our courts are showing a splendid co-operating spirit with the law enforcement agencies and during the last year we accomplished a 97 per cent conviction on arrests made for drunken driving.

Through the combined action of the Department of Motor Vehicles and the courts, 16,231 persons had their licenses suspended for infractions of the drunken driving law.

Conclusion

We may conclude that the problem of highway safety is the responsibility of three

agencies of our social structure. In their respective order, we would name them as engineering, education, and enforcement.

Without the closest cooperation and the

fullest coordination among these three agencies, little can be accomplished toward the objective for which we have met here today.

Speed and Accidents

By ARNOLD H. VEY

Traffic Engineer, State of New Jersey, Trenton, N. J.

Too fast a speed for conditions, or haste, as a factor in the highway accident problem, cannot be solved or eliminated by the adoption of arbitrary, unreasonable and possibly unpopular measures.

We learned long ago that supposed correctives, based upon opinions rather than facts, have proven many times to be not the cure-all as was at first believed. Correctives so applied have many times directly or indirectly caused accidents rather than prevented them.

Let us therefore not make the same error in dealing with the problem of speed. Permit us first to study the problem carefully, obtain all the facts which may be reasonably obtained, weigh these facts, and then carefully put into operation a program about which there is reasonable assurance that the results will be favorable.

It is true that at times, in the absence of complete factual data, it is necessary to establish supposed correctives but in few instances is it not possible by cooperative effort to obtain at least fundamental facts which, when properly analyzed, will serve to point the way to the eventual proper solution.

So it is with the problem of motor vehicle speeds. At the present time, sufficient facts are not available to enable a positive and complete solution. For example, we do not know the speed in miles per hour of cars at the moment of impact in a sufficient number of accident cases to say with any degree of assurance that universal compulsory use of governors, adjusted for a maximum governed speed of say 50 miles per hour, would save an appreciable number of lives in a year's time to make such a requirement sound.

We do know, however, some of the fundamental facts of the problem—facts which

at best will not give a complete answer but which will point the way to the possible ultimate solution.

Many of these facts have been fully reported upon by the National Safety Council's Committee on Speed and Accidents. However, because of their importance and in order to initiate clear thinking, it is important that a few major ones be mentioned herein. They are:

1. That speed too fast for conditions is not a sole cause of accidents but usually too much speed or haste combined with other factors.

These other factors might include highway defects, vehicle defects, driver defects, as well as faulty actions on the part of the highway user, driver and pedestrian.

Alignment and topography of the highway and other physical conditions, as well as pavement and weather conditions, are also factors.

Visibility is an important factor, particularly when driving at night.

2. That data so far developed indicates a small minority (generally less than 25%) of the cars are driven faster than 50 miles per hour even in rural areas.

3. That unreasonable or arbitrary speed laws and regulations, especially those having low limits, are not obeyed, even by the majority, unless enforcement measures are sufficiently great to cause observance.

4. That there is no one remedy for the so-called speed accident.

5. That we are dealing with a transportation medium which no longer is a luxury but a necessity and we cannot therefore seriously interfere with the present day flexibility of the automobile without greatly injuring its serviceability.

What Can We Do About the Problem?

It is possible, of course, to mention and discuss a number of activities which might be initiated and which may or may not correct accidents involving haste. However, to list and discuss only those activities which will curtail or solve speed accidents and of course which are economically sound and within reach of our pocketbooks and, too, without seriously affecting the serviceability of the car, is at present a difficult if not impossible task because of the lack of sufficient scientific data.

From the data now available, however, it is possible to mention certain activities which, with a reasonable degree of assurance, might result in a curtailment of accidents. Such activities include:

1. Legislation.
2. Zoning.
3. Enforcement.
4. Education.

A discussion of these activities will, I am sure, be of interest.

Legislation

There has been a tendency during the past few years to improve speed legislation materially throughout the country. Many of the horse and buggy day speed requirements have been abolished and in their place there have been recent trends in many states toward the uniform speed provisions now included in the Uniform Vehicle Code. However, there is still room for improvement to the end that the speed laws of the country will be basically sound and uniform.

Although the present *prima facie* limits included in the Uniform Vehicle Code may be considered more flexible than absolute or fixed limits, it is believed, based upon experience, that absolute or fixed limits are less difficult to enforce and, too, more readily understood by the average motorist. It is consequently the opinion of the writer that more effective speed control can be had through the adoption of nationwide, absolute limits where the maximum speeds for urban and rural districts are sufficiently high to approximate the present day practices of the majority and where it is permissible through uniform methods of engineering and traffic investigation to not only determine but adopt speed requirements lower than the maximum limit. In other words, the top limit to apply in all cases, except where

speed zones have been established through uniform engineering methods and stated speed signs have been installed, designating the safe, critical speed for such areas.

Universal maximum speed laws would not alone eliminate the confusion which now exists but would also save many motorists present-day difficulties, as well as embarrassment.

Such uniform laws would likewise eliminate the necessity of erecting speed signs generally throughout the highway system, as the speed requirement under comparable conditions would be the same, except at those places or zones where stated speed signs lowering the maximum limit have been erected because of the existence of unusual or extreme potential hazards.

Zoning

Speed zones are generally considered to be locations on highways where, because of special or unusual conditions, it is advisable or necessary to amend either the *prima facie* limit or the absolute limit.

Their purpose is two-fold: First, to advise motorists of the safe maximum speed under favorable conditions for the particular district concerned. Second, to bring about a more general, voluntary observance of such speed, thereby decreasing to a minimum and enabling enforcement of laws on speeds too fast for conditions.

Speed zones may be established at intersection approaches as well as at approaches to curves and hill crests and other points of hazard but, generally, a speed zone consists of a section of highway through small community centers between rural areas. It is important when establishing speed zones that a reasonable and proper critical speed be determined through proper engineering and traffic investigation. The establishment of arbitrary speed limits for speed zones, based upon mere opinion rather than scientific investigation, often is in conflict with reasonable requirements as well as the judgment of the average safe driver. The consequent result, therefore, is a general disregard of such arbitrary limits, especially when they are low.

In Rhode Island, as a part of a comprehensive speed survey, studies were made of the speed of vehicles passing through areas controlled by advisory speed limit

signs placed along the roadside. The results of this survey were as follows:

Speed Limit	Per Cent of Violations
20 miles per hour	86.1%
25 " " "	68.7%
30 " " "	52.4%
35 " " "	38.6%
40 " " "	12.8%
45 " " "	10.7%

With reference to this study, the Rhode Island report said "It is very apparent from these figures that there is a wide difference in opinion between the state police, as evidenced by the limit set by the signs, and the judgment of the average driver of the road conditions as indicated by his actual speed, especially where the state police speed limits are low."

Early returns of more recent speed observations made by the Illinois Division of Highways in scattered municipalities in the Chicago metropolitan area indicate that approximately 63% of the observed traffic is traveling at speeds that are within the limit indicated on signs in the respective zones. These studies also indicate that where the speed limits are low, there is a general disregard on the part of motorists unless enforcement activities are sufficient to cause observance.

A preliminary breakdown of observed speeds in the respective, permissible speed ranges, indicates the following standard of observance in the different zones:

Speed Limit	Per Cent of Violations
25 miles per hour	91%
35 " " "	51%
45 " " "	15%

When determining critical or maximum safe speed values for speed zones, it is of course necessary to select a value corresponding to average daylight conditions. Motorists are then required, when necessary, to reduce speeds further for adverse weather, visibility and traffic conditions.

Also, speed zone values for a section of roadway are generally set for between intersection conditions and motorists are therefore many times required to reduce speeds further at specific locations such as intersection approaches, curves, pedestrian crossings, etc.

Critical speeds for speed zones may be determined by speed observations made over a reasonable period of time and where the speeds of a large number of vehicles are recorded. However, some departments rely almost entirely on the judgment of trained observers who ride over the locations concerned, pacing cars or groups of cars at different speeds, and then come to a mutual agreement as to the maximum value that is safe for average daylight conditions. It is recommended, however, that wherever possible, actual speed studies through proper engineering and traffic investigation be made.

The National Safety Council has prepared, in memorandum form, bulletins describing the methods of calculating critical speeds at intersections having obstructions to view and it is therefore unnecessary at this time to further discuss these methods.

There are, of course, a number of conditions which affect critical or safe speeds. These conditions include road conditions, vehicle conditions, skill and condition of the driver, traffic conditions, the average general practices of drivers, as well as light and weather conditions. Space will not permit a discussion of these conditions. However, it is apparent that they are all important factors when dealing with the problem of speed and speed limitations and therefore should be given careful study and consideration.

When there is no concentration of accidents along a section of roadway being considered for a speed zone, it is reasonable and proper to adopt a speed at which 90% of the vehicles travel, as the critical speed, assuming, of course, that the critical speed adopted is not in conflict with legal requirements. If there are unusual or hidden hazards or other conditions which cannot be corrected, thereby making a lower speed necessary, the value of the critical speed may be considerably lower than the 90% speed. Often such locations will show up through an accident survey as high-accident points.

Although the use of flexible progressive signal systems is not to be considered in the same category as speed zoning for critical speeds, such systems, when properly designed to permit uniform movement at reasonably safe speeds, represent an ideal method for speed control. Such signal systems have long been in use and there is a trend towards more extensive use along important roadways where there is sufficient

traffic both on the major road as well as at minor cross streets to warrant the installation.

An indication of the effectiveness of a properly designed and installed progressive signal system may be had from a comparison made in New Jersey of the speeds of vehicles in per cent of running time, 30 miles per hour or more, when operating, first, under a direct simultaneous system and, second, under a progressive system along the same section of roadway.

The comparison is shown in the following table:

PER CENT OF RUNNING TIME—
30 MILES PER HOUR OR MORE

Miles Per Hour	Direct Simultaneous System	Flexible Progressive System
30-33	64.4%	92.8%
33-36	25.3%	7.2%
36-39	9.7%	
39-42	7%	

The above tabulation clearly illustrates the favorable results of a properly designed and operated progressive signal system in the control of speed.

Enforcement

Information obtained by the National Safety Council's Committee on Speed and Accidents on enforcement practices in cities and states, indicates that most present-day

enforcement still is directed at speeds that are five to 10 miles per hour above legislative limits, with some departments making arrests only after such limits are exceeded by 20 miles. A further study of the data indicates there is better enforcement in jurisdictions where speed zones and limits have been adapted to the conditions. In other words, at locations where speed limits were determined by facts and not opinion.

Unfortunately, it is impossible to measure accurately, from an accident reduction standpoint, the value and effectiveness of enforcement campaigns directed against speeding as, invariably, such campaigns not only correct or curtail excessive speed practices but also eliminate or decrease other improper driving practices which either singly or in combination with "too fast a speed," cause accidents.

We do know, however, that reasonable and continued enforcement activities produce favorable results and it is the opinion of the writer that such enforcement intelligently conducted, coupled with sound speed regulations, will prove most effective in the proper control of speed.

Education

Educational campaigns directed towards sound driving practices will likewise prove helpful. The education of young prospective drivers attending our secondary schools, in the matter of proper highway use, including safe operating speeds, is the most fruitful educational effort for highway safety in the future which we can enter into today.

TUESDAY MORNING SESSION

October 12, 1937

THE DRINKING DRIVER

The session was called to order by William C. Knoelk, General Chairman, Street and Highway Traffic Section, who presided. The address prepared by W. A. Gabrielson,

Chief of Police, Honolulu, Hawaii, was read by C. F. Van Blankensteyn, Michigan State Police, Lansing, Mich., in the absence of Chief Gabrielson.

Report of Committee on Tests for Intoxication

Judge Harry H. Porter, Chief Justice of the Municipal Court of Evanston, Ill., and Chairman of the Committee on Tests for Intoxication, summarized the report of this committee. The report, with the exception

of the appendices, will be found at the end of the Street and Highway Section of this volume. The complete report in pamphlet form may be obtained from the Council's Bureau of Information.

The Influence of Drunk-Driving

By W. A. GABRIELSON

Chief of Police, Honolulu, T. H.

Most traffic experts tell you that there are three fundamental factors toward the making of safer traffic. They are the three E's, engineering, education and enforcement. I wish to add another conception of engineering; that is, engineering of the automobile. By that, I mean the ability of an individual to operate properly.

To drive an automobile properly, the operator must exercise undivided attention and judgment. Lack of good judgment causes most of our accidents, along with a little lack of courtesy.

Accident Opportunities Increase

Every day and every month, we see more new automobiles upon our highway. Every day and every month, there is a new group of drivers. Each year, automobiles are made to travel faster. Our highways are improved so that greater speed can be attained with safety. Obstructions, sharp curves and dangerous locations are being eliminated. We are nearing the perfection of perfect automobiles and perfect roads, but we are now faced with a problem that is most perplexing to the police department: The person who is a very poor driver, and the person who drives while under the influence of liquor, who wilfully kills or maims, causing untold suffering.

How are the police going to stop drunk driving? My answer is, better trained officers, better laws and more severe punishment. Now, just what constitutes a drunken driver, or a person under the influence of liquor?

Quoting from the Medico-Legal Society, January 26, 1928, and the Police Journal, Volume IV, 1928: "Attempts have been made to define drunkenness, both from a scientific and statutory aspect. A committee to the British Medical Association, especially formed to consider the question of the definition, defined it as follows: 'That the word DRUNK should always be taken to mean that the person concerned was so much under the influence of alcohol as to have lost control of his faculties to such an extent as to render him unable to execute safely the occupation in which he was engaged at the material time.'

"Our Law, as well as the English Common Law, considers and implies that being drunk is within the experience and comprehension of every man; that it is an ordinary object uncertain of existence, just like a wet day or a badly-cooked meal; and that, as such, it deems drunkenness not as being incapable of definition, but as not requiring definition."

Declared a Crime

Gordon Wilson, M.D., in the Police Journal, Vol. I, No. 4, October, 1928, says, "... The law considers that his condition of being drunk is one so likely to cause anti-social consequences in certain circumstances that it has enumerated these circumstances and enacted that to be drunk in these circumstances is a crime."

The U. S. Army defines drunkenness as "any form of intoxication which is sufficient sensibly to impair the rational and full

exercise of mental and physical faculties." The "mental faculties" are "knowledge of time, place, dates, memory and intelligent response to questions." "Physical faculties" include "speech, muscular control, walk, bearing, balance, sight and perception."

These are two very good definitions of "intoxication," but it is essential that evidence be presented to the courts, and presented in an intelligent manner, so that the judge or jury will know the degree of intoxication of the driver.

Public Sentiment Needed

One solution to the drunk-driving problem is building up public opinion against the ruthless killer by using the newspapers, service clubs, parent-teacher associations and schools. Public opinion can be moulded on to the side of law enforcement officers if properly presented.

A great deal of stress should be laid on the mechanics of the automobile. If the brakes are inefficient, that machine is a potential instrument of death far greater than a racketeer with a "tommy gun."

If the driver is careless or under the influence of liquor, the danger increases.

When the machine is not in good working order, and the driver is under the influence of liquor, what chance has a person driving along the highway of avoiding being struck by such a weapon?

Why do we test drunken drivers? Drunken drivers are tested so that these examinations can corroborate the arresting officer's testimony and to test the degree of his intoxication.

All the policemen in the world cannot stop drunken driving. That result has to come from that individual and from his fear of the consequences. Insurance companies are doing very good preventive work in their educational program and by not insuring persons convicted of driving while drunk.

Honolulu is most fortunate in having a law which makes it compulsory for the judge to revoke the driving license of one convicted of driving while drunk. When that license is revoked, the offender cannot apply for a new one until a year from the revocation date.

In addition, Hawaiian law requires that he

must then secure public liability insurance before he can again apply for license. The amount of public liability is set at \$10,000, and property damages at \$1,000. Few insurance companies will underwrite the public liability of a person who has been convicted of driving while drunk. This practically eliminates many of our drunken drivers forever. We have the necessary machinery to see that this law is rigidly enforced. Eighty-five per cent of those charged for driving drunk were convicted during 1936.

Why do drivers of automobiles get drunk? It is all voluntary on their part. Many of them do not wish to, but being weak, indulge in too many drinks. When they start to drive home, the air affects them, and many times they are almost completely "out." There are a great many cocktail parties nowadays, in which the guests leave quite under the influence of liquor.

It is not the question of how many drinks a driver can endure before he becomes incapable of operating his car. A small quantity of liquor can have a definite, traceable effect upon his mental and physical reactions. Drink gives many persons a false confidence which, if manifested at the steering wheel, lures them into taking spectacular chances which would appall them when sober.

Marginal Cases

One of the police problems is the "borderline case" which is just as dangerous as a man who is 10% more under the influence of liquor. The borderline case is the one who takes chances, who speeds as a rule, and who will drive fast and cut in and out.

It has been our practice to charge such persons with heedless and reckless driving. Some judges have held that in a borderline case, if that person is charged with heedless and reckless driving, the fact that he has been drinking is sufficient evidence to convict him.

The drunk driver does not come from any special class, but from the best citizens down to the lowest classes. If public opinion is so moulded and an educational program is so perfected that it will show all drivers what dangers and sufferings they may cause, it will be one way of stopping some of the careless who have a disregard for other people's rights.

Handling the Case of the Driver Who Has Been Drinking

By HON. KING S. WILLIAMSON

Judge of Corporation Court, Dallas, Tex.

The automobile driven by the ignorant, incompetent, negligent and drunken drivers constitutes America's public enemy number one. This menace is controllable through the sound engineering, intelligence, strict impartiality by just enforcement and continual well-planned educational campaigns for the public. It is my opinion that the greatest of these, however, is enforcement; because as the enforcement index goes up, accidents, injuries and deaths go down.

The type of enforcement needed can only be had when all enforcement agencies, properly trained in and by scientific knowledge and experience, recognizing their full responsibility to nation, state and community, armed with uniform laws of the city, state and nation and supported by honest public opinion, join forces against the common enemy.

Much could be accomplished immediately by bringing a realization to the judiciary and lay its full responsibility and duty. There are able, powerful allies that have not yet been, as a whole, interested or organized in the war of public safety. The bench and bar have always been, and are now, one of the strongest moulders of public opinion, a most recent example being the Supreme Court issue. The profession is directly interested as a profession and individually as they try, prosecute and defend in all traffic cases and have much to do with the enactment of the laws. It is true that many judges and lawyers are now interested and working as individuals but we must have the bench and bar as a whole.

Much can be accomplished through the elimination of the above named dangerous drivers from the highways and streets by judicial decree and the suspension or revocation of the driver's license.

The greatest hazard, in my opinion, of all drivers, is the drunken driver. The public highways at best are avenues of danger. People are prone to err. Automobiles are not mechanically perfect. Accidents occur on the public highways when drivers are perfectly sane and sober. The brave recklessness and physical and mental deficiencies of the drunken driver adds in no degree to

the safety of the public. The problem is, and will continue to become, more serious because of the legalization of the sale of hard liquor and likewise more complicated. The number of drunken drivers has been more than doubled. There has not yet been time for the appeal for today's youth to develop into the pre-prohibition drunkard.

All men cannot be strong; some can and do overcome the temptation of drink; others cannot. Intoxication deprives a man of his sense of reason. In this weakened moment the drunken driver violates the law. Under such circumstances, is he a criminal? Should courts, who must view the situation from the standpoint of the defendant, classify him with the hijacker, the thief and the murderer? The offense he committed is prohibited by law, and his state of mind is not recognized by the law as a defense, but only in mitigation of punishment. Courts are unbiased, dealing in such cases, with violators of the law, on the two cardinal principles of law—"to punish the offender and deter others from committing like offenses." So in dealing with drunken drivers courts must consider the evidence and the offense charged and the defendant should be dealt with, therefore, in a manner to keep him within the law. Year by year the number killed and injured by drunken drivers is rapidly growing. A drunken driver can murder with a 100 horsepower car the same as with an automatic revolver, machine gun or cannon and every drunken driver is a potential murderer.

Every judge, prosecutor and peace officer in the investigation, preparation and trial of a drunken driver's case should remember his oath of office and recognize his full responsibility to the enforcement of the law, and remember that in order to obtain evidence a proper investigation must be made. A careful preparation of the case and a fair, impartial presentation of the case should be made before the court. May I say here, out of 23 years' experience, that cases are won or lost in preparation.

The criminal fears federal prosecution because of the perfect investigations and impartial administration of the law.

We know there are two types of drunken

drivers: One has imbibed to such an extent that he has become horizontal and is apt to park and go to sleep. The other is the fellow who thinks he can "take it" and imagines himself capable of doing the impossible. That, many times, is when something happens.

Unfortunately, this is the type of driver that is hardest to convict. The offense of intoxication has long been recognized as a crime by the law and convictions have been easy to obtain. Driving while intoxicated came with the automobile and in most jurisdictions is a felony, but because of the sympathies of courts, juries and the public generally, as well as a lack of a full realization of the seriousness of the offenses and properly trained officers who conduct the investigations, it has come to its present seriousness. The issues usually are the date, the place, whether the defendant was intoxicated, and the degree, whether he was driving the car and whether it occurred on a public street or highway. The investigation, therefore, should be a careful examination of the driver as to his condition with the full anticipation of the usual defenses in this type of case used by the defendant, in mind; as to his mental and physical condition and as to the physical facts.

Records should be prepared and, where possible, pictures should be taken and medical tests made. The investigation should be conducted as fast as possible, but always using sufficient time to complete it because a little time may make considerable difference in sobriety. The names, addresses and statements of all witnesses should be taken immediately, before any damages are paid, or the symptoms of time and sympathy get to work. It is as much or more the witness' duty to enforce the law as it is the officer's, who, in reality, is only the instrument of enforcement. The proper investigation should cinch the case as to facts.

The case should be carefully prepared for trial, and as soon as possible. Time is a great aid to the defendant. The officers should submit their investigations and all information to the prosecutor, then, together if possible, they should interview all witnesses and make a careful examination of the physical evidence. In this preparation it should be easily ascertained as to which was the proper action to file, that of driving while intoxicated or reckless driving, the idea being to punish each drunken driver

through law enforcement. Thus the jurisdiction and venue is settled. Then from the information the prosecuting attorney should draw the complaint or indictment, carefully checking dates, places and the technical verbiage of the pleading. A smart prosecutor is not going to trial until he has his case carefully and fully prepared.

As to the presentation of the case: First be sure your case is prepared and that all of your material witnesses are present before your announcement of ready. You had better continue the case than take a chance. You are prosecuting for a serious offense. If a jury trial, be sure that every jurymen is of open mind, has the ability to understand the case, a feeling of moral responsibility and subject to no outside influence.

Be careful to see that all legal formalities are complied with. Build your evidence in strict concordance with the facts in the case. Prove your case by proper questions, do not give the defense a chance to make many objections and directly or indirectly sell the jury that the defendant is being prosecuted although he is a very good man or the usual defenses used in like cases. Prove your statutory case beyond any reasonable doubt, then rest. I believe it is a good idea to save some strong witnesses for rebuttal. You may need them.

So far as possible it is my opinion that it is best to prove your case, at least your general facts, by witnesses other than the arresting officers and let the officers corroborate rather than establish the facts. An officer should always remember that he is the best witness when he testifies truthfully, answering questions as briefly as possible, but clearly without any degree of interest, but with a dignity that speaks louder than words his intention to enforce the law impartially. The court's charge should be carefully checked for error.

If the case is tried before the court it should be presented as fully in each detail as if it were a jury trial. The court is entitled to know, and should know, all the facts in order that his decision will be just. The court has the responsibility of fair and impartial trials and without fear of favor to enforce the law. His rulings should track the law and be clear. If not positive of the rule of the issues at bar, in my opinion, he should satisfy himself before making a ruling. A few minutes' delay may save a reversal.

The court should cooperate with the prosecution in the prompt setting and trial, in using his full power in the enforcement of the law and that the guilty be punished. He should keep ever in mind that it is his duty, and he is required, to give the defendant a fair and impartial trial. He should, after cases are tried, advise with the prosecutor and the officers in the discussion of mistakes made and should use his best offices to assist in an educational way in imparting germane legal knowledge to all enforcement officers. After the verdict, and before and

during the sentence, he should advise the defendant as to the seriousness of his crime. This has much influence on the defendant at the particular time and those in the courtroom, both spectators and reporters, possess ears.

His is a great responsibility—a protector, yet a corrector. He is the physical symbol of the majesty of the law. And unquestionably much in law enforcement rests upon his shoulders because after investigation and the presentation of the case, it is the court's judgment that enforces the law.

Chemical Tests for Intoxication

By R. N. HARGER

Professor of Biochemistry and Toxicology, Indiana University School of Medicine, Indianapolis

Conditions surrounding an automobile accident frequently make it difficult to obtain reliable information relative to sobriety, since the person involved may behave abnormally even when he has not been drinking. This all too often is used as a successful defense for definitely intoxicated drivers. The American Medical Association committee, appointed to study problems of motor vehicle accidents, has made the following statement: "Since it is impossible to diagnose drunkenness adequately—drunkenness from the symptoms alone—it is important that the chemical observation of the blood, urine, saliva or breath for alcohol be used to confirm obvious intoxication."

Chemical tests for intoxication are not particularly new. Most of the fundamental principles upon which they are based were known at least 25 years ago and some were discovered as much as 100 years ago. Tests using blood samples are now being employed in a number of European countries in connection with automobile accidents. They have been official in Sweden for several years where chemical tests for intoxication were first actually used.

These tests are based upon two fundamental principles. The first is that the degree of intoxication is closely proportional to the concentration of alcohol in the brain and higher nerve centers. Most people show beginning intoxication when the brain alcohol

reaches a figure of about one and one-half parts per thousand by weight, which is the alcohol equivalent of about six ounces of whiskey circulating in the body. These symptoms increase with increasing concentration of alcohol until, at five parts per thousand, all subjects will be "dead drunk."

This may seem to contradict the fact that some people "carry their liquor" better than others. The reason for this better handling of liquor is that these individuals usually get rid of their alcohol faster than other people and, therefore, require a larger quantity to obtain the same concentration in the brain.

It has been shown also that lower concentrations of body alcohol, even down to three quarters parts per thousand, are sufficient to render most people unsafe automobile drivers, since this amount of alcohol greatly increases the "reaction time"; that is, the time required for the muscles to obey the brain.

The second principle is that it is possible to predict the concentration of alcohol in the brain from the concentration of alcohol in the blood and other parts of the body. Experiments in our laboratory were made upon dogs which had received various doses of alcohol. These were killed at periods ranging from fifteen minutes to twelve hours after receiving the alcohol. The experiments showed that, at all times, brain alcohol could

be predicted quite accurately from the alcoholic content of the blood and liver, and, after a period of one or two hours, from muscles and even from the stomach and stomach contents.

Urine, saliva and breath may be used for predicting brain alcohol, since there is a constant relationship between the alcohol in the brain and the alcohol in these substances. Since these, as well as blood and spinal fluid give essentially the same information, the choice of material will largely depend upon which of these is more convenient to obtain.

Of the five substances, spinal fluid is undoubtedly the most difficult to secure and its use would appear to be ruled out in actual practice. It has been demonstrated that spinal fluid has no advantage over the other body materials.

The drawing of blood specimens requires the service of someone trained in this work which frequently necessitates a long delay before such a person can be obtained. Furthermore, drawing of blood means puncturing the skin and perhaps inserting a needle into a vein. While these procedures are generally harmless, there is always a remote possibility of subsequent infection. Then too, there is the legal question as to whether the state has a right to demand such specimens.

As for urine and saliva, these are undoubtedly much easier to obtain than spinal fluid or blood. However, Southgate and Carter of England reported that, in their experience, an intoxicated individual frequently will not, or cannot, urinate when requested. In some police departments a special urinal is provided which drains into a bottle outside of the cell. With this device, it is stated that a specimen can usually be obtained within one-half hour to an hour.

Obtaining breath specimens would appear less difficult than securing specimens of the other four substances.

A large number of analytical methods have been developed, and most of them give very satisfactory results. Maurice Nicloux published his method as a Doctor's thesis from the University of Paris in 1900. The majority of alcohol test methods in use today are modifications of the Nicloux method. In this country the procedures used by Heise, Bogen, Muchlberger, McNally and one recently published from our own laboratory represent modifications of the Nicloux method. All of these give satisfactory re-

sults, the modifications being largely in an effort to save time.

The method of Professor Widmark of the University of Lund, Sweden, which was first published in 1914, has been very widely used in Europe. This is really a modification of the Nicloux method. While the method is somewhat time consuming, it appears to give excellent results.

Another procedure consists in oxidizing the alcohol by means of acid dichromate and then distilling off the acetic acid and titrating this acetic acid. It was first described by Bechamp of France in 1879. This method was revived some years ago by Dr. Gettler, Coroner's Chemist of New York City, and has been used quite extensively by him and some other workers in this country. This method is open to the objection that body materials frequently give a rather high blank and this blank is somewhat variable.

The use of breath, first proposed by Emil Bogen in 1927, has appealed to us as offering a practical possibility along this line. When the body contains alcohol, a little of it is passed into the breath and the concentration always bears a fixed ratio to the concentration of alcohol in the blood. One fluid ounce of blood will contain about the same amount of alcohol as 2,000 fluid ounces of breath. As the alcohol in the blood increases or decreases, the alcohol in the breath also increases or decreases to the same extent. This is an application of Henry's law.

Research conducted in our laboratory has developed a new reagent for alcohol which consists of a solution of permanganate in a mixture of sulphuric acid and water. This gives a pink fluid which will absorb alcohol from the air or breath and which loses its pink color after a certain amount of alcohol is absorbed. This fluid is not affected by normal or diseased breath, nor by the breath odors coming from onions, garlic, sen-sen, etc.

A fixed composition of the fluid will be made to lose its color by a definite amount of alcohol so that this reagent can be used to determine how much breath contains a certain amount of alcohol. This volume divided by 2,000 should give the volume of blood containing the same amount of alcohol. Dr. E. B. Lamb and I have conducted tests on several hundred individuals at the Indianapolis City Hospital to see if this method does accurately predict blood alcohol and we find that it does quite satisfactorily.

If the subject will not, or cannot, blow his breath into a suitable container, the breath may be sucked through the apparatus by means of a pump so that it is possible to carry out this test without even touching the subject. We feel this has considerable advantages from a legal standpoint, since this procedure simply substitutes a chemical "smeller" for the policeman's nose. The latter procedure is accepted in practically all courts. We might add that the odor of the breath of one who has been imbibing is really due to the flavoring matter of the liquor rather than the small amount of alcohol present. The policeman's nose is unfair, since liquors vary enormously in their content of flavoring material. In fact, a person may be deeply intoxicated from alcohol alone with a breath that is not abnormal, even to a seasoned policeman's olfactory sense. Such breath, however, will rapidly remove the color from the pink solution.

Instead of measuring the volume of breath, we usually determine the amount of carbon dioxide in the specimen, since true breath constantly contains about five and

one-half per cent carbon dioxide by volume. This procedure adds to the accuracy of the method. The time required for this test should not be more than five minutes.

Our method will even detect whether a person has consumed a very moderate amount of alcohol such as is contained in one glass of beer, but in this case the quantity of breath necessary to remove the color from the pink fluid is many times greater than would be the case where the person is called intoxicated.

Almost any body material is suitable for estimating the amount of alcohol stored in the body and there are a number of satisfactory analytical methods, the choice of which will vary with the analyst. These chemical tests are not intended to replace or exclude evidence obtained by eyewitnesses, but they will give definite additional information which is often sorely needed. Such tests will exonerate the non-drinker, and even the mild drinker, and they will show accurately the concentration of alcohol in the drinker's brain.

TUESDAY AFTERNOON SESSION

October 12, 1937

JOINT SESSION WITH INSTITUTE OF TRAFFIC ENGINEERS

The session was called to order by Professor Roger L. Morrison, of the University of Michigan, president of the Institute of

Traffic Engineers, and vice-chairman of the Street and Highway Traffic Section, National Safety Council.

Engineering the Vehicle for Safety

By W. S. JAMES

Chief Engineer, the Studebaker Corp., South Bend, Ind.

The automotive industry knows that no one wants to buy or drive an unsafe car and, although standards of safety are constantly changing as roads, traffic and driver habits change, it has always kept abreast of

these changes. The interest of the automotive industry in safe cars has been demonstrated by its development and adoption of such safety improvements as four-wheel brakes, safety glass, lower centers of

gravity, all steel bodies, tougher tires, safety steering and "smooth" design of exterior and now interior.

These safety features have not only been brought to a commercial stage of development, but are still being constantly improved. Brakes have been made more uniform in their action; the effort needed to apply them lessened, the need for adjustment reduced and the life and uniformity of the brake lining greatly improved.

Safety glass has been improved by eliminating discoloration from sunlight, and the adhesion between the glass and the center layer of plastic has been made almost perfect. The center of gravity of cars has been lowered steadily and the tread widened until the cars of today can be tilted to almost unbelievable angles before they upset. All steel bodies have been made stronger, although lighter, by improvement in manufacturing methods as well as design until, today, they will withstand tremendous impacts and afford very substantial protection to the occupants in case of accident. Tires have been made tougher; steering safer. The important advances in these last two items particularly have not received the pub-

lic notice they deserve. They are typical of similar advances in many other elements of car design from a safety standpoint.

Not many years ago tires did not last more than 3,000 or 4,000 miles. At about this mileage they were very likely to blow out. This expression is very descriptive of what actually happened. Today tires will run from 5 to 10 times as far and, in addition, because of better construction and materials and being made much larger, the tires are permitted to deflect more and therefore can operate at lower pressures, 24 to 30 pounds. This means much longer periods of complete safety for the driver without attention to his tires.

Originally tires were made with square woven fabric where fibers crossed each other and chafed, wearing through. Now, cotton is made into cords which are built up in alternate layers with rubber insulation between. By this method there is no possibility of the cords stressed in one direction contacting cords stressed the opposite way.

Comparing the tires of today with those of the past, we find equivalent sizes to be as given in Table I.

Table I

Year	Size	Pressure	Section	Tread Contact Area—Sq. In.	Per Cent Increase Contact Area
1924	30x3-1/2	55 — 66	3.50"	11.70	
1930	4.75-19	32 — 36	5.20"	22.14	89%
1937	6.00-16	24 — 30	6.25"	28.05	140%

The present wide flat treads, of large contact area, 140 per cent greater than in 1924, provide traction, braking force and resistance to side skid, thus increasing safety to a marked degree. In any discussion of safety and tires, it should be remembered that the air in the tire carries the load. The greatest tire safety can be obtained by maintaining correct air pressures in the tires.

Steering, too, has been greatly improved in the last few years by the development of independently sprung front wheels and by the adaptation of "stabilizers" to solid axle designs. Although independently sprung wheels assume many different mechanical constructions, in all cases the relative move-

ments of the car frame and the wheels are definitely controlled by linkage. This has made it possible to connect the steering gear, which is fixed to the frame, to the front wheels so that relative movements of the frame and the wheels, due to spring movements or brake applications, do not change the steering angle of the front wheels. The importance, from a steady and safe steering standpoint, of the freedom of the steering connections from interference by spring movement and brake application can be understood when it is realized that at 50 m.p.h. a fore and aft movement of 1/4 of an inch of the steering knuckle ball may result in the car moving a foot to the side.

With the solid axle type of front suspension, it is very difficult to predict exactly where the steering knuckle ball will be at all times because of the sidewise and twisting flexibility of the springs which connect the frame to the axle. This difficulty is very greatly reduced by the use of a stabilizer bar which limits the twisting of the springs.

The development of independently sprung front wheels and solid axle types with a stabilizer bar has given a marked increase in security of steering and certainty of control on either rough or smooth road surfaces or under emergency conditions such as sudden tire failure. This is a very real contribution to increased car safety and still further improvements can be expected in the future.

Smooth design of both the exterior and interior of the car is a relatively recent development which makes cars safer if a collision does occur. It will probably be carried much further in the future. At present door handles and hood ornaments are no longer sharp. Instrument boards have fewer projections, and robe rails are soft.

Accurate estimation of future safety developments in automobile design is difficult. It is very likely, however, that some of them will arise from the list of questions which are at present highly controversial. One of these controversial questions frequently asked by safety-minded people is "Why are cars provided with engines capable of developing 80, 90, 100 or more horsepower?" Certainly not primarily to get high speeds. Engineers, in fact, have always sacrificed top speed in favor of acceleration and hill climbing ability at moderate speeds; and they have to compromise between the two every time they design a car. This tendency to compromise toward better moderate speed performance is stronger now than ever before.

As a matter of fact, what the engineer really is interested in is maximum torque, not maximum horsepower. The driving public doesn't understand what torque means, so the advertising departments can't be blamed for talking mostly about horsepower. Run over in the technical departments, where they lay out these engine designs, you will hear a great deal about torque and very little about horsepower. Here is why:

More torque or push at the rear wheels

means a car that is livelier and can climb hills more easily. The maximum torque of an engine is developed at moderate speeds, 20 to 30 m.p.h., where the driver most appreciates ability to increase speed rapidly. Drivers rebel at gear shifting for more rapid acceleration. They demand motor cars which, in high gear, will accelerate rapidly in traffic and will climb any hill our highways present. They expect engines not only to meet these requirements but also to operate without apparent effort and with no evidence of laboring at the moderate speeds at which traffic surveys show the vast majority drive. That is why engineers are primarily interested in torque rather than horsepower.

People sometimes ask: "Why are motor cars being equipped with more and more powerful engines?" The briefest answer to that is: "They are not." In actual fact the average horsepower has been practically constant since 1934. This can be seen from the figures given in Table II, which shows the average horsepower of the cars sold from 1930 to 1936. In these figures the number of cars produced by each manufacturer is taken into account.

TABLE II

Year	Horsepower of the Average Car Sold—Dynamometer.
1930	54
1931	57
1932	69
1933	71
1934	83
1935	84
1936	86

It will be seen that the trend was rather sharply upward during the first four years of this period but in the last three years average horsepower has been practically constant. This flattening out in the average horsepower is in accord with proving ground tests which show that top speeds have not been going up in the last four years.

Another question often asked is "How has the increase in horsepower affected car agility and top speed?" Available figures show that car agility has increased twice as

fast as top speed. This is shown in Table III. (The cars of 1930, 1933 and 1936 were selected because the figures in Table II, for average horsepower, group themselves

rather naturally into three periods of approximately equal horsepower: 1930-1931, 54-57 hp.; 1932-1933, 69-71 hp. and 1934-1936, 83-86 hp. inclusive.)

TABLE III
Maximum Per Cent Grade In High Gear

Speed	1930 Car	1933 Car	1936 Car	Per Cent Increase 1933 over 1930	Per Cent Increase 1936 over 1930
20	9.1	10.1	11.3	11.0	24.0
30	7.8	9.4	11.4	20.0	46.0
40	6.6	8.4	10.0	27.0	51.0
50	5.0	6.9	7.9	38.0	58.0
	69.0	77.0	82.0	12.0	19.0

Here we see that average agility or hill climbing ability from 20 to 50 m.p.h. has increased about 45 per cent while the top speed has increased only 19 per cent. No one who has driven a farm wagon or an old "model T" in today's traffic will question the feeling of added safety when driving an agile car.

The question may reasonably be asked "Why do the larger cars have to have such large horsepowers and such high top speeds?" The answer is that the same amount of agility for safety has to be built into the larger car as into the smaller one. The horsepower needed to drive a heavy car on the level road is not greatly different from that required for a light car, but to climb hills and accelerate like the engine horsepower of the large car must be considerably greater than that of the small car.

To illustrate this, let us consider two cars; one having a curb weight, with passengers, of 3,500 lbs. and the other, similarly

loaded, of 5,500 lbs. Having paid considerably more for his automobile, the owner of the heavier car is justified in expecting at least as good performance or agility in high gear at medium driving speeds as the light car provides. So, let us assume that both have the same performance and that the maximum grades they will climb in high gear are as shown in the following table:

TABLE IV

20 m.p.h.	12%
30 "	11%
40 "	10%
50 "	8%

These round figures are about representative of the high-gear, hill-climbing ability of cars in the last three years. For this hill-climbing ability the calculated power requirements of the two cars would be about as shown in Table V:

TABLE V

Speed M.P.H.	Maximum Grade in high gear per cent	Horsepower at the Clutch* 3500 lb. car	Horsepower at the Clutch* 5500 lb. car
20	12	25	40
30	11	37	37
40	10	48	74
50	8	57	87

*Horsepower at the clutch will run in roughly 90 per cent of the power output on the dynamometer.

If we adjust the horsepowers just given and complete the data by showing what normal engines capable of producing these powers at speeds of 50 or less miles per hour would develop at higher road speeds, we get the comparison given in Table VI.

TABLE VI

Speed in M.P.H.	Horsepower	
	3500 lb. Car	5500 lb. Car
20	28	44
30	41	63
40	53	82
50	57	97
60	70	111
70	72	121
77 Max. speed		
80		123
90		114

These figures indicate that the cars must be generously powered to give the kind of high gear hill-climbing and acceleration drivers want. The difference in power requirements occasioned by difference in weight is particularly noteworthy because it will be recalled that both of these cars

have the same hill-climbing ability up to 50 m.p.h.

It should be noted also that both engines develop their maximum horsepower before maximum car speed is reached and the horsepower is decreasing as the maximum speed is reached. In the case of the smaller car, maximum power is developed at 70 m.p.h. whereas the maximum speed is 77 m.p.h. In the case of the larger car, the maximum power is developed at 80 m.p.h. whereas the maximum speed is reached at 90 m.p.h. This sacrifice in maximum speed is made deliberately to improve the moderate speed performance as previously discussed. By using a slightly lower reduction in the rear axle gears, the maximum speed of these cars could be increased, but it would be at the expense of performance at moderate speeds. Of course, moderate speed performance could be improved and top speed reduced by using larger reductions in the rear axle gears. But higher engine speeds, with the accompanying increase in noise, vibration, fuel consumption and oil consumption, introduce practical limits in this direction.

Now, let us examine the power required to drive these two cars on a level road at various speeds as shown in Table VII:

TABLE VII

Speed M.P.H.	Power required to drive		(Adjusted to dynamometer values)
	3500 lb. car	5500 lb. car	
10	1.4 H.P.	2 H.P.	
20	3.7 "	5 "	
30	7.6 "	10 "	
40	14 "	17 "	
50	23 "	28 "	
60	36 "	42 "	
70	53 "	61 "	

It will be observed that it takes but very little more power to drive the heavy car at a given speed than it does the light one. At 70 the difference amounts only to 8 hp. and at 50 m.p.h. to but 5 hp. On the other hand, it will be recalled it took 40 more hp. to give the heavier car the same hill-climbing ability at 50 m.p.h. as the lighter one. The reason for this disparity is that the power required for hill-climbing varies directly with the weight, while the power required to drive the car is increasingly determined by the wind resistance as the speed goes up.

Because the heavy and light car will have substantially the same projected frontal area, their wind resistance will be substantially the same. Consequently, the power required to drive a heavy car is not materially larger than that required to drive a light car. The result is that, because of the considerably larger power which the heavier car must have to climb hills as well as the lighter car, the top speed of the heavy car is raised materially. Specifically, in the case of the two hypothetical cars under consideration, they both have the same hill-

climbing ability up to 50 m.p.h. but for the reasons just outlined, the heavy car can go 90 m.p.h. as compared with 77 m.p.h. for the lighter car—a difference of 17 per cent.

Another very controversial question at present is "What can be done about speed too fast for conditions?" There seems to be rather general agreement that proper education of the driving public and proper enforcement of regulations will be effective in keeping speeds proper for conditions.

These remedies are not of an engineering nature and need not be discussed here. The use of governors or other mechanical devices has been suggested but there is not sufficient information available to decide definitely whether or not their use would be helpful in maintaining proper speeds for safety. Satisfactory devices of this nature can, without doubt, be made to limit the maximum speeds of cars without the difficulties present in the available types. It would always be difficult for enforcing officers to be certain that the devices were in proper adjustment. Their use would increase traffic congestion as it would markedly increase the distance required to pass when cars were being driven near the governed speed.

For example, if a car traveling 45 m.p.h. were overtaken by another car traveling 60 m.p.h., a clear road of at least 600 feet would be necessary. Although a great deal of work is now being carried on to determine the actual effect of speeds on accidents, there is still too meager information from which to draw conclusions. It is rather apparent, however, that no matter what speed limitations are imposed, cars can always be driven too fast for some conditions. The investigations now in progress may throw light on how frequently the speeds too fast for conditions are high speeds or low speeds.

Another controversial question often asked

is "Why have car manufacturers reduced visibility with long hoods, thicker posts at the side of the windshield, lower seating fronts and lower roofs?" In actual fact, the reduction in visibility over the last ten years is not nearly so great as most people think.

The question is often asked, "Why not put the engine in the rear and move the driver farther forward to increase his vision of the road?" There is insufficient experience with passenger cars of this type to answer this question adequately. Without doubt he could see more of the road close to the car, and the number of dented fenders would be reduced. There is some question as to whether or not the driver should watch the road too close to the car because at 40 m.p.h. he is moving about 60 feet per second. The change in engine location would probably not materially reduce the size of the front corner posts.

Many drivers might not like to be so far forward in the car as, in case of what is now a minor collision, they might be more seriously injured. The question of proper weight distribution for safe handling and a possible reduction in rear vision are in a debatable stage. The moving of the engine to the rear of the car would involve such a radical change in appearance that many people would prefer a more conventional design for some time to come.

The pros and cons which arise in connection with almost any question about motor design are well illustrated in the question we have just been discussing. The record to date of the automotive industry in reaching satisfactory solutions to questions of our safety appears to be very good, as accident statistics show considerably less than 10 per cent of all accidents are attributable to car defects. Cars of today are safer and more reliable than cars of yesterday. There is no question but that cars of tomorrow will be more reliable and safer than cars of today.

Engineering the Highway for Safety

By R. E. TOMS

Chief of Division of Design, U. S. Bureau of Public Roads

The highways of the United States as they exist at present represent the efforts of highway engineers to provide a large and continually increasing mileage of improve-

ments to meet the demands of rapidly expanding motor vehicle usage. The necessity of spreading a practicable degree of improvement as quickly as possible with limited

annual revenues over a large mileage of important highways—all in urgent need of improvement—forced a choice between long deferment of improvement on many of these highways, or of undertaking a more uniform up-building of the entire group.

Acceptance of the latter as the more feasible course has given the country a system of main highways improved in thousands of component sections each to a degree seen as imperative and practicable in point of cost at the time of its construction.

During this period of highway development the highway engineer was called upon to solve many problems of immediate concern that were created by the changing character of vehicles.

There was first the necessity for preventing the rapid disintegration of waterbound and gravel surface because of the loss of binder caused by the shearing effect of rubber tires in producing tractive effort.

Then there was the problem of providing road surfaces that were structurally strong enough to carry the loads moved over them. During and immediately following the world war a considerable mileage of improved highways were practically destroyed from the pounding of trucks equipped with solid rubber tires. Research undertaken by highway engineers in cooperation with tire manufacturers on the effect of impact on road surfaces largely was responsible for the development of the balloon tire which permitted an increase in the load carrying capacity of the vehicle without damage to the road structure.

From the researches also came the multiple axle feature of support which again added to the load capacity without damage to the road.

Construction technique also was concentrated upon the production of smooth riding surfaces to minimize the damaging impact from vehicle loads. The demand for the rapid extension of highway improvements focused attention upon the development of low cost dustless roads. Here again research and the application of knowledge pointed the way to practical solutions.

Practically all of these important problems had to do with the structural integrity of the road surface. It is no overstatement to say that these features of road design have been solved so that the highway engineer may proceed with confidence to design a road structure with assurance that it will

be wholly adequate for the controlled wheel loads.

In recent years there has been a sudden and marked increase in vehicle speed. This, combined with a greater usage of the vehicle itself, has caused an increasing number of highway fatalities each year. The average driver knows little and cares less about the strength of the pavement or the bearing power of the subsoil over which he rides. He accepts a structurally sound, smooth pavement surface as an accomplished fact, but he is very conscious of sudden curvature in the alignment or a lack of clearance between his vehicle and another and the speed at which it seems safe to travel.

All of these elements concern the geometric phase of highway design which in its broad sense deals with alignment, grades, curves, widths, intersections, etc.

To design or plan a utility intelligently, one must know the uses to which it will be subjected during its expected life. The essential elements that affect the adequate design of a highway are the speed, number, width, length and weight of the vehicles to be accommodated, and the safety, comfort and pleasure of travel to be afforded.

The width, length and weight of vehicles concern physical characteristics which largely have been controlled by legislation. The enforcement of legislative limits with respect to these characteristics generally is possible of accomplishment so that for any given set of conditions roadways may be provided with a reasonable degree of assurance that they will meet requirements. Construction technique has produced smooth highways that are comfortable to travel. Design and construction practice can produce highways that are as pleasing to the eye as they are comfortable to travel. Volume of traffic, speed and safety remain elements that must be appraised in design.

Volume is important only insofar as it affects congestion, the dangers that arise from congested highways and the number of traffic lanes required. The speed factor which largely has been disregarded in the past is a most important element in the design of safe highways. In effect it serves to control to a certain extent the width of traffic lane and to fix absolutely many of the geometric features of design, and it is upon the geometric features of design that safety of operation primarily depends.

What speed shall highways be designed

for? Highways constructed 20 years ago were designed for 30 miles per hour; now even the slow drivers are moving at 40 miles per hour and speeds of 50 and 60 miles per hour are common rather than the exception. There is no doubt that the trend in all transportation is toward higher speeds. The highway engineer cannot afford to disregard this trend. It may be assumed, therefore, that highways in average topography to be reasonably adequate for present and future usage must be designed upon assumptions that will permit reasonably safe operation at speeds of 60 or 70 miles per hour.

If the development of the vehicle should be curtailed or other undiscovered means found to fix a lower speed limit which could not be exceeded, there at least would be a very desirable factor of safety in such construction.

By designing for reasonably safe operation, higher rates of speed are not encouraged any more than on straight sections of highway. There is hardly a road of any considerable length in the flat and rolling sections of this country that does not have straight sections of varying lengths. A straight road with sufficient vision may be traveled at a speed limited only by the performance of the vehicle and the ability of the driver. The effect of designing for any given speed simply controls the maximum rate of curvature in the interest of safety without inviting the maximum speed.

Having determined upon the design speed it is incumbent upon the engineer to design all component parts of the highway so that it will be safe for travel at this speed. The inclusion of short sections of highway in which the curvature, sight distance or other details fall below the general standard constitutes a very serious fault.

If physical difficulties are encountered that necessitate the inclusion of substandard sections, then they must be adequately signed. An indication of the safe speed at such locations would be exceedingly helpful.

Granting that ample provision has been made to insure the structural integrity of the roadway surface, engineering the highway for safety consists essentially of providing ample width of traffic lanes and sufficient clear vision.

You need more space to go fast than you do to go slow. You need greater clearance between vehicles. There is also a greater reluctance of drivers to travel at high speed

near the edge of the pavement. The legal limit for overall width of trucks in most states is 8 feet. In order to provide adequate clearance we must provide traffic lanes not less than 11 feet wide for highways carrying a considerable volume of truck traffic.

The necessity for ample clearance on bridges is equally important. For reasonably safe operation the distance between curbs on bridges should be not less than four feet and preferably six feet more than the width of the adjacent roadways. Short span bridges and culverts preferably should permit the entire roadway width including pavements, shoulders and guard rail. Drivers then will be given no sense of constriction and shoulders will be available for emergencies at all points on the highway other than major bridge locations.

Sight distance assumes great importance in highway safety. This is particularly true on our two-lane highways, which constitute the bulk of our highway system. On a winding two-lane road fast moving vehicles frequently overtake slower vehicles. Head-on collisions and side-swipe accidents may be reduced by constructing highways so that impatient and careless drivers would be encouraged to remain behind slow moving vehicles until they see a sufficient length of highway clear of opposing traffic for passing. Obviously, such encouragement is not afforded on a highway with mile after mile of inadequate sight distances. On the contrary, such a highway will tend to encourage even a patient and careful driver to take a chance, especially after remaining behind a slow moving vehicle for one curve after another without encountering opposing traffic and realizing that passing could have been accomplished.

While it is desirable to construct highways with adequate sight distance for safe passing at all places the limitations of topography and right of way may make it economically inadvisable to do so. It is not absolutely necessary that every horizontal and vertical curve be designed with adequate sight distance for safe passing, but if safe driving is to be encouraged it is vitally necessary that sections of highway, in which a driver will see enough of the highway to know whether or not it is safe to pass a slower moving vehicle, are not too far apart.

On the basis of the foregoing it is evident that highways should be designed with

two minimum sight distances in mind; one to accommodate the passing of motor vehicles with safety, and one to be considered as a nonpassing minimum. A non-passing minimum sight distance should be encountered at all points on the highway. It should be at least long enough to permit a vehicle traveling at the assumed design speed of the highway to stop before reaching a stationary object in the same lane.

A passing minimum sight distance should be encountered at frequent intervals depending upon the topography, the assumed design speed of the highway and the probable density of traffic. The passing minimum sight distance should be sufficient in length to permit a vehicle to safely pass another vehicle, and preferably two vehicles, which are traveling at a speed of ten or more miles per hour less than the assumed design speed of the highway in the face of opposing traffic traveling at the assumed design speed of the highway. The desire to pass vehicles traveling ten miles an hour less than the assumed design speed is a reasonable one and should be satisfied.

There seems to be little advantage in increasing the minimum sight distance on existing highways or increasing the standard for minimum sight distances for new highways unless such increases provide the minimum sight distance sufficient for safe passing. This is particularly true on high speed highways.

Increasing sight distances by small amounts in excess of the non-passing minimums generally does not provide sight distances adequate for passing with safety and may make the highways more hazardous by encouraging vehicle operators to attempt to pass. It seems to be more advisable to concentrate expenditures on limited sections of the highway where topographic conditions make such changes feasible and improve these sections to secure sight distances adequate for passing with safety.

A brief discussion of non-passing sight distances may be worth while because of the belief that a considerable amount of data heretofore published on stopping distances at various speeds fails to take into consideration a very essential factor. Data heretofore published on stopping distances at various speeds have been predicated almost wholly on brake reaction time and brake resistance. A third element necessarily enters into this determination, that is, the time required for motor vehicle

operators to come to a realization that the brakes must be applied. If we term this the perception time, it may be defined as the time elapsed from the moment a stationary object becomes visible to the instant the operator realizes that the object is stationary. Under certain conditions operators will come to this decision almost instantly. Among these conditions are disabled vehicles with persons on the ground adjacent thereto, flares at night and flashing lights at night. Under most other conditions the operator must learn by subconscious association with adjacent stationary objects such as walls, fences, trees, guard rail, etc., that the object is stationary. This takes time. The amount of this perception time will vary considerably, depending upon the natural rapidity with which the operator reacts, the optical ability of the operator, atmospheric visibility, type and condition of roadway, type, color and condition of vehicle, etc.

At higher speeds perception time may be less than at lower speeds due to the fact that drivers are more alert and due to the rapidity with which the stationary object apparently increases in size, but the total perception reaction time should not be decreased for higher speeds due to the greater danger involved. An allowance for perception time moreover compensates for momentary inattention on the part of the operator.

Perception time, being discriminative in character, probably is much greater than brake reaction time. For most motor vehicle operators it is assumed to be two seconds, although this may be changed considerably when and if exhaustive scientific tests are made. In determining non-passing sight distances for various assumed design speeds, they should be predicated upon a total of three seconds for perception and brake reaction time, and a braking distance obtained by using a rolling coefficient of friction of 0.4, which is about the lowest obtained in tests on clean wet pavements. On these assumptions, the suggested practical non-passing sight distance which should be encountered at all points on a highway is approximately ten times the assumed design speed of the highway.

A safe passing sight distance is a function of the speed of the passing vehicle, the overtaken vehicle and the speed of the vehicle approaching from the opposite direction. If the differential in speed between the passing vehicle and the overtaken vehicle is

large the safe passing distance is much less than when this differential is small. It increases if more than one vehicle is to be passed. A vehicle traveling 40 miles per hour, desiring to pass another vehicle traveling 30 miles per hour in the face of opposing traffic traveling at 40 miles per hour, will require 1,200 feet of sight distance to pass one vehicle; 1,600 feet to pass two vehicles, and 2,000 feet to pass three vehicles. On the other hand, a vehicle traveling 60 miles an hour, desiring to pass a vehicle traveling 50 miles per hour with opposing traffic moving at 60 miles per hour will require 2,400 feet of sight distance to pass one vehicle; 3,200 feet to pass two vehicles, and 4,100 feet to pass three vehicles.

These distances are based on reasonable assumptions. It is obvious that we must revise our conception of sight distance if we are to provide highways on which overtaken vehicles may be passed with safety.

Horizontal curves which may be traveled safely at the assumed highway design speed frequently do not afford sufficient sight distance for a passing minimum. Except for comparatively flat gradients, it is impossible to obtain sight distance at the apex of a vertical curve sufficient to permit passing with safety at high speeds. It is practically a physical impossibility to provide highways with ample vision for safe passing at all points. There is much, however, that can be done to meet this situation that has not been done in the past. There has heretofore been but little conscious effort on the part of highway designers to provide safe passing sections at the speed at which highway travel moves at the present time. The fact that such sections are encountered on our existing highways has been due primarily to natural conditions encountered rather than to the efforts of the designer. Our highway designs in the future must be studied and worked out to avoid combinations of horizontal and vertical curvature which in effect, for mile after mile, deny the traveler an opportunity to pass.

Advantage must be taken of favorable topography at frequent intervals to provide safe passing sections, even if by so doing the design is made more costly. In rough topography favorable topography must be utilized to provide short lengths of widened road surface on which the slower moving vehicle would be directed to travel.

When two highways cross at grade and it is not desirable to subordinate the traffic

on one to that on the other a driver on either highway should be able to see the intersection in time to stop his vehicle before reaching the intersection and he should see enough of the intersecting highway to enable him to judge whether or not he should brake. A driver should see the intersection at a distance at least equal to the safe stopping distance. The length of intersecting highway visible at that point should equal, at least, the product of the time required for the vehicle to stop and the assumed design speed of the intersecting highway. Where this is not possible traffic on one road should be subordinated to that of the other by appropriate signs.

When traffic on one road is subordinated to that of the other it may be done by stop or slow signs. The intersection should be visible to a driver on the preference road in sufficient time to enable him in an emergency to bring his vehicle to a stop before reaching the intersection. The same applies to the subordinate road except that warning signs sometimes may have to be resorted to in lieu of sufficient visibility. When traffic on the subordinate road is stopped at the intersection, enough of the preference road should be visible to allow the driver of a stopped vehicle to determine whether he may cross with safety.

Slow signs indicating the speed at which vehicles on the subordinate road may approach an intersection may be used where available sight distance is intermediate between that necessary for nonpreference road intersections and that necessary for stop sign intersections.

The speed on the slow sign should indicate that the point where visibility opens is far enough in advance of the intersection to enable a vehicle traveling at the signed speed to stop before reaching the intersection and that the length of intersecting highway visible at that point is equal to the product of the time it will take to stop and the assumed design speed of the intersecting highway. The slow sign should be placed far enough in advance of the critical point to enable a vehicle traveling at the assumed design speed to slow down to the signed speed before reaching the critical point on the road.

At nonpreference intersections, sight distances less than those outlined above may not be extremely dangerous due to the possibility of a driver on one road slowing down to permit a vehicle on the intersecting

road to clear the intersection before he approaches it. The danger lies in the possibility of confusion between drivers. Both drivers may either slow down or maintain speed and thus approach the intersection simultaneously.

Danger also lies in the possibility of dense traffic or considerable turning traffic on one road making it necessary for traffic on the other road to stop. Sight distances less than stopping distance under such circumstances may end in disaster. No properly designed highway would have sight distance less than safe stopping distance at any point, intersection or otherwise, but inability to see an appreciable length of the intersecting highway may have as disastrous results as insufficient sight distance along the highway.

Where traffic increases to such an extent that safe passing sections lose their usefulness due to the fact that opposing lanes are generally occupied by traffic at the same time, congestion results and can only be relieved by providing additional traffic lanes. The three-lane highway is the product of economic necessity rather than a desirable objective. The extra traffic lane in theory is intended for passing purposes only. It is not always so used by traffic. It unquestionably is an invitation to traffic in opposing directions to compete for its use. Competition of this character is decidedly hazardous. Here again the ability to see is a fundamental requisite. The minimum sight distance for three-lane construction should not be less than the minimum safe passing sight distance for two-lane construction. For relatively high road speeds this sight distance is exceedingly large and difficult to obtain except in very easy topography.

A three-lane road with inadequate sight distance becomes nothing more than a wide two-lane road. There is no doubt that the three-lane highway increases traffic capacity, but unless topographic conditions are favorable every effort should be made to provide a four-lane highway with traffic in opposing directions separated by a neutral strip or parkway.

On four-lane highways a raised type of separation is decidedly preferable to a flush median strip for the separation of traffic flow. The width of separation of opposing lanes may be from 4 to 6 feet, or from 12 to 30 or 40 feet. It is almost impossible to maintain grass or ground cover in healthy condition in areas less than 8 or 10 feet in width. Narrow widths should be paved with

some form of material to reduce maintenance to a minimum. If the separation is paved, it must not be of a width great enough to permit the parking of vehicles.

Aids at Intersections

In addition to practically eliminating head-on collisions with opposing traffic, the four-lane separated highway may be designed to decrease the hazards at grade intersections. On heavily traveled four-lane roads it is almost impossible to obtain a sufficient break in traffic going in two directions to permit cross movement of vehicles without extreme danger without traffic control lights.

If the roadways are separated widely enough to provide a safety island, cross movement may be effected in two operations. A break in the flow of traffic in one direction permits a vehicle to be moved on to the pavement adjacent to the safety island, and the crossing is completed when there is a break in traffic in the opposite direction. For this purpose there should be a width of parkway of not less than 30 feet between opposing lanes of traffic. Such construction also affords a high degree of flexibility in permitting recreational and pleasure traffic to utilize the openings provided for cross movement for turn around purposes.

Other than traffic lights, adequate traffic circles, and grade separation structures, divided roadways with ample width of parkway offer the safest means yet devised for the movement of traffic across heavily traveled roads. On four-lane separated highways, it is not possible for vehicles to encroach on opposing traffic for passing so that the sight distance for safe operation may be limited to the non-passing or safe stopping distance for the designed speed.

We know definitely that the elimination of all possible points of collision make for safer highways. We know definitely that indiscriminate access from intersecting roads or driveways on which vision may be obscured to highways designed for high speeds constitutes an element of surprise that takes a large accident toll.

The ideal highway design, therefore, is one in which the highway will have four or more traffic lanes with opposing traffic separated, no cross traffic at grade, no access except at predetermined points, and sidewalks provided for pedestrian traffic where needed.

To eliminate unrestricted access from abutting property, border roads would undoubtedly have to be provided in many cases to service adjacent property and serve to pick up local traffic and deliver it to points of predetermined access on the main highway. Where the development was sufficient to require the construction of border roads on each side of the main highway this type of construction in effect would require the paving of a minimum width of 80 feet of roadway which together with the necessary grading and cost of grade separation structures would entail an expenditure of from \$250,000 to \$400,000 per mile. However desirable this type of improvement may be, it is not economically possible except on a very limited mileage of our State highway systems.

A properly constructed two-lane highway is capable of carrying a traffic volume of from 4,000 to 6,000 vehicles per day without serious congestion. There can be no economic justification for attempting to provide four-lane divided highways for traffic volumes less than can reasonably be accommodated on a two-lane highway. Our state highway systems comprise about 324,000 miles of highways that represent the principal routes of highway travel in the United States. Figures released by the American Association of State Highway Officials show 4,655 miles of three-lane construction, 2,576 miles of four-lane construction and 201 miles of six-lane construction.

Divided Construction

Of the 2,777 miles of four- and six-lane widths only 565 miles were indicated as divided construction. In other words, after 20 years of effort in highway construction, less than two per cent of the state highway mileage has been improved to standards that are recognized as providing the maximum of safety and only an insignificant portion of this latter mileage has been developed to the point of separating all traffic at intersections by means of underpasses or overpasses.

To improve approximately five per cent of the state highway mileage with four or more traffic lanes with opposing traffic separated, grades at intersecting highways separated, border roads provided and sidewalks constructed where needed, would involve an expenditure of approximately four billion dollars. When these figures are con-

sidered we must admit that insofar as the future can be visualized approximately 95 per cent of the state highway mileage in this country may never progress in improvement beyond the status of a two-lane highway.

There is no question but that the trend in highway design where four traffic lanes are justified by traffic volume, must be toward construction that will physically separate the flow of opposing traffic. In fact, there should be no further four-lane highway construction undertaken in rural areas in which this principle of design is not incorporated.

While engineers generally know and understand the broad principles of highway design that affect the safety of travel, there are a number of blind spots that still need to be explored. Highway engineers generally are fully aware of the problems involved and the necessity for putting into practice the knowledge already available as well as the facts gained by investigation and research. That a concerted effort is being made to provide the greatest possible safety for highway travel in the construction of highways is evidenced by the fact that the American Association of State Highway Officials has designated the administrative officials of 12 of the leading state highway departments in the country to serve as a committee for the investigation and formulation of sound design policies having to do with highway safety. The Secretary of Agriculture recognizing the importance of this work has appointed the members of this committee as Consulting Highway Specialists to the Bureau of Public Roads in order to effectuate more rapidly the purposes of this committee. The program of the committee contemplates a thorough investigation and research of all phases of highway design, particularly with respect to geometric designs because of their influence upon traffic safety. The recommendations of this committee applied intelligently to highway design in the future will go a long way toward increasing the safety of highway travel insofar as it is possible to do so by adequate highway design.

It is significant that this committee at its first meeting unanimously decided that the subjects of highway classification, sight distances and the treatment of intersections were the most important for immediate consideration.

Controlling the Driver

By ALAN CANTY

Traffic Psychotechnologist, Psychopathic Clinic of the Recorder's Court,
Detroit, Mich.

The average citizen knows the traffic problem is being attacked on many fronts. He knows the highway and the car have been rendered almost foolproof through the application of sound engineering principles. With reference to the driver, he learns of the law enforcement approach and finds that Lieut. Kreml is studying the types of violations most frequently resulting in accidents. He observes that "traffic drives" are made periodically by certain police departments and that paragraphs are written about the drunken driver.

He learns that standard license laws with provisions for the examination of new drivers have been adopted by many states. Again he hears of the organization of bureaus for the compilation of permanent records of driver violations.

Educators also are interested in the problem, he finds, and are including courses in traffic regulations and operating practices as routine studies. Actual driving instruction is being given in certain high schools and he knows that motor vehicle associations, particularly those affiliated with the A.A.A., are developing among school children a safety consciousness.

He hears next of a somewhat different approach which is related to the clinical study of traffic violators. He finds that in Wichita, Kans., the deviations of traffic offenders are investigated through psychophysical tests and a supplementary interview.

In the Psychopathic Clinic of the Recorder's Court, Detroit, he sees the activity in which your speaker is engaged. Here, as we have previously reported, a series of investigations including aptitude tests, physical and neurological examinations, intelligence measurements and psychiatric surveys are given, the subjects in each case being traffic violators. Reports are then made to the trial judge, outlining the examination findings and including recommendations as to the suspension or revocation of licenses, the correction of defects whenever dis-

covered, probation, institutionalization, and so forth.

In addition, he reads reports of statistical studies of accidents and accident causes. He generally finds that in most cases the approach is made through the study of groups of accidents or groups of individuals. Psychologists in their studies stress the factor of individual differences, since human behavior cannot be weighed or measured exactly. Neither can they say one individual will react the same as another in a given circumstance. The psychological approach to the study of these individual differences includes the analysis of physical reactions and motor skills through the construction and application of various aptitude tests, and attempts further to investigate the attitudes of individual drivers. In some instances however, the public has been misled as to the importance of psychophysical tests through the injudicious exhibition throughout the country, of apparatus displayed as "driver tests."

Various pieces of this equipment have not been adequately standardized. While so-called standards are being established, the tests are given for the most part by individuals untrained in psychology. Many of the measurements made by these machines are of little value. Quick reaction time is important in driving, but many devices for measuring it are not equipped to detect the elements of fatigue, toxic conditions in the body or any of the many other factors which influence the individual's ability to react.

Similarly steering ability, color blindness, glare sensitivity, vision and other factors are measured, although little effort is made to correlate the results with ordinance violations or accident-proneness. Knowing this, the average citizen feels inclined to urge that the limitations of testing apparatus be recognized since the value of these techniques is being grossly exaggerated.

Now our hypothetical average citizen comes away from his investigation unsatisfied. He finds, among the various groups

attacking the problem, enthusiasm and a completeness of their individual activities. He sees there is money available and that, among the workers themselves, there is ability and intelligence. He is surprised, however, to find that each group is isolated, that their separate approaches are undirected and that there exists today no concerted, integrated concept of the problem as a whole. He then concludes that the problem driver is neither insane, defective nor physically handicapped. This observation suggests a further study of "faulty attitude."

That "faulty attitude" toward the law enforcement agencies, toward society in general, and toward other drivers is an important factor in any investigation or the driver is almost universally conceded, yet no satisfactory tests for evaluating this deviation are available.

In Detroit we have found that a scientific interview conducted by the psychologist or psychiatrist has produced most satisfactory results. Since we obviously cannot subject each driver in the country to such an interview, should we therefore admit that we cannot solve this phase of the problem?

Let us first consider what this term "faulty attitude" really means. We have the so-called "smart alec," the "show-off," the selfish driver who has little regard for the rights of others and the horn blower who laughs at the speed laws. All these and many others might be included in this "faulty attitude" group.

Some of us are able to achieve success in a manner considered socially acceptable. Others, not so fortunate, use methods that do not have social approval. Since a car may be owned and operated by almost everyone, what is more natural than an attempt to excel in the daily "driving contest" if success in other fields is not forthcoming. We also must not lose sight of the fact that speeding and other reckless maneuvers are, of themselves, the mediums through which approval from "the gang" is achieved by many youthful individuals.

Since man is a product of his social environment, let us expect to find in America many individuals steeped in their cultural traditions, compensating through fancied victories in traffic situations, for failures in other fields of endeavor. Perhaps the term "faulty attitude" might be more correctly styled "American attitude."

What can we do about it? We must change our concept of the problem. Sociologists have learned there are definite delinquency areas in our urban centers and have focused attention upon the environment conditions as causative factors.

Clark Tibbets in the *Journal of Criminal Law and Criminology* (May, 1931), in an article entitled "Success or Failure on Parole Can Be Predicted," showed that it is possible to forecast with a surprising degree of accuracy the success or failure of an individual on parole.

Ernest W. Burgess, writing in the *American Sociological Review* (October, 1936) pointed out that success or failure in marriage could be predicted through an investigation of historical data.

Sheldon Glueck of Harvard university in his book "Five Hundred Criminal Careers," describes similar studies.

These results are accomplished through a study of the past history of the individual. Given a detailed study of the subject's background, his future behavior may be predicted with a reasonable degree of accuracy. Presumably, then, the early environmental factors, the home situation, the attitude of parents and relatives, the educational experiences and other related circumstances are important in moulding the attitude of the individual toward the social structure.

If in the study of drivers we are interested in their attitudes, and I am convinced that our interest in this phase of the problem has not hitherto been sufficiently great, we must not lose sight of the sociological factors.

Obviously we cannot eradicate delinquency areas nor can we control to any appreciable degree, the attitude of parents or the multitude of experiences and contacts to which the individual may be exposed. We can and should give more attention to the youthful individual. Most of us, myself included, are concerned with drivers who are violators. We appear on the scene after the trouble has occurred and try to find out why. Although our intentions may be laudable, still we must admit that we are not attacking the problem at its source. We must go back along the road and meet the younger drivers and even future drivers coming along, and devote our attention to them if we are to make our efforts really constructive.

Social workers, teachers, community center supervisors and social agencies know of families in which the children are being subjected to unhealthy social instruction. They know of individuals who are striving for social approval in an antisocial manner, and who have little regard for the rights and privileges of other. Can we expect these future drivers to abide by the rules when they later become operators of cars?

Let us stop treating the symptoms of this disease and start looking for its causes. As traffic men, most of us are not qualified to study delinquent children, but let us recognize that the study of these delinquents, by qualified individuals interested in the future driver, is likely to produce more constructive results than the study of those who have already deviated. Let us continue our present activities, but can't we look back, observing our future drivers preparing to take the road and give our support to those whose traffic studies are related to younger individuals? Let us encourage the educator and let us further enlist the cooperation of social agencies in an attempt to discover and train the potential driver who may later "commit" accidents. While I may seem to be stressing

the importance of the study of juvenile delinquents, I realize, of course, that many well adjusted youths may later become problem drivers. It is unquestionably true, however, that a sense of irresponsibility or an inability to adjust socially, will occur more frequently in the individual who has revealed these same tendencies in his youth, than in the case of the adult who has been seemingly adjusted in the past.

Ideally, we should hope ultimately to concentrate much of our efforts upon the proper "traffic education" of very young children. Practically, let us try to so adjust our present activities to give greater study and instruction to the younger group. We have a central organization in the National Safety Council. Let us, through it, exchange ideas and formulate a program looking toward the selection of pre-accident prone drivers. Let us establish contact especially with the school authorities, the social workers and employers. This involves no question of spending money, but in fact, we may expect more return per dollar. This is an approach which is not Utopian, nor visionary, but as sociologists have proved, one that has a definite practical value.

WEDNESDAY MORNING SESSION

October 13, 1937

SPECIAL GROUP SESSIONS

Wednesday morning was devoted to a series of four group sessions for informal

discussion of specialized phases of the public safety problem.

TRAFFIC COURT JUDGES

The session was called to order by the Honorable Harry H. Porter, Chief Justice, Municipal Court, Evanston, Ill., who presided.

Since all discussion which took place at the meeting was informal, no record of the proceedings was obtainable for publication in the Transactions.

Street and Highway Traffic Section

DIRECTORS OF PUBLIC SAFETY

The meeting was called to order by Eliot Ness, Director of Public Safety, Cleveland, Ohio, who presided.

The discussion at this session was all informal. No record of the proceedings is available for publication.

CITY AND STATE POLICE

The meeting was called to order by R. W. Groo, Director, State Highway Patrol, Salt Lake City, Utah, who presided and directed the discussion.

City and State Police Meeting

By R. W. GROO

Superintendent, Utah Highway Patrol, Presiding

Some of the factors of the traffic problem were presented by Mr. Groo as an outline for discussion:

The basic work for any department must be first the collection and compilation of adequate records.

Studies based on the records will show:

a. What causes accidents:—speed, road conditions, volume of traffic and equipment.

b. Where treatment is needed,—city or rural areas.

c. Why treatment is needed,—because of personal injuries or property damage.

d. Who suffers injuries or loss,—men, women, children, adults, drivers or pedestrians.

2. Is it practical or desirable to reduce speed for night driving?

3. What can we do to secure evidence for conviction of the drunken driver?

4. Is compulsory inspection of motor vehicles having a marked safety effect?

5. Personnel training in Public Relations.

Leaders in discussion were E. Raymond Cato, Chief, California Highway Patrol; O. W. Wilson, Chief, Wichita Police Department; J. J. Marsh, Supervisor, Colorado Courtesy Highway Patrol; Don F. Stiver, Superintendent, Indiana State Police; Mathew A. Skez, Captain, Public Safety Department, New York City Police Department.

Questions for Discussion

1. What is the relative importance of speed as an accident cause, and how can speed be controlled?

There was an attendance of 36 at the meeting, with 14 jurisdictions represented: Arizona, Arkansas, California, Colorado, Iowa, Illinois, Indiana, Kansas, Missouri, Nebraska, New York, Oklahoma, Utah, West Virginia.

STATE HIGHWAY OFFICIALS

The session was called to order by John E. Furlong, Traffic Engineer, Colorado Highway Department, Denver, who presided.

State Highway Officials

By JOHN E. FURLONG

Traffic Engineer, Colorado Highway Department, Denver, Presiding

In opening the meeting, Mr. Furlong said in part:

No state can afford to "junk" entirely those millions of dollars invested in the now obsolete, yet *super-type roadbeds* of 1920 to 1935, simply because 1937 traffic wishes to move at speeds ranging from 50 to 80 miles per hour. Therefore, does not our salvation lie, at least to some extent, in studying how to better and make more safe some of those existing older pavements?

Problem Is Apparent

Is not the very essence of our gathering here this week an admission that something is wrong—that we are groping in the dark? Have we not come here to contact each other in hopes of gaining from the other fellow his experience, or what he has learned from highway accident history?

Accidents, their location, their frequency and other detailed analysis, should furnish us a valuable clue to necessary betterments. Yet, how many highway departments use a definite method of accident analysis to find hazardous conditions or where obsolete pieces of pavement are actually causing trouble?

Planned for Future

In view of Colorado's limited income for highway purposes, C. D. Vail, State Highway Engineer, foresaw in 1932 miles of obsolete and inadequate roadbeds, coupled with insufficient funds for new construction. He, therefore, began to set up, within his highway department, a road signing and traffic investigation section. The duties of this section were, first, adequately to *mark* the roads, and secondly, to ferret out areas or stretches of high-accident frequency and try to relieve the situation as *economically* as possible.

Many times the installation of just one reflector type caution sign or directional arrow sufficed. Money spent to centerstripping blind hill tops, or areas where accident reports indicated deficient visibility, was found to be well worthwhile.

After trying numerous physical traffic control devices in some accident prone areas, it was found that the major cause of accidents might be purely recklessness on the part of the drivers. The only way this could be overcome was by police operation. Therefore, the Colorado State Highway Department is now financing our State Highway Patrol.

Plan for Secondary Roads

Another reason is appearing for the highway engineer to have a knowledge of the ratio of accident frequency to road conditions and maintenance—the newly considered Federal Aid Secondary Road System, as sponsored by the United States Bureau of Public Roads. This program will call for the eventual improvement of many of our well-traveled, yet less important, highways.

Construction standards will probably be lower than those in effect upon our present Federal Aid Highways. Does not this indicate that we should attempt to gain the best knowledge possible of mistakes we have made in designing our present roads, so that we may avoid a recurrence of conditions that cause accidents?

Seven States Represented

Following these introductory remarks, Mr. Furlong turned the meeting over to the delegates, who represented the states of Minnesota, Kansas, Illinois, Arkansas, Iowa, Nebraska, and Pennsylvania.

Much of the discussion dealt with the technicalities of building safety into the present day two and four lane highways, and especially into the four lane divided type.

Another point which created much discussion was the superspeed trains and their effect upon the grade crossing problem.

Discussion also centered about driver responsibility in the use of public highways, particularly during times of adverse weather conditions.

WEDNESDAY LUNCHEON SESSION

October 13, 1937

The session was called to order by William C. Knoelk, general chairman of the Street and Highway Traffic Section, who presided. Reports were presented as follows:

Committee on Annual Congress Program, Col. John A. Cutchins, Director of Public Safety, Richmond, Va., chairman.

Committee on Accident Records, W. Graham Cole, Director of Safety, Metropolitan Life Insurance Co., New York City, chairman.

Committee on Vehicle Inspection and Ac-

cidents, Walter Dent Smith, President, Delaware Safety Council, Wilmington, chairman.

Committee on Traffic Violations and Accidents, Capt. Ray Ashworth, Assistant Director, Safety Department, International Association of Chiefs of Police, Evanston, Ill., chairman.

Nominating Committee, George C. Eichhorn, Director of Traffic Safety, Greensboro, N. C., chairman.

Results of the election of officers will be found elsewhere in this record.

WEDNESDAY AFTERNOON SESSION

October 13, 1937

PEDESTRIAN PROBLEMS

The meeting was called to order by O. W. Wilson, Chief of Police, Wichita, Kan., who presided, introducing the speakers.

Report of Committee on Pedestrian Control and Protection

Leslie J. Sorenson, City Traffic Engineer, Chicago, and Chairman of the Committee on Pedestrian Control and Protection, briefly summarized the report of this committee. The complete report will be found at the end of the Street and Highway Traffic Section of this volume. Copies of this report are available in pamphlet form from the National Safety Council's Bureau of Information.

How Can We Protect Pedestrians in Traffic?

By WALTER W. MATTHEWS

Director, Philadelphia Safety Council

Within the last year Philadelphia has been given the credit (if there be any) for pressing the movement to classify pedestrian accidents by that designation, rather than

calling them merely "traffic" or "motor vehicle" accidents.

The statement, applied years ago to industrial and public accidents, that "we need

to know more about more accidents" is just as true today, and it has a special application to the pedestrian problem.

We shall only be able to protect pedestrians in traffic when we know what they do (not so much what vehicle drivers do); why and how they do it; and what their reaction is to the apparently ineffectual present remedies.

We will know these things only when we begin to study pedestrian accidents separately, when we have looked at them for what they are, and have not, in every case, considered them as automobile accidents, even though the automobile may have been the means by which the casualty occurred.

It will be variously argued that the ratio of pedestrian fatalities does not warrant this detail, and it is even contended that the rural pedestrian presents our greatest difficulty.

It is doubtful that we have a clear realization of what the problem really is. Three persons out of every four killed in our major cities are pedestrians, and the percentage is rapidly rising.

From a survey conducted by T. E. Traneau, Philadelphia's Assistant Director of Public Safety (subsequently published in "Public Safety"), we find that in 13 principal cities the percentage figure for 1934 was 71.3; for 1935, 71.9; and 75 for 1936.

We are perhaps inclined to be apathetic to the problem because the percentage of pedestrian fatalities, compared with the total fatalities in the United States as a whole, is fairly steady at about 40 per cent.

But when it reaches 75 per cent in the principal cities it becomes a major traffic problem, demanding separate and special analyses and treatment.

There has been a steady decrease in the fatality rate for most of the 13 cities studied, in spite of greatly increased vehicle usage and increased gasoline consumption. There has, likewise, been a slight decrease in the rate of pedestrian fatalities and a rather steady decrease in occupant fatalities. The occupant reduction has been about 75 per cent. The comparison of only 7 per cent reduction in pedestrian fatalities in all the 13 cities is therefore all the more unfavorable. In Philadelphia, personal injury accidents involving the driver or passenger in a fatality were reduced 32 per cent from 1929 to 1936, but, in the meantime, pedes-

trian fatalities had decreased only 10 per cent. The decrease in total fatalities among the 13 cities from 1934 to 1936 was 12 per cent.

That it is not yet recognized as a major municipal traffic problem is evidenced by the lack of information available from even those cities whose experience is least favorable. Our traffic engineering department received mostly sympathetic regrets from them, with accompanying expressions of best wishes in our effort to solve "our" problem.

The Philadelphia safety council sought information from major insurance companies relative to pedestrian claims, and was astounded to find that with the exception of two or three, no data of this character were available, and apparently no effort whatever being made to accumulate it. There are at least two bright spots in this gloomy and somewhat pessimistic picture from which we can glean some comfort and mayhap they will point the way to intensified pedestrian endeavor.

The steady reduction of occupant and driver fatalities certainly shows the effect of the concerted driver-education programs developed during the past 10 years.

The record among school children is too well known to warrant detail here, but it does prove conclusively the value and effect of mass education—where it is possible to gather people together, or exercise some discipline or control (as in industry), much can be done by way of instilling safety education.

And it is largely upon education that we must depend if we are to protect pedestrians in traffic.

No one minimizes the protective value of all the engineering aids—safety islands, walk-signals, cross-walks—nor the educational value of enforcement, although it is doubtful if the great majority of our citizens are yet ready to accept, or have been educated to the point of accepting, arrests for the average pedestrian violation. It smacks too much of regimentation to suit the average legislative or councilmanic mind, and since there is much psychology in proper terminology, why not call it "discipline," anyhow?

There would seem to be good reason for the foregoing conclusions, especially as to mass education and the psychological ap-

peal, particularly in city pedestrian accidents.

Contrary to rather widespread public belief, and unfortunately the same viewpoint is often reflected in the attitude of traffic engineers, most pedestrian accidents do not occur in great numbers at busy intersections. Many of them occur at points not ordinarily considered as being particularly hazardous, and to that degree, even though urban in character, apparently require much of the same treatment given rural accidents.

Last June the Philadelphia safety council undertook, with the complete cooperation of our Department of Public Safety, a detailed analysis of each of the 98 accidents in which 100 pedestrians had been killed during the first five months of 1937. Taking two pedestrian fatalities as a minimum base, 11 of our main traffic arteries (and they do not, of course, have important intersections throughout their entire length) produced less than 50 per cent of the total. In fact, the total of all traffic deaths for 1936—252—of which 85 per cent or 187 were pedestrians, was accumulated at 231 separate locations at widely scattered points throughout the city, and much the same condition is evident this year.

Another supporting factor is that only about 37 per cent were killed within, or at intersections, while 45 per cent were crossing in mid-block, or at a point other than the intersection.

The survey disclosed many other interesting, and to us, new angles of the problem. Frankly, we were somewhat staggered by the fact that while pedestrians were involved in only 36 per cent of our total traffic accidents, they did comprise 85 per cent of the fatalities.

And we have been forced to the consideration of special group education by the tragic discovery that 64 per cent of the pedestrians being killed in Philadelphia are 50 years of age or older. 31 per cent were 65 or older.

How then to reach this age group, many of whom do not drive automobiles? Several injured pedestrians of advanced years, when interviewed by our accident squads, stated that they had never driven. In other words, they had no appreciation of vehicle speeds, lacked judgment of distance and the coordination of movement generally acquired by an experienced driver.

Obviously we must resort to a different

approach. Perhaps we have overlooked the fact that while vehicle speeds have increased tremendously, people still walk at about the same speed they always did. It may even be assumed that wider streets do not always register in the minds of pedestrians (particularly those of advanced years) in terms of how much longer it takes them to get across.

The driver, for years, has been bombarded with rules of conduct, charts and regulations, tabulations of stopping distances, all sorts of technical safety information with respect to himself and his car.

In fact, all of our safety education, with the exception of that in the grade schools, has been directed to the driver.

On the other hand, have we ever informed the pedestrian of the average walking speed; told him how long it takes to cross the street of average width; given him a formula for judging the speed and distance of approaching vehicles in terms he will understand; advised him of what to do when caught between moving traffic streams; and countless other things?

Undoubtedly, the chief impetus to driver training, at least in the larger cities, has come through the related activities incident to participation in the National Safety Council's Inter-City Traffic Safety Contest. Entry in the contest has the effect of stimulating all manner of safety educational activities.

Therefore, as a second conclusion, may I venture the suggestion that to focus attention on the pedestrian problem, there be some special credit set up in those contests for pedestrian accident reduction. This, of course, is predicated on the first conclusion that we will classify pedestrian accidents separately.

It will be inferred from this discussion that education is favored above any other means. I believe it is our chief ally in protecting pedestrians.

In the cities it must be reduced to neighborhood or community activities. The advanced age group, (and they are the ones we must reach), do not scan the newspapers too thoroughly. They are not particularly receptive to mass safety meetings. They are naturally opposed to any restriction of their supposed rights by pedestrian enforcement or regimentation. That they too frequently set a poor example to the youngsters is obvious from only a casual survey.

Reviewing this presentation, it is obvious that no new note has been struck, nor is there any complete panacea offered. We, in Philadelphia, are by no means likening

ourselves to a voice crying in the wilderness, but we are hopeful that by emphasizing the facts on city pedestrian accidents, we may discover remedies not hitherto suggested.

How Can We Protect Pedestrians in Traffic?

By C. G. BECKENBACH

Traffic Engineer, Police Department, Dallas, Tex.

The Tentative draft of the Report of the Committee on Pedestrian Protection and Control contains one startling table, indicating that at least since 1932 three quarters of the lives lost in urban traffic have been pedestrians. The rural problem as developed by the report is similar, but less acute. Yet among the literature on traffic problems, and among the proceedings of various safety gatherings, I find few studies or considerations of pedestrian problems.

Why we have so long overlooked this matter I cannot be sure. In Dallas both the police department and the Citizens'

Traffic Commission have only within the last year awakened to the importance of the problem; and I know from our correspondence with other cities that they have had a similar experience. One possible reason is that a traffic congestion, or a collision between two vehicles is a prominent figure in any landscape, while a pedestrian is often killed without those nearly so much as being aware of the tragedy. Their passing has not delayed us or interfered with our own use of the streets, and hence our lack of vision of the complete picture.

For 12 years I have been a practicing

Fatalities from Motor Vehicle Collisions with Pedestrians, Dallas, Texas, Yrs. 1934-1935-1936							
Child 0-14 5-14	1936			1935			Total
	Day	Dusk	Dark	Day	Dusk	Dark	
	2			3			4
	4						9
Total Child	6			3			13
Adult 15-24 25-64	1			1			2
	1	8		4	10		36
Total Middle aged	2	8		4	11		38
Elderly-- 65 & over							
	1	6		3	3	1	5
Total Adults	3	14		7	14	1	56
Grand Total	9	14		10	14	1	70
SUMMARY:							
	Daylight			Dusk			Dark
Child	13			0			0
Adult	12			1			25
Elderly	5			0			14
	30			1			39

civil engineer, dealing with the design and construction of streets and roads. I have been concerned with these pavements in rural areas, and in the small hamlets and the largest city in the state. Yet I cannot recall once when pedestrians were given more than a passing thought in considering pavement designs or street construction.

Let us agree, then, that at least as far as concerns the loss of life, the element of pedestrians on the roadway surfaces is of paramount importance. It is a subject far removed from the problem of moving large numbers of vehicles rapidly and without collision among themselves. But, nevertheless, the most serious of the safety problems facing us in traffic.

There are so many factors, and local conditions, surrounding any accident that it is difficult to make tables painting an accurate and true composite picture. The table on page 40 is a study of the two factors: age groups and conditions of daylight or darkness, for the years 1934, 1935 and 1936 in Dallas.

Consider for a moment the child pedestrian death problem. In Dallas we have lost only two children while going to or from school in the past 13 years. This we ascribe to the excellent safety program which has been built into the Dallas schools.

Out of the 68 Dallas schools, all but three or four of the smaller ones have a Junior Safety Council, and all of them which lie near a heavily traveled street have safety patrols. Most schools have one hour of safety instructions weekly, none have less than a half hour weekly. An analysis of the actions of the school children while crossing the streets was made in the spring of 1937. All-day observations were made at 557 crossings, covering the vicinities of 48 schools. The total number of children crossing was 46,722, of which number there were selected 15,378 children whose individual actions were recorded. The selection was so conducted as to assure true representation of average action.

The table on page 42 expresses in percentages the actions of the children in making the crossings, and shows the effectiveness of various types of control. It also shows a comparison among the morning, noon and afternoon periods. In general, there was a slackening of care in the afternoon. Both of the child deaths mentioned have been in the afternoon periods. Dallas' other child pedestrian deaths—of which there have been

13 in the past three years—occurred at times and to individuals away from the influence of the school safety training.

From this study we might conclude that education is very effective. Conversely we might conclude that the non-school child deaths are largely caused by the bad training which children receive from watching us older folks.

Let us now look into the adult pedestrian situation. Dallas has had traffic signals since 1923. Pedestrian obedience was required from the beginning.

We recently made all-day surveys at 21 of the 151 signalized intersections, selecting some in the downtown district having the new side-type signals with flexible-progressive control and some in the same district which have not been changed to the new equipment, but still have center suspension lights, with alternate simultaneous control. The side type signals have amber over-lapping off-going green only, but the center suspension lights have amber following both green and red, and ring a bell along with the amber. We also included several suburban locations having the center suspension lights with amber following both green and red but without the bell.

The results, shown both as total pedestrians observed and as percentages, are given in the table on page 43. In this survey, the actions of all pedestrians were recorded, and the counts included the time from 7 a.m. to 9 p.m. From this result we conclude there should be few pedestrian deaths at signalized locations, if signals do in fact offer any positive protection to pedestrians.

We have analyzed the circumstances of "What Pedestrians Were Doing," and found that of the 70 pedestrians killed in 1934, 1935 and 1936, their actions were as follows:

Crossing at intersection with signal	3
Same against signal	6
Same, no signal	17
Same, diagonally	0
Crossing—not at intersection	29
"Hopping" vehicle	0
Playing in roadway	3
Walking in roadway	4
Working in roadway	1
Waiting for or getting on or off St. Car	2
at safety zone	2
Same—no safety zone	1
Not in roadway	2
Getting on or off other vehicle	2
	70

EFFECTIVENESS OF VARIOUS TYPES OF CONTROL
Observed morning, noon and afternoon
(Percentage of Observance. See footnote on page 43.)

Manner	Time	Stop and Go Signal	Officer on Duty	School Patrol	No Control	Average All Types
Crossed in Cross Walks	A.M.	84.5	91.0	87.7	57.7	72.1
	Noon	83.5	89.7	86.2	57.9	67.0
	P.M.	74.2	75.6	78.8	60.5	66.1
Crossed Out of Crosswalks	A.M.	08.2	04.6	07.7	21.2	14.1
	Noon	04.7	00.7	08.3	19.0	14.9
	P.M.	11.3	04.2	11.5	14.7	13.2
Between Intersections	A.M.	07.3	04.4	04.6	21.1	13.4
	Noon	11.8	09.6	05.5	23.1	18.1
	P.M.	14.5	20.2	09.7	24.8	20.7
Permission Given	A.M.	85.8	83.0	71.7	—	77.2
	Noon	82.3	66.9	59.7	—	66.3
	P.M.	75.5	61.4	58.6	—	64.0
Permission Removed	A.M.	14.2	17.0	28.3	—	22.8
	Noon	17.7	33.1	40.3	—	33.7
	P.M.	24.5	38.6	41.4	—	36.0
Walked Vigilantly	A.M.	78.7	90.3	85.9	74.7	79.9
	Noon	67.4	77.2	81.9	68.4	71.5
	P.M.	71.2	85.4	81.9	73.6	75.6
Walked Heedlessly	A.M.	08.0	04.1	05.4	16.6	11.4
	Noon	09.3	09.6	05.2	13.7	11.4
	P.M.	13.8	06.1	06.1	16.5	13.8
Ran	A.M.	13.3	05.6	08.7	08.7	08.7
	Noon	23.3	13.2	12.9	17.9	17.1
	P.M.	15.0	08.5	12.0	09.9	10.6
Started When Safe	A.M.	88.6	94.1	94.7	86.8	89.9
	Noon	91.9	90.4	94.3	84.0	87.1
	P.M.	80.8	94.2	93.4	85.2	86.9
Started When Unsafe	A.M.	10.1	04.0	03.5	08.0	06.5
	Noon	07.2	09.6	04.2	10.8	09.1
	P.M.	16.7	05.6	03.8	10.6	09.6
Did Not Look	A.M.	01.3	01.9	01.8	05.2	03.6
	Noon	00.9	—	01.5	05.2	03.8
	P.M.	02.3	00.2	02.8	04.2	03.5
*Total Crossings Surveyed	A.M.	22	20	45	105	192
	Noon	18	6	31	123	178
	P.M.	20	10	31	126	187
Total		60	36	107	354	557
**Total Individual Child Observations	A.M.	536	699	1552	3081	5868
	Noon	322	136	795	2594	3847
	P.M.	558	376	1014	3715	5663
		1416	1211	3361	9390	15,378
***Total Pupils Crossing	A.M.	1672	2138	5272	9340	18,422
	Noon	749	323	2418	4805	8395
	P.M.	1875	1931	4024	12,075	19,905
		4296	4392	11,714	13,220	46,722

Number and percentage of pedestrians leaving curbs on various signal indications, broken down as to type of signals and locations.

Leave Curb On	All Intersections. 25,795 persons observed		Downtown Intersection. Side type equipment. 17,616 persons observed		Downtown Intersections. Center type equipment. 5,398 persons observed		Residential Center type 2,739 persons observed	
	No.	%	No.	%	No.	%	No.	%
Green	23,186	89	16,308	92.5	4,446	82	2,396	87
Amber or Green-Amber	942	4	684	3.9	206	4	52	2
Red	945	4	561	3.2	120	2	258	9.5
Amber	722	3	63	0.3	626	11.5	33	1.0

We felt this might be of some value as a guide for the direction of educational work, but of little value otherwise, at least for the purpose of taking remedial measure.

The accident cards of all the daytime accidents were spread out together, with their diagrams, to try to determine whether any factor could be found common to any considerable number of them, of a more specific significance than "What Pedestrians Were Doing." We believe these facts are significant:

1. In practically every case it was possible for the vehicle to wander over a considerable portion of the street, often easier for it to travel on the wrong side than the right, both at the intersections and in mid-block.

2. Because of this, the pedestrian was exposed to vehicles coming from more than one direction. Many pedestrians who were struck on the near side of the street were looking to the right in anticipation of a vehicle coming at them on the wrong side of the street.

3. Also, because of this, there was a tendency for the drivers to "crowd" the pedestrian, which often caused the pedestrian to collide with a car other than the one he was dodging. Studies made in the field indicate a very pronounced refusal of motorists to yield right of way to pedestrians.

Drivers to an alarming degree tend to try to swing their cars in front of pedestrians so as to get by first, heedless of the fact that the pedestrian is left standing in the street.

We believe all three of these adverse conditions will be materially corrected by divided roadways and channelized streets and intersections. Pedestrians, being physically protected against all vehicles save those from one direction, will give all their attention to that one direction. Drivers will be forced to stay on their own side of the street, and positively prevented from making the short left turn; which movement exposes pedestrians on two crosswalks to being struck from the rear.

We realize it is not possible to rebuild all streets, or even any fair number of them. Yet channelization must be made very extensive if material benefits are to accrue. In Dallas we have devised a type of construction which we believe meets the requirements in an inexpensive and thoroughly efficient manner. We simply build center lines, lane lines and islands from rows of mushroom buttons 12 inches in diameter by 4 inches high, held in place by a single bolt. The buttons are built of white concrete, made in our own shops, and set in place for a total cost of labor and material of less than 40 cents each. Frankly, we have been

(See table on page 42.)

*The variation in the number of crossings surveyed is due to the fact that the type of control changed at various times of the day. This is distinctly noticeable in the "Officer on Duty" column. The 557 crossings were for children from 48 of the 67 public schools in the city. The other schools are not near streets carrying heavy traffic.

**The above percentages are based on recorded actions of one out of each group of children approaching the crossings. The specimen child was always selected before the group reached the crossing, to be sure of an unbiased selection.

***Total numbers of children making the crossings were recorded for the purpose of having complete information, for future control design.

amazed at the functioning of this regulatory construction. We find that in addition to pedestrian protection, we are able to smooth out the velocity of the various vehicles in a traffic stream, slowing down the reckless and speeding up the cautious, and to form definite lanes, generally gaining one lane more than the number previously formed.

Similarly, we laid out all the cards recording the night pedestrian deaths. We drew a blank when we tried to analyze them. We could make neither heads nor tails from the reports of the street lighting, so a spot map was prepared of all the night pedestrian deaths for five years, and each location was studied carefully on the ground at the time of night at which the fatality had occurred.

It was found that, neglecting some of the deaths in which the pedestrian was intoxicated, either one of two conditions of lighting existed, and neither of two other conditions existed.

A. The light conditions found to exist at practically all the death scenes were:

1. The accident occurred half-way between two mast arm street lights of 400 candlepower each, when the lights were not closer than 600 feet nor farther than 1,000 feet, or—
2. The accident occurred about 50 feet

beyond one of these lights, with the vehicle traveling away from the light, toward the pedestrian, but with the pedestrian in bright, direct illumination. In this case, there was no silhouette effect whatever.

B. The lighting conditions which were found practically never to exist in connection with night pedestrian deaths were:

1. A condition in streets, even long, fast-traveled streets, equipped with no street illumination whatever.
2. A condition of uniform illumination, with neither dark spots nor bright spots. The degree of illuminations apparently made no difference, so long as it was uniform.

We have many streets meeting each of the above conditions, which are uniformly free of pedestrian deaths. Our street lighting is directly under the supervision of the Director of Public Utilities, and that office is now cooperating with the traffic division of the police department to consider lighting from a traffic standpoint in addition to the other safety standpoints previously considered.

We confidently believe that the measures herein outlined will be material factors in reducing our pedestrian losses in the future, namely channelized streets and uniform lighting.

Protecting the Bicyclist

By LEON E. RUDD

Western Union, Kansas City, Mo.

I shall attempt to give you a brief résumé of just what the Western Union has been attempting to do for years, in the hope that it will give you a thought which can be carried further, broadcast and gradually bring into realization our dream of safety for our messenger boy. May I say here, no one unit, corporation, or individual, can ever work out a solution, because a complete solution calls for the co-ordination of many factors not under our direct control.

The tendency of the uninitiated is to lay the blame for an accident to the police department's failure to enforce various ordinances designed to protect the pedestrian or bicycle rider. My answer to that is

pure, unadulterated "bunk". Our experience has demonstrated beyond any doubt that police departments of all cities understand the problem and are doing everything in their power to remedy it.

This bicycle problem is a constantly growing one, so it must be faced now. We are interested in "our boys", but after all, they are *your* boys too.

We figure there are three basic subjects under which the problem should be handled:

1. **Education**—That is, education of the boy in the danger of certain acts, or lack of certain equipment. Encourage

him to talk safety to his friends and family. Propagandize the subject among each individual's circle of acquaintance.

2. **Organization**—Not only among the boys, but every employee, so there is a definite follow-through which will keep the subject *alive*. Safety literature when brief and pertinent. Bulletin boards which carry other subjects usually are interesting to the boy. So he is constantly meeting the word **SAFETY**.

3. **Supervision**—which includes daily inspection of all equipment, such as lights, brakes, tires, etc.

Street observation by certain designated employees. When a boy applies to us for employment as a "bicycle messenger" he must first demonstrate his ability to ride intelligently in traffic. Each application carries in bold face type "I promise to obey all city traffic regulations and safety rules of the Telegraph Company."

He is instructed *never* to take chances in making deliveries. Safety comes before speed. In addition to our anxiety for the boy's welfare we realize that an accident may cause him to lose a telegram or delay it. Therefore we impress upon him that his obedience to the law means safety for himself, safety for the company, and safety for the patron.

His bicycle is subjected to a rigid inspection of parts and accessories and, even though he passes all other requirements, he is not accepted until he has complied with all city requirements, such as horn, electric lights on front and rear of his bicycle, good brakes, etc. After employment his equipment is given rigid inspections each day to see that equipment is maintained. They soon learn that if they report for work with a defective set of brakes, or broken light, etc., they are not permitted to go to work until repaired.

We often help them secure the necessary repairs, but they finally realize their equipment must be in good shape, or they earn no money. About one experience for a new boy and we have no further trouble on that point.

What do I mean by daily inspection?

1. Boy's physical condition.
2. Are coaster brake and chain in proper condition?
3. Are tires defective? Properly inflated?

4. Are pedals and hanger in good condition?

5. Are handle bars and saddle properly adjusted?

6. Are handle bar grips securely cemented?

7. Are mudguards secure?

8. Is horn or bell in good working condition?

9. Are front and rear lights in operating condition?

Each boy is provided with a manual in which four of its 18 pages are devoted to safety, being changed from time to time to meet varying conditions. He must know these rules, since he is liable to be quizzed at any time on them. One very effective plan is to have a "Kangaroo Court," composed entirely of fellow messengers, who assess small fines on conviction of violations.

Another point which may seem insignificant at first thought, but contributes heavily toward eliminating accidents—each boy is required to have his handlebars turned up rather than down and the seat lowered until he is forced to assume an upright position when riding, thereby improving his vision and alertness. High seats and turned down handlebars in heavy traffic guarantee an accident sooner or later.

We have inspectors who circulate among various branch offices, observing the conduct of boys on the street when they apparently are free from observation. I recall a specific instance of the operation of this plan. Near a certain branch office the street had been repaired, leaving a small hump. This particular boy formed the habit of riding over this hump at every opportunity, as it caused the wheel to jump when struck head on. He got a thrill by taking this jump to see how often he could do it without being thrown to the street. He was told why it was dangerous as a spill would throw him in front of fast moving automobiles and not only injure him, but might wreck the automobile. He listened attentively, left the office on another rd and hit the hump full force. When he returned to the office he was suspended. We have never caught him doing it again and the other boys saw we would not tolerate violations.

Group meetings are held at regular intervals when safety is the main topic and they are shown how a slight violation of traffic regulations may sometimes result in

serious accidents. We do not lecture the boys, but have a round table discussion of the problem and the boys are urged to express their opinions. Illustrated posters are displayed in messenger quarters.

We offer prizes each year, the grand total amounting to as high as \$7,500 for the city and individuals having the least number of accidents. Individual prizes range from \$5 to \$25.

Possibly I should amplify this statement:

The greatest difficulty we experience in awarding prizes occurs when several offices of the same class have perfect score. There must be a limit on prizes—or the boys would lose interest, or we would go bankrupt. So we have worked out the following:

\$7,500 is set as the total prize money granted for one year. One quarter, or \$1,875 is distributed every three months.

Since there are eight divisions in the company, each division covering several states, this leaves \$238 for each division each quarter, or \$80 for each group or class. Offices are divided into three classes—large, medium and small, depending upon number of messenger hours worked. Therefore,

every three months a \$25 first prize, \$15 second, \$10 third and a number of \$5.00 prizes are granted.

Since several cities may have a perfect score, the only way we can grant prizes is to place each eligible boy's name in a hat and draw—the first name out gets \$25 and so on until all prizes are distributed.

This keeps the interest alive because a perfect score for any city in their class entitles each boy to participate. A checkup shows 15 per cent of all messengers win a prize each year.

The managers of delivery departments who are in charge of the boys are granted a separate group of prizes.

ALL employers of bicycle boys should be required by law to enforce police regulations covering inspection of bicycles. If the corner drug store permits their delivery boys to ignore the law, how do you expect the boys to cooperate? If the parent takes the attitude he is too busy to see that his boy obeys the law, there is one way to cure him. One, or two fines, or, better still, being required to appear in court personally to defend himself will soon wake him up.

Can the Public Be Educated?

By R. J. DUNLAP

Managing Editor, St. Paul Dispatch-Pioneer Press, St. Paul, Minn.

I am asked, "Can the Public Be Educated?"

The answer is three-fold: The public can be educated in safety practices. The public has been educated to a certain degree. But the public has not been educated sufficiently.

Naturally, opinions expressed in this talk are the results principally of observations made in Minnesota. However, Minnesota motorists are no different from the motorists of other states. They are human beings, with human faults, with the human tendency to become careless at times, to ignore safe driving practices.

In Minnesota, there is an expression that seldom is heard any more. That expression is "Boy, I made it in two hours flat!" The scarcity of that expression, I believe, is proof that the public can be educated. Its absence

indicates a new attitude toward driving. Why is it that people don't make such a remark?

It's because the motorist has come to realize that fast driving under improper conditions is likely to bring him scorn instead of commendation. It's because safety education has given the motorist an instinctive knowledge of when his driving is right or wrong.

"All right," the public says. "If the motorist knows when he is driving wrong, why in blazes does he do it?"

He does it for the same reason that people do things that are wrong. The human race is not perfect. It will never be perfect. But the majority of people are law-abiding citizens and are so because they wish to be so. When it is agreed universally that passing an auto-

mobile on a curve is a downright indecent act, accidents will have been reduced to a minimum.

A public knowledge of the wrong involved in a violation of a traffic rule is the first object to be accomplished by safety leaders. As I said, I believe this has been realized to a major degree in Minnesota. How did we do it? By education—education in the newspapers, on the radio, in magazines, by speakers at meetings of every sort, through every available agency. This campaign has been carried on under the direction of the Minnesota Public Safety Committee, a non-political organization with affiliated city and county committees. Its members have been men and women in all walks of business, professional and governmental life. Its activities have included yearly contests for cities and counties, with an annual dinner at which plaques are awarded for the lowest traffic fatality death records; poster and slogan competitions, and the distribution of considerable literature.

The Committee is recognized as an institution of merit and its words carry weight. In fact, it has come to be so well known that often strange requests arrive in the mail for the director. There was the man who wanted the committee to support a law requiring that all automobiles come to a stop when cats were seen on, or about to cross, the road. He didn't say anything about dogs. A farmer wrote that he had a cow which mooed whenever it heard an automobile horn. The farmer offered the cow for sale to the committee for advertising purposes.

But, in all sincerity, establishment of such a committee as the one in Minnesota will do much to get a program underway. The public will lend its ears if advice comes from persons known and respected throughout the community.

Safety education must be interesting.

You can't expect to hold the attention of a group of intelligent persons by telling them that the bogey man will get them if they don't watch out. They know all about the bogey man—the spectre who waits around the corner to wipe them off the face of the earth—but they don't take him seriously. There is little to be gained by a continuous repetition of warnings of the death and horrible injuries awaiting the careless. "What the dickens," says the public. "It's no fun listening to this stuff. Let's go out for a ride."

But sponsor a slogan contest, get half the

town thinking up safety slogans, and becoming safety-minded without knowing it. It isn't necessary that the slogans be serious. In fact, a lively slogan with some humor in it may do more good than some dirge about death and sorrow.

Safe drivers' schools offer a splendid opportunity for interesting education. The school would be a flop if it consisted solely of a long-winded talk about the dangers of running red lights. But, it can be interesting if moving pictures of accidents are shown. It would be more helpful if the audience is asked to give opinions as to which driver was at fault, if the instructor explained how some law was violated, what caused the mishap and how it could have been avoided.

Safety education has been subject to the same type of trouble that plagued other types of education before the nation's school system was brought up to a certain standardized form. It has been haphazard. It has bounded from the sublime to the ridiculous, has chased a lot of rainbows and has caused the public no little confusion. I believe the time has come when a well directed, thoughtful system of safety education is necessary to prevent the loss of what gains have been made. This system should start with the kindergarten.

School children now receive a certain amount of safety education, considerable in some states, none in others. There should be no state in which the school curriculum does not include a course in safety at home and on the highways. After all, what good is a doctor's or lawyer's degree if the graduate is killed in a traffic mishap? Nevertheless, safety education is in a woeful condition in most educational systems. And this criticism is directed at Minnesota, just as much as at other states.

The fault is our own, of course. There should be no difficulty in obtaining safety education in all schools. Educators offer no opposition to it. The trouble is that there has not been sufficient demand for it.

In the next year, I would like to see a campaign on a national basis for school safety education beginning with the kindergarten and continuing through high school. This can be accomplished if we set our minds to it. The proposal can be placed before all sorts of organizations by safety leaders of cities, counties and states. If the subject is stressed sufficiently, it will be approved. A small start has been made in St.

Paul and Minneapolis, where directors of safety have been appointed to devise a curriculum, and we hope for success.

Other types of education start with the child. Safety education is no different. It, also, should be started with the child. If interesting safety programs could be outlined for each child in the United States, the problem would be nearly solved. Already, in many instances, the child has become the safety teacher for the adult!

How about pedestrian fatalities?

Pedestrian control always will be a problem until safety authorities iron out the misunderstanding between the pedestrian and the motorist. For a misunderstanding surely exists.

The driver and pedestrian do not understand each others' rights. The pedestrian feels that the driver is his enemy and the driver believes that the pedestrian is a stubborn fool who certainly does not want to live long. The result is a complete difference of opinion often ending in the pedestrian's demise.

What can be done about it?

Safety education again is the answer. Pedestrians must be brought to realize that signal lights are meant for them just as much as for motorists. Drivers must recognize that a pedestrian, like the proverbial chicken, wants to cross the road some time. The average pedestrian still does not understand that he is a hard person to see at night, that the only safe way is to assume that the driver does not see him.

Traffic court judges could be of valuable assistance in putting an end to driver-pedestrian differences. When laws permit, it might be advisable to hail a few bullheaded drivers and pedestrians into court for a good lecture by the judge, during which he could point out the rights of both—with subsequent publicity in the newspapers.

Speaking of newspapers, the daily and weekly papers of your communities are a tremendous aid in reducing accidents. Their editors will co-operate if you will give them something legitimate to write about. Send in your publicity with an eye to its news value. Try to avoid a repetition of the same type of story. The newspapers for which I am managing editor, the St. Paul Dispatch and Pioneer Press, have given much space to stories regarding safety activity through the support of the publisher, Mr. Lee E.

Owens, the two newspapers sponsor an annual Northwest Traffic Accident conference, at which delegates from six states and two provinces of Canada confer on traffic problems. My newspapers are safety-minded and will continue to be so. Our reward is the knowledge that we have contributed to the saving of life and property in Minnesota.

Candidates for public office should be questioned before election on their attitude toward public safety activity. You probably are thinking that naturally their answers will be that they are "solidly behind any movement that bring greater safety to the residents of this great and noble community." Nevertheless, publication of that answer will give greater impetus to safety activity, will give it a higher position in the public questions of the day, will place it on a par with other campaign issues, and that's where it should be.

In the last presidential campaign, the platforms of the political parties contained no reference to public safety. In other words, the leaders of those parties did not think the subject merited such attention. They were wrong. After all, when accidents take as many lives as do wars, the subject of accident prevention is a mighty important one; when the financial loss because of mishaps takes millions of dollars from the pockets of United States citizens, any movement that cuts this loss is a movement which should be considered.

I believe that national parties in 1940 will take a different view of the situation. However, it's up to us. We can put public safety in the national campaign picture if we so desire, and I assume we do.

Safety education to date has placed too little emphasis on the financial loss resulting from mishaps, has somewhat forgotten that if money talks, the loss of it screams. We have yelled about death and injury and whispered about hospital bills, the high cost of liability insurance and the drain on the family purse whenever a fender is smashed. Death is just a myth to the average person. "Sure, we all must die," we say. "But what of it?" On the other hand, money is a reality, something we know when we have it and we know, ah, how well we know, when we are without it. The week-end traffic deaths of the nation are counted and published in many newspapers. The money loss also should be published. Police departments should estimate this loss at the end of each

year, let the public know what each mishap costs. The public should be informed just what a rising fatality rate will do to insurance rates.

We feel that education must be given the lion's share of the credit for whatever measure of success we have achieved in Minnesota. Of course, advances have been made in engineering and enforcement, and they have contributed to accident reduction, but they cannot be said to have done the job. The records have been made because of in-

tensive educational programs that have marked Minnesota's drive against death and injury.

The public can be educated. It's a slow process and it takes patience, but it can be done. That is what all safety leaders need—patience and lots of it.

All things, however, come to those who wait. And, some day, safety-minded men and women will see the result of their labors materialize in a world offering a longer and happier life to its inhabitants.

THURSDAY MORNING SESSION

October 14, 1937

THE NIGHT ACCIDENT PROBLEM

The meeting was called to order by the Honorable Clifford Davis, Vice-Mayor and Commissioner, Fire and Police, Memphis,

Tenn. The address prepared by W. S. James was read by Robert A. Mitchell, Traffic Engineer, City of Philadelphia.

Report of Committee on Night Accident Hazards

Ralph W. Eaton, public service engineer, Providence, R. I., summarized this report in the absence of Professor Harry Tucker, of North Carolina State College, Chairman of the committee. The complete report will

be found at the end of the Street and Highway Traffic Section of this volume. Additional copies of the report are available in pamphlet form from the Council's Bureau of Information.

What Can We Do About Night Accidents?

By L. A. S. WOOD

Chief Lighting Engineer, Westinghouse Electric and Manufacturing Company, Cleveland, O.

Public authorities and the public in general apparently accept the steadily increasing annual automobile fatality rate as the inevitable result of increased traffic volume and greater speed.

During the past 20 years car registrations have increased 600 per cent, the average mileage per car 125 per cent, and the average speed 100 per cent.

Twenty years ago visibility distance with

automobile headlights on light dry roads was 200 to 250 feet and almost nil on dark or wet roads. Today, with more cars and greater speed, automobile headlight visibility distance remains the same.

Naturally, the illuminating engineer approaches the problem from a different angle from that of the average safety engineer. The illuminating engineer wants to know the visibility conditions under which traffic accidents and fatalities occur. He differentiates the fatality and accident statistics between daylight and darkness and discloses a startling and hitherto almost unseen picture.

Over a period of years the trend of traffic fatalities follows closely motor car annual registrations. Public authorities appear satisfied with the effectiveness of their safety programs. When, however, fatalities in daylight and darkness are studied it will be noted that, since 1929 when safety measures and safety programs were first intensively promoted, daylight fatalities have steadily decreased while night fatalities have risen rapidly. This experience is recorded in spite of increased traffic and speed. Twenty years ago night fatalities were but 30 per cent of total; today, they constitute more than 60 per cent.

Lack of Night Visibility Is Cause

The sharp upward trend of night fatalities is significant of night time conditions beyond the control of the driver. Otherwise the safety measures, so effective in accelerating the downward trend of daytime fatalities, would be equally effective at night. There appears to be an overall factor, absent in daylight, which influences the night fatality rate. Illuminating engineers and others who have studied the problem, believe that this factor, hitherto largely overlooked by public authorities, is *lack of visibility*.

Few people in fields closely related to the problem of public safety, even in fields dealing directly with the problems of traffic safety have realized the vital relationship of darkness with death. Few people have realized that traffic hazards remain substantially unchanged throughout the 24 hours, except that darkness comes down to confuse the driver and pedestrian.

Fatality Records

Last year, 60 per cent of the motor vehicle deaths occurred during hours of darkness, a period in which traffic is only 20 per cent of the total volume.

The greatest number of fatalities occur during the so-called "rush hours" between 5:00 p.m. and 8:00 p.m., but during these hours in winter, when it is dark, statistics show that twice the number of persons are killed than in the corresponding summer months, when it is light. R. E. Simpson, an authority on traffic accidents, recently made a special survey of 47 American cities for the National Bureau of Casualty and Surety Underwriters and found that the most dangerous streets are the main traffic thoroughfares at night, accounting for two-thirds of the total fatalities. These thoroughfares represent but ten per cent of the total street mileage but account for more than 46 per cent of the night and 30 per cent of the day traffic fatalities. He found that in these cities, seven out of ten pedestrians were killed at night. He also found that 73 per cent of the pedestrians killed (both day and night) were involved in accidents on main thoroughfares and that 69 per cent of these happened at night.

Detroit's experience is extremely significant. This city, like many other American cities during the depression curtailed its street lighting service in the mistaken idea that money could be saved. It proved anything but an economic measure.

In 1931, Detroit had what was then considered a good street lighting system, and the day and night fatality experience was practically the same—119 deaths in daytime and 124 at night, for ten months starting January 1. In the following year, street lighting was reduced to 65 per cent of 1931 level and to offset this reduction, an intensive safety campaign was organized. In the corresponding ten months of 1932, the safety campaign reduced the daytime fatalities from 119 to 75 but the curtailed street lighting increased the night fatalities from 124 to 151.

Because of the alarming increase in night fatalities evidently caused by curtailed street lighting, the service was increased in 1933 to 85 per cent of the 1931 level, but there was no special safety campaign. In the ten months of 1933, with increased street lighting, the night fatalities dropped from 151 to 138, but without the safety campaign, the day fatalities went up from 75 to 90.

Mr. Simpson has stated that, "Every survey of streets where fixed lighting has been installed in accordance with illuminating engineering specifications, has shown that the night accident rate decreases as the grade

of street lighting increases. The sum total of all investigations supplies unmistakable evidence that properly designed fixed lighting can and does provide adequate visibility and that visibility has a far more important bearing on the night accident rate than is credited by the public in general or by public authorities in particular."

Adequate Lighting Reduces Accidents

The facts are clear, simple and beyond all question. The conclusion they establish is not so astonishing as the apparent failure of public authorities to meet it seriously or at least seriously enough to do something about it. Safety campaigns and all other safety measures, to be effective both day and night, must be coordinated with the overall factor of darkness. They should be accompanied by measures which will improve night visibility such as modern street lighting and adequate systems of fixed lights on the highways.

Night Visibility

Objects are seen at night by either of two entirely different processes. The object may be illuminated with sufficient brightness that every detail of the object is observed, or the object may be seen as an outline contrasting with the pavement beyond which, under a system of fixed lights, is generally brighter than the object observed.

Discernment by surface detail and discernment by silhouette are, to a considerable degree, mutually opposed. More light on the object provides better discernment by surface detail and poorer discernment by silhouette because the brighter the object, the less it contrasts with the background. Conversely, the more light on the background and less on the object provides better discernment by silhouette and poorer discernment by surface detail.

In business districts and so-called white-way areas where super-illumination is provided for its advertising value, objects are clearly discerned by surface detail, but in thoroughfares, residential districts and on the highways, we must depend on discernment by silhouette for adequate night visibility.

Night Visibility by Headlights

On our highways, where at present there is scant highway lighting, objects on or immediately adjacent to the road are seen at night in the illumination of automobile head-

lamps by the light reflected from the objects toward the automobile driver. They are visible in proportion as light reflection from their surfaces is good or they may be visible because they are naturally darker or lighter than the more distant pavement as lighted by the headlamp beams. When seen against the pavement illuminated by approaching headlamps, they appear as silhouettes.

There are certain limitations in automobile headlighting which must be recognized before the advantages of adequate street and highway lighting can be fully appreciated. When the pavement is light in color and the road surface is dry, headlamps provide safe and pleasant driving conditions at normal speeds, except for the glare of approaching headlamps.

When the pavement is wet, instead of diffusely reflecting the light (like blotting paper), it reflects light specularly (like a mirror) with the result that headlamp beams are reflected in a direction away from the driver's eye, leaving the pavement substantially black. In this case, objects are seen only by the light reflected from them toward the driver, and since such objects are predominantly dark in color, their visibility is low.

On dark dry pavements also, predominantly dark objects are seen only by the light which they reflect back to the driver's eye.

Many improvements have and are still being made in automobile headlamps, but there is one major limitation which cannot be overcome, legislative limitation of beam candle power. Furthermore, long continued and intelligent efforts have conclusively established the impracticability under actual driving conditions, of controlling headlight glare to a point where it will produce no material discomfort and no serious reduction in visibility.

Headlamps are needed on automobiles, that we can see at all on unlighted streets and highways, but as a satisfactory solution to night driving under all varying road surfaces and weather conditions, they fall far short of the ideal.

Polarized Light

Recently there has been much discussion concerning the merits of polarized light as a remedy for the night visibility problem. Extravagant claims have been made for it—some valid, others erroneous and ill considered. Polarized light can undoubtedly

have a favorable influence on one factor contributing to the dangers of night driving—glare. Polarized light can greatly reduce the glare of headlights; so would less powerful headlights. But not only does polarized light fail to increase existing illumination—it actually reduces, by about 40 per cent, the effectiveness of both headlights and street lighting. It should be recognized that polarized light does not even potentially embody a solution to the night visibility problem. Even if its application were practical, which is questionable, its physical limitations are many.

Driver Visibility

The burden of avoiding traffic accidents rests mainly with the automobile driver. When an accident is imminent, the pedestrian is either too close to danger or too confused to help himself. Except in areas where superillumination is provided and discernment by surface detail is possible, modern street and highway lighting practice gives maximum visibility to the driver.

It is now recognized that objects are seen more readily by contrast, either of color or brightness (silhouette) than by direct illumination (surface detail). From this it is evident that to provide maximum visibility, the road surface must be rendered bright so that objects may be seen by the motorist in silhouette.

In order that the pavement shall appear bright, it is important that much of the direct reflection of light from it shall be in the direction of the driver. An adequate and effective lighting system should produce this surface brightness under all changes in road surface conditions. The ideal is uniform surface brightness, although in practice, it is relatively unimportant.

The brightness of any surface containing an element of specularity is affected by the angle at which the light strikes the surface (angle of incidence) and the angle from which the surface is viewed (angle of reflection). Herein lies the reason why many motorists find it increasingly difficult, when driving up-to-date cars, to see clearly at night on urban streets and thoroughfares. The modern low built car seats the driver closer to the road surface than with cars of the older type and his eyes are thus located below the angle at which he can see surface brightness with many existing street lighting systems. This difficulty, however, is not ex-

perienced in downtown districts where discernment by surface detail is possible.

Pavement Brightness

It is a simple problem to design a lighting system which will produce uniform brightness on a light dry (diffuse) road because the light from lamps located adjacent to the roadway, on striking the road surface will be diffused in all directions, and the surface will appear bright when viewed from any or all directions.

Producing surface brightness for the driver on a dark or a wet road surface requires careful study and involves refinements in luminaire design and placement. Most roads possess an element of specularity, and a lighting system which is effective on a wet road surface should provide adequate visibility on a dry dark surface. In addition, it will produce effective visibility on a light dry road.

"Problems of spacing, mounting height and luminaire design are interwoven and mutually dependent. A large proportion of the light which is provided should be delivered on the roadway and this should be accomplished with the most uniform distribution of brightness and with the least possible glare. In order that the pavement shall appear bright to the motorist, it is important that the light sources be located well over the roadway."

These and other recommendations for effective night visibility have been prepared by the Street and Highway Lighting Committee of the Illuminating Engineering Society.

Modern Street Lighting Practice

Based on the requirements of the I. E. S. Code and a new street lighting technique, new types of street lighting equipment have been developed to meet the needs of modern street lighting practice. In the new luminaire, which is designed for a spacing-mounting height ratio of 5 to 1, the light source is completely shielded from the eye of the observer, thus mitigating glare. By the addition of a system of reflectors within the globe, the light flux is distributed at a grazing angle up-and-down the street to produce maximum surface brightness against which objects may be seen in silhouette. At the same time, the house fronts are screened from undesirable light. These luminaires are located on brackets over the

roadway and suitable standards are available for their support.

Highway Lighting

In interurban highway lighting, at the relatively low levels of illumination economically possible, discernment by silhouette assumes even greater importance than in urban street lighting. The problem, therefore, is to provide maximum surface brightness.

The same rules apply as in urban thoroughfare lighting, although the public authority responsible for highway lighting and the methods of financing the service are different.

Visibility Distance

According to a recent report of the American Road Builders' Association, studies indicate that a visibility distance of 1,800 feet is requisite for safe use of the highways under modern traffic conditions. By day this objective may be attained by the elimination as far as possible of vertical and horizontal curvatures as well as natural and man-made obstacles. This will entail realigning and rebuilding many of our highways at heavy cost and will also increase the cost of new highways.

Such a program of highway improvement is commendable, but it will only provide visibility for the 4,760 hours of daylight in the year. What about the other 4,000 hours of darkness? Would it not be better to light our highways adequately and make curves, obstructions and grades clearly visible at night? In the final analysis, economics will determine the best procedure.

Distribution of Traffic

The report of the A.R.B.A. further states that "there exists with good reason a decided disinclination on the part of the public against night driving. The eye strain induced by headlight glare, the nervous tension brought about by the repeated experience of driving past glaring headlights into possible unseen and unknown danger, the increasing public appreciation that night driving is more hazardous than day driving all tend toward greater concentration and congestion of day traffic than would be the case under safer night driving conditions."

"Graphs show a definite relationship between accidents and traffic flow with the accident curve consistently below the traffic flow curve during the day and just as con-

sistently and abnormally above at night. If we had a standard of visibility at night approaching that during the day, it follows that the traffic flow and accident curves would bear the same relationship throughout the 24 hours."

Somewhat allied to the distribution of traffic is that of increasing the load factor on highways. This implies a community of interest involving the automotive, road building and oil industries. Day trucking has grown to such proportion that it constitutes a serious interference with the even and rapid flow of traffic. If more of this day trucking could be transferred to the lighter traffic of the dark hours, the day traffic would benefit. The keystone of increasing and redistributing the traffic load is adequate visibility at night and visibility at night is almost wholly a matter of adequate highway lighting.

Highway Lighting Saves Lives

There are relatively few systems of adequately lighted highways in the country where there are also records of day and night accidents and day and night traffic flow, before and after lights are installed, but the few examples we have substantiate the contention that adequate highway lighting reduces traffic accidents.

Recent investigation on the parkways in Westchester County, New York, covering a four year period, and also on the parkways of Long Island for a three year period is significant. The investigation covers a traffic exposure well over one billion vehicle miles. In Westchester County, with lights in full service, the ratio of day to night accident rates was 1 to 2.2; with the lighting reduced 40 per cent, the ratio was 1 to 3.7; and with all lighting turned off, 1 to 4.8. On Long Island, the day to night accident ratio was 1 to 1.4 with lights on and 1 to 2.6 with lights off.

Mr. Arnold H. Vey, Traffic Engineer, State of New Jersey, has made an analysis of the day and night accident experience on a well lighted, heavily traveled section of Route 25 and the less heavily traveled and unlighted section of Route 26. On Route 25, the accident rate per million vehicle miles was 3.10 by day and 2.61 by night, while on Route 26, the average for these sections was 2.50 by day and 8.00 by night. The accident record on Mount Vernon Memorial Highway shows 250 per cent increase in the night accident

rate with the lights out of service as compared with the rate for an equal period with the lights in service.

The survey of the 1936 accident record of the 26.4 mile stretch of the Bayshore Highway in San Mateo County, California, is convincing. With the day traffic exposure of 75 per cent of the total, 39 per cent of the accidents occurred, while at night 25 per cent of the 24 hour traffic accounted for 69 per cent of the accidents. Of the fatalities, 18 per cent occurred by day and 82 per cent by night.

Thus we have a similar experience with highway lighting as with street lighting, indicating that lack of visibility at night is the predominating cause of the abnormal night traffic rate.

Luminaires and Lamps

The new sodium vapor lamp, owing to the monochromatic character of the light and its high efficiency, appears peculiarly adapted to highway lighting, and suitable luminaires designed for a spacing mounting height ratio of 8 to 1 have been developed. The high intensity mercury lamp also has its place in highway lighting for the illumination of grade crossings and dangerous intersections.

Highway luminaires for use with the new pre-focus bi-post Mazda lamp have also been developed. These are designed for a spacing mounting height ratio of 5 to 1, and these require closer spacing than the vapor units.

According to the Code of Highway Lighting published by the Illuminating Engineering Society, the lamps should be mounted on one side of two lane highways. On three or more lanes, the lamps should be on opposite sides staggered. Double highways with traffic in opposite directions, separated by parkways or islands should be treated as two separate highways.

An overall system providing adequate illu-

mination for dark wet road surfaces can be obtained with the 10,000 lumen sodium lamp in a luminaire designed for a spacing mounting height ratio of 8 to 1. This would involve approximately 22 units per mile. Such lamps should be mounted at a minimum of 30 feet and supported on mast arms at least 5 feet and preferably more out over the pavement. Owing to variations in length and location of existing power line poles, special poles should be used to support the luminaires.

Adequate illumination on two lane highways can also be provided by the 4,000 lumen bi-post Mazda lamp in a luminaire designed for a spacing mounting height ratio of 5 to 1. This would require almost double the number of units per mile than the sodium vapor installation.

Cost of Highway Lighting

It is estimated that an adequate sodium highway lighting system with special poles to support the luminaires, complete with the necessary transformer and control equipment will cost approximately \$4,000 to \$4,500 per mile. The resulting annual cost with fixed charges on the investment included on a 10 year amortization basis would be in the neighborhood of \$1,700 per mile per year.

With fixed charges on the investment excluded, the operation and maintenance cost of such a system is estimated at \$800 to \$900 per mile per year.

Highway lighting will eventually extend for long distances, and is thus removed from the jurisdiction of the county or township. The financing of highway lighting service thus becomes a function of the state, to be financed out of gasoline taxation. This does not imply any necessity for additional gasoline taxation, but merely the application of excess gasoline tax funds, at present with doubtful legality diverted to other than highway purposes, to the purpose for which the tax was originally authorized.

What Can We Do About Night Accidents?

By REYNOLDS WEAVER

Traffic Engineer, State of Oklahoma, Oklahoma City, Okla.

A little more than a year ago at the request of Earl J. Reeder, Chief Traffic Engineer for the National Safety Council, a special study of day and night accidents on

two of the major routes through Oklahoma was made. This study has been enlarged and now includes the major portion of the highway system.

When first begun, the study consisted of a compilation of accident records for a six month period, segregating them into night and day accidents and making a special spot map of each. Collision and conditions diagrams were made of locations where there were night or day high accident frequencies or both.

An attempt was made to draw conclusions regarding the cause of night accidents at certain locations and determine the benefits of traffic control devices during the hours of darkness. It was immediately evident that, rather than being in a position to draw accurate conclusions, we needed additional factual data.

At some locations where traffic control devices had been installed the number of accidents occurring after dark was abnormally high. The same devices at other locations reduced night accidents. At still other locations, where little or no precautions had been taken against night accidents, after dark accidents were practically negligible.

On one section of U. S. 66, dubbed the Main Street of America, new reflectorized signs had been installed just prior to the six months' study period. On this 27 mile stretch of highway, in which there are 16 hills of 2.5 per cent grade or more, reflectorized signs reading, "No Passing Zone," were erected for experimental purposes. Reflectorized signs reading "Do Not Pass on Hills or Curves," were placed at intervals of five to ten miles. During the first six months, 40 per cent of the accidents on this section occurred during daylight hours and 60 per cent at night. The corresponding period of the previous year, before installation of these signs, 72 per cent of the accidents occurred during the hours of darkness. Night traffic on this route is substantially higher than the average. Forty per cent of the traffic is at night.

During the latter months of 1936, centerline reflector markers were installed in conjunction with the "No Passing Zone" signs and on curves. This installation consisted of several different types of the reflectorized markers for experimental purposes and to determine replacement and maintenance costs of the different designs. Night accidents on that section of roadway during the first six months of this year were reduced 14 per cent over the corresponding months of last year, the period following the installation of "No Passing Zone" signs.

Slightly different treatment was made on a 75 mile stretch of U. S. 77, the main north and south route through Oklahoma. All of the signs on this route were reflectorized. In place of the "No Passing Zone" sign, a sign reading "Do Not Cross Centerline" was retained. The reduction of night accidents was appreciable although not as great a reduction was attained as on the first location. Reflectorized centerline markers have been installed on this route and a still greater reduction has been noted and, although they have been in some time, it is not yet fair to publish a comparison.

Encourage Use of Reflectors

Similar results have been obtained at other locations where like treatment was made. These experiences encourage the use of reflectorized signs and centerline markers and were particularly valuable in influencing the highway commission in authorizing a more extensive use of reflector buttons.

Reflectorized centerline markers are rather expensive and maintenance on them is probably more than ordinarily would be expected. Many engineers feel the maintenance is prohibitive and the benefits derived from such markers do not warrant the expense. In my opinion, based on accident experience, these markers, regardless of the installation and maintenance costs, are warranted on vertical curves, where clear sight distance is not sufficient, and on horizontal curves of five degrees or more. Another interesting experience brought out in the original night and day accident study, occurred at an illuminated bridge. The bridge is a 20 foot structure 380 feet long. One approach is straight and the other is a ten degree curve. Because of an abnormal number of night accidents the bridge was illuminated with incandescent light.

Night accidents increased substantially. The lights were removed and abutment flashers installed along with reflectorized advance warning signs, 48 inches square, and reflectorized centerline markers. There has been only one night accident since the latter installation more than ten months ago. During the period the location was illuminated, two or three night accidents a month were not uncommon. Possibly more efficient illumination would have attained the same results but at a much higher cost.

The Texas Highway Department recently made night and day accident studies of sev-

eral isolated intersections, which have an interesting and very definite bearing on this subject.

J. G. Rollins, division engineer at Dallas, began these studies and later aided in the development of the present installation at such locations. The first night high accident location to come to their attention was on U. S. 77 and 81 just north of Waco, Texas, at the intersection of the City Route and By-Pass Route.

The night accident frequency at this location prompted them to illuminate the intersection. Believing this would accomplish the job, they turned their attention to other hazardous locations. Much to their surprise, lighting this wide-open intersection, which was entirely free from view obstructions, increased night accidents substantially. The illumination installation consisted only of lighting the intersection.

The lights were removed and the location was treated in an entirely different manner. The final treatment, which has reduced night accidents at this and several other locations, is rather different and unique.

Stop signs are placed on each of the four approaches. Signs reading "Stop Here," are suspended 16 feet above the pavement.

This reflectorized sign bears 18 inch letters and is dropped forward three degrees at the top to afford better reflecting qualities. To secure a satisfactory degree of illumination from that height, it was necessary to use white reflector buttons rather than red.

Where installations of this type have been made an appreciable reduction in night accidents has been noted. The illumination installation at this location included only the intersection; not the approaches.

It is quite possible that illumination of the approaches several hundred feet back in addition to the lighting of the actual intersection would have proved more successful. Undoubtedly in illuminating intersections or other high accident locations, approaches to the danger point should be lighted equally as well as the hazard. Engineers who have had considerable experience with lighting high accident locations should be able to derive a formula by which we can determine the distance approaches must be illuminated for a successful installation.

If study of a location indicates the need of stop or stated speed signs, we place them on the minor street and the heavy traffic on the

major route is not impeded. If it is necessary to use both stop and stated speed signs, the stop sign is placed on the street carrying the lesser traffic and the stated speed sign on the more heavily traveled street. Advance warning signs are installed at certain distances back from the danger point to conform with the stopping distances of vehicles.

We are considering the volume of traffic, average speed of vehicles and stopping ability. Illumination installations at high accident locations should be designed and dictated by similar fundamental principles. Lighting should be continued on approaches to illuminate danger points a sufficient distance to coincide with volume, average speed or critical speed and stopping ability.

Hundreds of miles of roadway have been lighted in this country during the past few years, for experimental purposes. However, there is no accident experience available prior to the installation for many of these miles. Without "before and after" studies, little factual information as to its worth will be obtained.

Illuminating engineers should feel duty bound to light areas where needed data can be obtained and in general make an effort to determine the criteria for the need of highway lighting.

Must Be Based on Facts

We determine the type of sign or other traffic control device needed at any location by locating view obstructions, determining the speed of vehicles on the major arterial and the minor roadway, volume of motor vehicle traffic, pedestrian volume, vehicle movements and many other conditions which warrant treatment. Why then isn't it just as practical to base the need of illumination on certain facts, determined by accident experience, volume and the like.

Every type of traffic control device is designed to meet certain conditions. It is common knowledge that "Stop" and "Go" signal lights reduce right angle collisions and, on the other hand, increase rear end collisions. Installed at some locations, signal lights satisfactorily control traffic and reduce accidents, but literally thousands of signal installations throughout the country have actually increased the accident potential.

In view of these known fundamental facts, we should realize that illumination will be more effective at some locations than at

others. Lighting is no different from other traffic control devices—it will answer the problem in some cases but is not a cure all. The illuminating engineer who advocates "lighting every mile of every highway" is not conscientious in his statement.

Oklahoma and many other states have not completed their major road building programs. These states have been unable to meet the increased traffic volume by building dual multi-lane roadways. And certainly that is the most needed step in reducing night accidents as well as day accidents. In these states the most that can be done is to light fixed objects and other known locations that will be hazardous without it.

Even this should not be done extensively until the criterion for determining when lighting is needed has been established or revealed to the highway and traffic engineer.

Speed unsafe for conditions, is another highly important contributory factor in night accidents, brought out in our daylight and dark accident study.

Speed is a highly controversial subject. There is much sound argument pro and con as to whether speed is the contributory factor in most accidents or whether speed is responsible only for the fatalities in accidents.

As a member of the National Safety Council's Committee on Speed and Accidents, I have had a closer contact with the subject. Speed unsafe for conditions—that is excessive speed on curves, at intersections and the like—is the direct cause of too many night accidents.

With a committee of 28 traffic experts from all over the country working to find the answer to "What is the relationship between motor vehicle speed and traffic accidents?", and to recommend to the National Safety Council a policy covering speed regulations, one would be rather foolish to make any definite statement regarding the proper maximum speed. The studies made by members of the Committee and others who have so kindly offered to make speed studies, possibly will bring out new thoughts on the subject and certainly concrete facts will be established and specific recommendations made.

Excessive speed at night is resulting in too many accidents and should not be allowed. Limiting night driving to a maximum of 45 or 50 miles per hour in our state has been considered, but no definite steps have been taken in that direction. We are advised that under our law a maximum speed limit for night driving may be legally set and it is possible this will be done.

At locations where night accidents are largely attributed to speed unsafe for conditions, stated speed signs are being used very successfully. None of these signs carry a stated speed in excess of 35 miles per hour.

There is much to be learned about speed and its effects in daylight accidents as well as those occurring after dark. The best policy to adopt on speed regulations can be determined only through extensive study. I hope that every person in a position to make these studies will offer his services to the Speed Committee during the coming year.

What We Can Do About Night Accidents

By W. S. JAMES

Chief Engineer, The Studebaker Corporation, South Bend, Ind.

Because the most apparent difference between day and night operating conditions is in the amount of light available, it is perhaps not surprising that there should be a tendency to make headlights the scapegoat for the high incidence of accidents after dark.

There are, however, other important differences in operating conditions of which fatigue and alcoholism are outstanding ex-

amples. Consequently, if we are to view the problem which is the subject of this symposium in true perspective, it is important to recognize that, while lighting clearly is one of the most important elements in the situation, there are also other factors whose influence cannot be ignored.

Perhaps the best evidence that the automotive industry recognizes the importance of lighting is to be found in the large sums

of money which it has spent and is spending on headlighting research and in the high calibre of engineering talent assigned to this work. These research activities have produced the modern headlight which is considered to be the finest and most accurately made piece of optical equipment in large scale production.

The objective of the industry's efforts further to improve headlighting, is, of course, the provision of as safe seeing conditions as possible for the driver at night. Three elements are involved in this problem, the design and manufacture of the lighting equipment, the use that is made of the equipment on the road and the care with which it is maintained.

Starting with the first element, design and manufacture, what can the engineer do to make night seeing conditions safer? In considering this question, it seems logical to commence with a brief survey of the various inter-related factors which determine the eye's ability to see and what lighting can do about each of them to improve driver vision. Among these determining factors are the following:

1. The size of objects which the driver must see for safety.
2. The contrast between these objects and the backgrounds against which they are viewed.
3. The time available for seeing them.
4. The degree of driver concentration on seeing.
5. How brightly hazards are illuminated.

A casual inspection of these factors is sufficient to indicate that most of them are not subject to direct control. Although some of the hazards the driver must see, such as rocks on and holes in the pavement, are pretty small (even pedestrians are not very big, since at 300 feet they have the same visual size as an object $\frac{1}{4}$ inches wide held 14 inches from the eye) there is obviously nothing that can be done about it.

Contrast is in the same category as size since it depends on the nature of the background against which hazards are viewed. With well-designed highway lighting systems, visibility can be improved markedly by increasing contrast, but when the driver is dependent on headlight he has to take his backgrounds as they come and make the best of them.

The time available for seeing an object may

be defined roughly as the period elapsing between the instant when a hazard first becomes visible and the last instant the driver can avoid the hazard by taking some action. This period depends on the driver's seeing distances, his speed, the controls on his car and his skill in using them, his reaction time and on actions of other users of the highway. Of these, only seeing distances are affected by lighting.

Driver seeing distances are influenced very greatly by the extent of his concentration on the seeing job. This has been demonstrated recently by tests which indicate that drivers see objects they are looking for at as much as twice the distance they see the same objects when they loom into view unexpectedly. Since, as objects get nearer they reflect more light back into the driver's eye, this means that when the driver's mind is partly occupied with other matters, it takes substantially more light to make him conscious of a hazard ahead than when he is concentrating on the seeing job.

This matter of concentration obviously is also in the category of things lighting cannot do anything about directly, although it would be helpful if some way could be found to get drivers generally to appreciate how much they can increase their factor of safety by devoting more attention to seeing.

As the preceding paragraphs indicate, none of the four factors determining the eye's ability to see, which have been discussed so far, are subject to direct control. This leads up to the important conclusion that it is in the fifth factor, brightness, that hope for improvement lies.

Increasing the brightness of hazards means simply throwing more light on them and to do that, there must be more light in the headlamp beam. In this way, hazards which previously could not be seen, can be made visible. Hazards which could be seen previously become visible at a greater distance, thereby increasing the time available for precautionary action. Moreover, while light in the headlamp beam is no substitute for attention on the part of the driver, increasing the brightness of hazards will in some degree compensate for inattention.

Putting more light in the headlamp beam involves using bulbs of higher candlepower. At the present time, the legal limit in many states is 32 candlepower. This limit means that the engineer has about as much light with which to illuminate an area, say 500

feet long by 30 or 40 feet wide, as is provided by one 60-watt bulb such as we use in our homes which we know will not illuminate even a small room satisfactorily.

Although there is a mistaken impression that this limit on bulb candlepower is a protection against glare, there is actually no necessary connection.

Due to the concentrating effect of the reflector, a pair of headlamps equipped with 32 candlepower bulbs can be designed to project a beam with almost any desired intensity ranging from very much less than 50,000 candlepower to a great deal more. Similarly, by design, headlamps with bulbs of 50 or more candlepower can be made to project a beam with a maximum intensity either well below or well above the 50,000 candlepower figure. Since these candlepowers in the beam are so much more intense than any direct rays from the bulbs, they obviously are the important factor from the glare standpoint. Limitation of bulb candlepower consequently serves no useful purpose in this respect.

Actually all this limitation does is to set a maximum on the amount of light available which means that the engineer cannot light hazards as brightly as he might otherwise do. If he puts more of the available light into the high intensity portion of the beam to make hazards visible at a greater distance or to increase the area covered by this high intensity portion of the beam, then he has to reduce the amount of light in the portions of the beam providing foreground and lateral illumination, or vice versa. With no limitation on bulb candlepower he would not have to make these compromises. Fortunately these objections to a legal limit on bulb candlepower are being recognized by forward-looking administrators and there are indications that in some states at least, where 32 candlepower is now the top, this limit will be eliminated.

Although, as has been explained, more light in the headlight beam does not necessarily mean higher intensities and hence more glare, the consensus of opinion among headlighting engineers, as reflected in the current headlight standards of the Society of Automotive Engineers, is that they could provide safer lighting if they were permitted to design lamps for a maximum candlepower in the beam of 75,000. This maximum is now permissible in most states but inasmuch as certain states prohibit anything

over 50,000, design has to conform to the lower figure. These figures perhaps seem large, but actually beams of these maximum intensities provide illumination of only $\frac{5}{6}$ and $\frac{5}{9}$ foot-candles respectively on objects 300 feet down the road, as compared with a minimum for home illumination of say four foot-candles.

The effect of using beams of the higher maximum intensity, of course, would be to increase the brightness of hazards and thus make them visible sooner which in turn would increase the driver's margin of safety. Engineers realize that there is a limit to how far they can go in this direction to increase sight distances without interfering with the vision of drivers of approaching cars at unreasonable distances ahead. At the present time, they feel that the 75,000 candlepower maximum represents a practical compromise on this point.

What are the objections to the use of the higher maximum for candlepower in the beam? The chief objection is glare although it also has been suggested that the reason why headlighting engineers want to increase intensity is because they are interested largely in higher speeds. On the latter objection, it may be said that studies of actual speeds on the road indicate that the vast majority of cars are operated at moderate speeds. Engineers believe that this vast majority could operate more safely if they had the added margin of safety which higher candlepower in the headlamp beam would give them. Furthermore, if the objective is to control speed, it appears no wiser to attempt to do so by reducing the driver's range of visibility at night, than it would be to attempt to control day-time speeds by requiring drivers to wear smoked glasses so that they couldn't see so well and thus have to slow down in self-protection.

So far as glare is concerned, while a 75,000 candlepower beam may cause somewhat more annoyance to the driver of an approaching car and require resort to the passing beam at a slightly greater distance, the interference with his vision will not be appreciably greater than with a 50,000 candlepower beam since both of these intensities are well above the maximum beam candlepower allowable from a glare standpoint. Consequently, the lower limit represents a sacrifice in seeing distances without any improvement in the vision of a driver of an approaching car.

This discussion of glare brings us to the second element in the problem—proper use of headlighting equipment on the road. Headlight engineers believe that for safest seeing, the driving beam should be aimed with the center of the high intensity portion of the beam substantially horizontal. This throws the high intensity rays down the road to illuminate hazards well ahead. Aimed in this manner the driving beam glares. Recognizing this fact, all cars built for nearly 10 years have been equipped with multiple beam headlighting systems providing a driving beam intended to be aimed substantially in the manner just described and one or more addition beams. These additional beams are designed so that high intensity rays are not directed in the eyes of drivers of approaching cars.

Obviously how much these multiple-beam systems contribute to safety depends largely on the extent to which drivers use them. The record on this score is spotty. Where education and enforcement have encouraged the proper use of these multiple beam systems, conditions are better than where these stimulants have been lacking. Generally speaking, however, use is not nearly as good as could be desired.

Barring some revolutionary development like polarized headlighting, if we were to believe as some do that drivers cannot be educated or made to use multiple beam systems properly, the alternative would be to go back to the old single-beam system. If this were done, to give relief from glare, headlamps would have to be aimed so that the top of the beam would not go above the horizontal as is still required in some states.

This would curtail seeing distances thus increasing the hazards of night driving unless there was a substantial reduction in average operating speeds. Effecting this reduction would be no mean problem in education and enforcement. So whether we use multiple or single beam equipment, we are faced with an education and enforcement problem. Headlamp engineers believe that education in and enforcement of the proper use of multiple beam equipment will yield better results measured in terms of highway safety.

The importance of the third element in the problem, maintenance, is self evident. Just as other parts of the automobile require regular services, so do headlamps. In the main, they are not receiving this attention. As a result, headlamps on cars in service on the average probably do not throw more than half the light on the road that they could if they were in proper condition and what light they do throw in many cases is not projected where it will do the most good.

The industry is working along two lines to improve this situation. From the design standpoint, it is working on the development of headlamps which will retain their efficiency as light projectors for longer periods and the outlook for improvement along this line is promising. From the strictly maintenance standpoint, it has under way a program designed to get service stations to put more pressure behind headlamp maintenance and to impress the public with the need for regular servicing of the lighting system. This program also comprehends more forceful efforts directed at the education of drivers in the proper use of multiple beam equipment.

THURSDAY AFTERNOON SESSION

October 14, 1937

JOINT SESSION WITH COMMERCIAL VEHICLE SECTION

On Thursday afternoon the Street and Highway Traffic Section met jointly with the Commercial Vehicle Section. An ac-

count of the proceedings will be found in the section of this volume devoted to the Commercial Vehicle group.

THURSDAY AFTERNOON SESSION

October 14, 1937

GROUP SESSION FOR STATE SAFETY DIRECTORS

The meeting was called to order by Carl L. Smith, Director, Ohio State Safety Council, and Managing Director, Cleveland Safety Council, who presided.

Discussion centered about the organiza-

tion, finance, and program of state safety councils. The group expressed a desire for the same type of meeting at the next Congress, a session thrown open to discussion, with no planned program.

FRIDAY MORNING SESSION

October 15, 1937

JOINT SESSION WITH CHILD EDUCATION SECTION

The Drivers of the Future

The joint session of the Street and Highway Traffic Section with the Child Education Section, to discuss "The Drivers of the Future," was held Friday morning, October 15.

Sidney J. Williams, Director, Public Safety Division, National Safety Council, was chairman of the panel discussion. Panel participants were:

Lieutenant Franklin M. Kreml, Director, Safety Division, International Association of Chiefs of Police, Evanston, Ill.; Walter Dent Smith, President and Manager, Delaware Safety Council, Wilmington, Del.; William H. Johnson, Superintendent of Schools, Chicago; Mrs. W. A. Hastings, Vice President, National Congress of Parents and Teachers, Madison, Wis.; Henry H. Hill, Superintendent of Schools, Lexington, Ky.; Burton Marsh, American Automobile Association, Washington, D. C.; William Greene, Connecticut Department of Motor Vehicles; Walter S. Paine, Aetna Life Insurance Co., Hartford, Conn.

CHAIRMAN WILLIAMS: In the beginning, I am going to say only this, by way of defining the subject: As I understand it, when we speak of drivers of the future we mean, in general, young drivers around 16 years old, who therefore are commonly attending high school or about to attend high school. Our discussion is: what are we going to do about these young drivers from now on? One who has been in contact with this subject in a practical way for a long time is Lieut. Frank Kreml. I am going to call on him first to answer a couple of questions from his viewpoint and experience.

Frank, what do you say from the standpoint of the traffic police who are dealing all the time with these young drivers on the highway? Do you think we need some definitely organized training of future drivers, more than we generally have now? If so, why, and what do you mean by that kind of training?

LIEUT. KREML: We certainly are very much concerned in the police field with the tremendous increase in the accident rate among young drivers, particularly of high school age. During the last 10 years, ending January 1, 1937, deaths among persons of high school

and college age increased 150 per cent, which is the greatest increase in deaths of any age group. We feel that, to a large extent, this high death rate develops from a lack of training, which in itself produces two evils: These are a lack of ability to drive an automobile properly (and I don't mean mechanical ability), and a bad attitude towards their responsibility in driving.

We feel these two problems can be overcome only through training. The gratifying results of training in those high schools where it is being done indicate that is the answer. Certainly we think the schools ought to handle this training.

CHAIRMAN WILLIAMS: What kind of training do you think they ought to give? Do you mean classroom training or do you also include putting youngsters into a car?

LIEUT. KREML: We certainly think they ought to be given very practical training in actual automobile operation. Classroom instruction is not accepted with the interest that actual driver training receives. Since it fails to excite that interest, it fails miserably in attaining that change of attitude which is so important if we are to overcome this problem.

CHAIRMAN WILLIAMS: Then you think they ought to be put in a car. Do you think it is the job of the schools to do this rather large task not only of classroom instruction but of providing cars and instructors and picking out training streets or areas where these may be driven? Do you think that is all the job of the schools, or do you think police or the state motor vehicle department ought to take any part?

LIEUT. KREML: I think it is primarily the job of the schools, for the very good reason that this is an educational job. It is a matter of teaching them to do something. The schools should, if they are not, be better equipped to do that than any other agency in the community.

I think we as police and the motor vehicle department, as represented by Mr. Greene, have a very important responsibility in giving assistance to the schools in formulating their programs and helping them to start functioning.

However, I for one (this is a very definite reason which I should like to interject here before all these school people) feel that the police should not take too prominent a position in any kind of educational program with young people. It is purely a police, profes-

sional reason. I have spoken of it only once before, that I remember. The police of other nations, the European nations particularly, are not superior to American police, in my opinion, yet they are more effective because they have preserved for themselves a certain aloofness which results in more effective police work.

Our police have failed to maintain that aloofness, in my opinion, largely as the result of the educational activities they do in the community, especially in the schools. This results in a friendly attitude between the young people and the police officer, which is very healthy, but sometimes also develops a contempt for this very human, fallible creature, this police officer.

For that reason I am not anxious to see the police take any prominent leadership in such an educational movement.

BURTON MARSH: I would like to raise a question. I can't agree with part of that thought, and I would like to ask a question of Lieut. Kreml. As I get it, this aloofness is deemed by him to be more effective in producing the result we all desire, reduction of accidents and improvement in traffic conditions, than would be an attitude which we have been trying to build among the police and the schools of the nation. When I was a kid, I used to run from the policeman. At any rate a lot of us did, and maybe a part of the reason was that there was too much fear of the policeman.

Today, it has been my experience that children have a real affection for the police. It doesn't seem to me that affection and close relationship necessarily interfere with the effectiveness of police effort.

One of our major difficulties today in the whole traffic picture is a failure of the people to understand the problems of the police and to have that close and sympathetic attitude with the splendid kind of enforcement work which Lieut. Kreml typifies in his activities. That can only be obtained by this sort of a relationship which, without overdoing it, brings the police into a friendly relationship with the school operation.

CHAIRMAN WILLIAMS: Frank, I was going to pick you up on that, too. Aren't we today getting a little away from this Jehovah psychology? I am thinking of family relationships. The child today isn't afraid of his father anywhere near as much as he used to be when I was a youngster. Most of us, I

thought, feel it is better for him to regard his father with more friendliness and less fear.

Applying that to the situation you mentioned, do you mean the policeman can't maintain his dignity with the youngsters that he deals with, even if they used to hang on his coat tails when they were in the third grade?

LIEUT. KREML: Both of you have presupposed that I believe the policeman should be moved into a position that inspires fear. That would be suicidal for good police work. Good policemen want no one to fear them, except the outlaw group. However, there is something short of fear, and it isn't dignity, either. The foreign police officer, while entirely friendly, fair and regarded highly by the people, does not mix with the public. He isn't given to frolicking with children or gossiping with citizens. He represents the dignity of the law. He never forgets that and the public never forgets it, because of his demeanor. We need some of that in this country.

CHAIRMAN WILLIAMS: Probably we can stand a little more dignity in this country, anyway, on the part of others as well as the police.

LIEUT. KREML: Probably. It seems to me that one place where that thing breaks down materially is in the school work that police do. I have purposely steered off this because I recognize the fallacy of reaching a general conclusion from some specific case, but I know of such a case.

This young boy crossed my school intersection when I was a motorcycle policeman in Evanston, for three years, four times a day. He was a nice kid; I liked him a lot. He was a lot of fun; full of pep. He used to climb up on my back and unfasten my holster and push my cap down over my eyes. I always laughed good-naturedly because I liked him, and I couldn't become impatient with his antics.

About four years ago this boy had reached 17, and it was my responsibility to take him in charge after arrest by another officer, on a charge of automobile theft. I got absolutely no place questioning him, or impressing him with the wrong he had done. Occupying any official position, as far as that youngster was concerned, was simply out of the question. I was "Frank," you see.

Of course, that is a matter a little beyond the immediate question before us, that of traffic control. Nevertheless, it is a very im-

portant part of police administration. Another officer was entirely successful with this young man because he was a stranger.

WALTER DENT SMITH: I agree with Lieut. Kreml. The schools, in the long run, ought to do this job but from an entirely different line of reasoning. From the community standpoint, I think the big job is to see that each element bearing on this complicated accident problem does its own particular job; that is, see that the police do the enforcement job; the engineers do the engineering job, and the school people do the educational job. In a good many communities you find that all mixed up.

Fundamentally, this is an educational problem, and while there are a lot of headaches and difficulties that we will have to work out to make it possible for the schools to do this, we will have to find a way to solve them rather than start on a false scheme that won't work.

CHAIRMAN WILLIAMS: Suppose we hear from the schools. We have been telling the schools, we non-school people, in the usual American custom, what they ought to do.

Dr. Johnson, how do the school people feel about this, do you believe? To what extent are they inclined to accept the responsibility for this job of training future drivers?

DR. WILLIAM H. JOHNSON: I think in general that when an activity becomes sufficiently important that it enters into the life of every individual, and certainly the use of the automobile has done that, it becomes a definite job of the school system to train that individual to take his place in society, using those devices and techniques that society apparently has intended to use.

The result is, I think, that the matter becomes something of prime importance for the school to look into. We in Chicago are definitely committed to the policy of giving education in this field and using the school budget money for this purpose.

We found some rather interesting data as a result of several studies. One of our technical high schools has about 9,000 boys in it. We made a survey, asking questions of each youngster and found that less than 10 per cent of these boys admitted they could drive a car.

We have found just what the Lieutenant says, there are at least two things we have to do something about: One is to give actual instruction in the use of cars. The other is to

attempt, if possible, to impregnate in these young people an attitude of respect and cooperation with their fellow citizen, whether those citizens are drivers or pedestrians.

I am confident, in fact the results of the past year's experience have shown that of the 10 per cent who claim they can drive, less than half of them really were competent.

CHAIRMAN WILLIAMS: Dr. Johnson, are most of these young fellows old enough to drive legally, that is 15 years old, in Illinois?

DR. JOHNSON: I would say at least three-fourths of them were over 16.

CHAIRMAN WILLIAMS: In other words, for practical purposes you can say that this overwhelming majority that said they didn't know how to drive were legally old enough.

DR. JOHNSON: Yes.

CHAIRMAN WILLIAMS: Of course, nobody in Illinois drives under legal age.

MRS. W. A. HASTINGS: It seems to me this subject has more than two sides, because with all that the schools and community forces do, if the home isn't considered I am afraid the education is rather incomplete. Attitudes certainly are developed in the home. Courtesy on the road is part of general good manners. Children can't be taught in just a few lessons in school. Use of the car by children who happen to be under driving age, or infringement of the law by the father or mother in driving, are all unconscious education. Unless the three groups work together, all the school does and all the community does can't help a great deal.

MR. MARSH: Isn't there likely to be sort of a reverse English on that, too? That is, as this school program progresses and these youngsters really get a concept of the needs of traffic and their responsibilities in being decent folk on the road, and as they learn correct driving techniques, wouldn't it be likely that the youngsters are going to carry back to the parents (who are not the best trained drivers) some of the good they are getting out of the schools? May they not even carry back into the home a new concept of attitude on this subject?

CHAIRMAN WILLIAMS: Dr. Johnson, tied up with that, let me ask you this question in educational psychology. Suppose, for the sake of argument, we agree that the attitude in driving, on the part of anybody, is fully as important as our skill in enabling us to drive safely. Is it possible to teach an attitude sus-

pended in the air, so to speak, unattached to any specific skill or habit?

DR. JOHNSON: I don't believe so. I think if a habit or skill is to function, it has to be brought in a practical situation. It is a good deal like the Saturday night bath; it has to be repeated with a certain amount of regularity. As I look around at this group, I doubt whether there is a soul among them that hasn't violated some law practically every time they took their car out of the garage.

CHAIRMAN WILLIAMS: Is that their fault or the fault of the law?

LIEUT. KREML: It can't be the fault of the law.

DR. JOHNSON: I think we are all inclined to do it. If I may cite an illustration of my own: Just a few days ago I was on an errand. It happens that my wife has been critically ill, and it was necessary for me to make a trip and make it rather quickly. I was careful, but I did drive a little rapidly. Of course, in a few minutes a young officer caught up with me—they will do that. My mind was so thoroughly clogged with the critical mission I was going on that I was hardly aware of the officer. Incidentally, this will show the quality of our police in Chicago. I had a very important prescription that only could be filled in a certain place. I mentioned it casually, and said to him,

"I don't think you want to bother with me."

He turned around and said,

"Well, move over there, anyway. I am willing to learn."

When I explained my mission he not only was very courteous but he led the way for me clear down to the Loop and I had access through the red lights. But I can't help but feel that that attitude is within us. As I say, there are times when you and I will be on certain missions where we just forget all the rules and regulations. Under those conditions I think we may be warranted in losing our attitude, so to speak.

On the other hand, we may cause a lot of trouble even under those conditions. I can't help but feel that what we have got to do is to get these people young enough and imbue them with the proper attitudes and spirit, and make those attitudes and that type of spirit function continuously in every-day living. It has to be drummed in. I understand here in Kansas City they haven't killed a child for some time. Am I right about that?

CHAIRMAN WILLIAMS: Over a year now.

DR. JOHNSON: I am taking that idea back. I was thinking on the train that it might be smart for me just to issue a bulletin, probably the same bulletin with slight modifications, and simply demand that the teachers read it every Monday morning to the children. Eventually, of course, they will get tired of reading the bulletins. I can't help feeling that Saturday night bath business is terrifically important. I certainly agree with Mr. Marsh that the young people can carry these ideas back to the home, and they do carry them back.

You know, the school and the people are not any too close to one another. Listen to the average conversation around the table at home in the evening. Do you ever hear them discuss school? Dad asks the youngster how he got along today, possibly, if he happens to have nothing else to talk about. The youngster says, "Hell, I had a terrible time." That is the way it goes.

WILLIAM GREENE: I would like to ask Dr. Johnson whether you ever have checked to see how many of your students in high schools drive to school without a license, without permission?

DR. JOHNSON: I have had practically no complaints for the last year or so.

MR. GREENE: That, of course, brings the attitude in the home in there. In a high school in a small residential town outside of Hartford, we found between 100 and 150 students driving to high school without any license. We are rather strict in Connecticut about operators being licensed. There was the wrong attitude in the home, to begin with. There was the wrong attitude on the part of the high school teachers in permitting that.

DR. JOHNSON: We have a safety council, for example, in each school, connected with the student government. There is a regular card which the parents must sign if their youngster comes to the school in a car. So there is a check. The youngster cannot come to school in his car without this permission apparently indicated.

MR. GREENE: We remonstrated with the high school principal concerning the situation and he said,

"See the position I am in? These students are sons and daughters of responsible residents. If I get tough with them, some of the parents are on the school board and they will get tough on me. So I have to suffer in silence."

MRS. HASTINGS: It ties up, too, with the accident rate in the evening and at night, with the young people coaxing to take the family car out.

MR. GREENE: The answer is they are going to drive anyway, and they should be taught. They should be taught to drive and permitted to drive under certain conditions.

CHAIRMAN WILLIAMS: I would like to chip in on this one point of youngsters driving to school without permission. Of course, you realize Mr. Greene and Dr. Johnson are talking against somewhat different backgrounds. Connecticut has a general driver's license law, and Illinois does not, to our great regret. But some high schools in Illinois have for some years taken account of that. They have taken the matter into their own hands and, as Dr. Johnson said, have required a special license, so to speak, permitting the student to drive his car to school only on certain conditions. One of those conditions is the approval of the parents and another is the student's agreement to live up to the regulations which, for example, forbid his taking that car out during the noon hour for a little joyride.

I am speaking particularly of the New Trier High School which serves a very high grade group of suburban communities just north of Evanston. This system was introduced into the New Trier High School by the principal six or eight years ago, and, I should say, before this subject was anywhere near as popular as it is now. When he introduced it, some of the boys and their parents raised great objection. The parents said in effect that it wasn't any of the business of the high school or its principal, whether their boys drove to school or not.

The principal said in effect, "Maybe that is what you think, but you are wrong; it is our business."

This objection was made by two or three very prominent men of wealth and other position in the community, but the principal had courage enough to stick to his guns. He fought the thing through the school board. The board sustained him and sustained the rule that no boy in Winnetka or otherwise in New Trier Township could drive a car to school unless he would live up to the conditions laid down by the school authorities, which, of course, went even farther than your general driver's license.

In other words, I am suggesting, Mr.

Greene, in this community you mention, if the school authorities would just tighten up their belts a little bit and take the proper position and insist on it, regardless of local opposition, that thing might be overcome.

MR. GREENE: We accomplished it by getting in touch with the chief of police in the town. He, without advance notice, sent some officers down there one day, and they checked up all the students that didn't have licenses, took their names, got in touch with the parents, and the practice has stopped.

CHAIRMAN WILLIAMS: You could do it there because they were violating the law.

MR. GREENE: Incidentally, the school has put in a safe driving course, so in time it will overcome it.

LIEUT. KREML: I would like to say a word from the standpoint of the police on the matter of the home responsibility for developing attitude in the young people.

I think it is deplorable that parents depend upon governmental agencies to discharge parental responsibility to the extent that they now do. American men and women are simply shirking their responsibility toward their young people, and it is highly evident in this phase of the problem.

MR. MARSH: Nevertheless, even though it is deplorable, with which point of view I entirely agree. I would like to ask Dr. Johnson if he wouldn't say that, since the facts exist, must we not face them? Isn't it, therefore, something that the school will have to do as well as it can, in order to build this all-important matter of attitude? Are we going to be able to change the average parent's attitude, or are we going to do better by taking this less desirable course?

LIEUT. KREML: The work of the schools won't be enough. You didn't address the question to me, but there has to be this training and development of attitude.

Then there has to be work in the homes, too. Maybe that can be done through the children. I am not qualified to pass on that. That has to be done, or a bad parental attitude will vitiate all the good that might be done in the schools.

CHAIRMAN WILLIAMS: I would like to ask Dr. Johnson to complete one part of his original remarks, and then I want to ask somebody else to check up on that. Dr. Johnson, you referred to the fact that, as most of this audience knows, the Lane Technical High

School is doing this very thorough job, including the provision of cars and an area on the school grounds where the cars may be driven for practice. I believe you have already said you regarded that as a proper charge against the school budget. Of course, the per capita charge to do that in a school of 9,000 boys would be about a minimum. You are operating under very efficient conditions where you can use one set of sixteen cars. For 9,000 boys. Sixteen cars is not very many per boy. Do you, and does the school board back you up on this, so far feel that fact to the extent that you intend to extend that system to all the Chicago high schools?

DR. JOHNSON: At present we are contemplating the building of another school on the South Side, and we have taken a sufficiently large area, 22 acres or more, to establish a second driving course. Of course, you can't establish these driving courses at all schools. You understand this driving course is quite a complex thing. It involves probably four or five acres, a total of probably half to three-quarters of a mile of actual driving area.

We spent \$30,000, for example, in constructing this first driving course. It has a hill and all the lights and signs, and it gives you every type of turn and driving condition.

We expect to build those driving courses wherever there is sufficient land available. As I said, the board is fully behind the theory and making its contribution financially. They purchased the cars. Our job, in so far as the 37 high schools are concerned, will be either to secure additional land, which I think is the ideal situation, or else we shall simply have to cooperate with the police department to use the neighborhood streets during a portion of the day. I see no reason why we can't do that. The police have cooperated in many instances, in the grade schools, by shutting off streets for play during practically the entire school day. I am convinced the city authorities are behind this.

We have a Keep Chicago Safe Committee, in which the mayor and several others are definitely interested. I see no dangers ahead at all in training our young people to use a social device which society recognizes as essential to every-day living. We intend to go forward very definitely.

CHAIRMAN WILLIAMS: I imagine the problem, especially the financial problem, is more difficult in smaller communities. In Lexington, Mr. Hill, you don't have very many high

schools with an enrollment of 9,000 each, do you?

HENRY H. HILL: No, that is about the total enrollment.

CHAIRMAN WILLIAMS: Do you think, Mr. Hill, in the first place, it is the proper job of the schools and, in the second place, financially practicable to do this sort of job that Chicago is starting?

MR. HILL: I think the schools have to accept certain responsibility. I am a little bothered for fear they might run into something here, go too fast and too rapidly. I am always a little opposed to government by fiat without proper education in the meantime. In other words, I think Americans got to taking baths on Saturday night without any law passed requiring them to do so.

It may be possible, through education, to develop an attitude of receptivity on the part of the home and the parents and then, perhaps later on, to pass some blanket regulation that every high school student must have a driver's certificate before he finishes high school. But the financial problem will vary from state to state. I don't have any figures, but my guess would be that only one, two or three per cent of the six or seven million boys and girls enrolled in the high school have any real instruction at present.

CHAIRMAN WILLIAMS: Not over that, certainly.

MR. HILL: That is a top figure, probably. I am particularly concerned with going into this somewhat slowly in the different states and demonstrating its effectiveness, and tackling some of the problems we run into before we move too hastily through legislation or fiat.

CHAIRMAN WILLIAMS: There has been no proposal this morning, so far at least, for any legislation requiring driver training in all high schools. Of course, we all are behind the idea of the driver's license laws generally, which would require the young driver to pass a simple examination and get a license before he may drive.

That has been done for many years in many of the states, long before there was any thought of driver training in high schools.

Let's talk for the moment about the high school voluntarily assuming this job of teaching the driver. I agree with you that we ought to have considerably more experimentation before we think of passing laws requiring all high schools in Kentucky or Illinois to do this.

Let's leave that out for the moment. Do you think the high schools ought to do it voluntarily? Do you think the high school ought to assume the financial responsibility as well as the rest of the load?

MR. HILL: Responsibility for the actual instruction and organization of the program. I agree with Lieut. Kreml the teaching job must necessarily fall on the school. I am not so sure about all the finance involved.

It might be helpful if Mr. Marsh would talk to his group on the possibility of automobile manufacturers making some concession to school boards for this particular purpose. I suppose if they said they were going to give a car to every school board that established driver training, they would be overwhelmed with applications.

It might be possible in a smaller community for the automobile industry could work out some kind of rental of a car for a period of a year or so. The typical American high school is still only two or three hundred. If you are ever going to reach that crowd, you have to work out an entirely different technique.

On finances, I am inclined to think schools which can't pay the whole cost, since this is a voluntary enterprise, could say to the parent, "It is an entirely legitimate expense for you to pay for the gas and oil, 50 cents or one dollar."

You will say that restricts some persons who can't pay for it. Those persons who can't pay for it, for the most part, are not drivers. There are plenty of financial expedients that we in the South and Near South know about, that we can use in lieu of the money that Chicago, Winnetka and other places have. I think there should be proper care in administration before we become committed too far.

I also propose another thought. I am afraid in Chicago, Mr. Johnson, 5 or 10 years from now the parents will say the schools are at fault for all these accidents because they said it is compulsory and they are now teaching it. In other words, there is a little boomerang in there because no panacea yet has ever worked. I am afraid we are not going to do as much as the public thinks. Particularly in the smaller community, would it be possible and feasible to set up some kind of joint relationship, let the school do the teaching but perhaps let the automobile club come in, to a certain extent, on the financing, and the

police department or city authorities on laying off certain streets at certain hours a day, and let it be a voluntary enterprise, not restricted to high school students? The high school student would use it, but so would persons 25 to 65.

What I am looking at, broadly, is the education of the adult. I wonder what you think of that possibility.

DR. JOHNSON: You are quite right. As a matter of fact, we do have the motor clubs and various other organizations cooperating. In the matter of the automobile, for example, Studebaker sold us four or five cars at half price.

MR. HILL: I will make a note of that.

Mrs. HASTINGS: May I ask your criticisms on a plan that I am watching quite with interest, that is being tried out in a community of 65,000? It brings in the three elements in the community, the home, school and the traffic men.

In one of the larger high schools in the town, a group of about 20 teachers and parents were very much interested in safety. They had gone through a course of training.

The local traffic officers, some instructors from the state highway department, and so on, have helped these people. They have gone through this course of training, passed the examinations, and now they are training high school youngsters to this extent: Any parent who wants his or her child to have training by one of these people sends in an application to the school. They agree to let the teacher take the child out on the highway. Of course, they have had the theoretical training in the schoolrooms, but to get their highway experience, they use the family car which, used with the consent of the parent, makes the insurance good.

This driver then takes the child out for a sufficient number of hours, until he feels the youngster is qualified. Then the youngster passes both a written and an oral test, and the school gives him a certificate recommending to the licensing bureau that they consider him fit to have a license. That is in its first year of trial, but it seems to me there are many possibilities there.

CHAIRMAN WILLIAMS: Where is that?

Mrs. HASTINGS: In my home town—Madison, Wis., one of the results of the interest that has been created is that the vocational school now is putting in an evening course

for adult drivers, which means anybody over 16. So there has been that reverse result. I think, perhaps, there are many ways which will be by the trial and error method worked out to show the cooperation of the three groups.

CHAIRMAN WILLIAMS: That raises a couple of questions. Before I ask them, I want to ask the audience, if you feel any part of this isn't being cleared up or any of you has a question to put at any time, I wish you would just raise your hand or stand up in your seat and say so.

BEN STRAUP: I would like to ask, Mrs. Hastings, on the family car, do they allow other students to ride in that car, too? I understand from Dr. Neyhart that you can teach a child in about one-third the time if you will take four out at once and let them take turns under the wheel.

Mrs. HASTINGS: I am not sure on that point. I know it is their own child and their own family car. I would have to find out on that point.

CHAIRMAN WILLIAMS: I was going to ask this question that has been running all through this discussion—where do we get competent instructors to teach these youngsters how to drive?

MR. GREENE: Where do you get manual training teachers?

CHAIRMAN WILLIAMS: The teacher training institutions are turning out manual training teachers, but the school system as a whole is not, as far as I know, turning out people who have had any instruction or any knowledge in how to teach driving. I know a couple of answers. I want to elaborate the question first. I think we will agree, won't we, we on the bench here, on the fact that a man is in the automobile business as a dealer, or a police official, or the fact he is the motor vehicle commissioner or highway patrolman, or a safety council manager, doesn't necessarily make that man a good driver. If there is any dissent from that, I will quote some specific cases that might be embarrassing.

Now, suppose he is a good driver. We still don't know that he is any good whatever at teaching driving to others. That is well known, isn't it? There are plenty of expert technicians in every line that are not competent to teach their trade to other people. I hardly needed to ask Mr. Marsh to tell you, because I imagine you all know, the American Automobile Association has been doing its best to remedy that situation through the services of

Dr. Neyhart who was, as far as I know, the first man to develop a definite teaching technique. But with all that, that still isn't quite covering the United States in a thorough fashion, is it, Bert?

MR. MARSH: Far from it. There have been, however, about 500 teachers who have been sufficiently interested to go into an intensive course in preparation for teaching this sort of thing. It is rather encouraging to note the very active interest of teachers in picking up some operational knowledge. Of course, in a short period you can't expect to pick up a tremendous degree of it.

CHAIRMAN WILLIAMS: Then my question to Dr. Johnson first is, where are you going to get in the Chicago schools the competent instructors for these driving courses? Are you going to assume that a man who teaches a course in auto mechanics, say, can also teach a course in safe driving?

DR. JOHNSON: As a matter of fact, we have asked Northwestern university to put on a special course of this type for teachers, and they are doing it this fall.

LIEUT. KREML: Starting next Monday. That is a three-day course, too.

CHAIRMAN WILLIAMS: You mean not through Frank Kreml's Institute but the university proper?

DR. JOHNSON: The university.

LIEUT. KREML: The Department of Education and the Institute.

DR. JOHNSON: Of course, we do have a number of men who have given every evidence of ability in this field. We have several men, for example, who have for the last two years been doing nothing but experimenting on the development of the proper curriculum and so on. I might illustrate just how we carry on this instruction.

We have one large auto shop in Lane Technical High School, for example. We have 30 cars that have been stripped so that only the drivers' compartment remains. We use movies and slides. Each car, that is each section, can contain one boy. These 30 youngsters sit in their respective cars. All of the driving apparatus is there, that is the clutch and the brakes and all of the rest of the items are there. The room is darkened a bit, and a motion picture is shown. This would be simply a test of their ability after the instructional activity had gone on for a time. It is previous to their going out on the actual driving course.

Each contrivance on the automobile, by the way, is connected with a panel up in front. Every one of the brakes is connected, let's say, to a white light, so if there are 30 cars, there are 30 white lights. If there are 30 clutches, there are 30 blue lights, or whatever the color happens to be, and so on.

This motion picture has been taken through the windshield of a car, so the youngsters actually simulate driving conditions. They will be required to do what they would do if they were driving, as they go along in this imaginary car on the screen. If you don't think it is real, you ought to sit in one of them some time and you will be amazed at how real it is and how nervous you will get if you don't know what to do.

MR. W. A. SEARS is in charge for the entire city, in building up this instruction. We don't expect to build this up in six months. We have been at it for two years. We feel now that we have it pretty well organized in one institution. We are not scattering this all over the city either, as the gentleman from Kentucky is worrying about. We don't do that. We feel it is a mighty good stunt to take the best available area and really carry it on to the point where it is ready to go into other schools.

We have class instruction with a group, and yet it is individualized to the extent that the instructor can tell exactly whether the individual is doing the right thing. When they are ready to go out on the driveway for actual instruction, they are given a card.

On that card are all the various items in the car which ought to be checked before they take it out.

We insist the youngster must check at least 15 or 20 items before he begins to drive, and that check is checked against the chap who just came in with the car.

We believe we are making the child thoroughly conscious of the mechanism itself. He then moves into the car. Some of the Studebakers have dual control, a good deal like an airplane. The result is the youngster actually manipulates the controls. I think it is perfectly possible to put this instruction program over. You are not going to convince the public in a month or six months, any more than a police organization can convince the public of certain violations not being desirable. We can do it if we hammer at it long enough. We can do it if we take it slowly and systematically construct this type of curriculum in this field of action, just as we do in any other field.

If everybody puts his shoulder to the wheel and we do this type of thing over a period of four or five years, in both large and small towns, and if we collaborate and get our materials organized and get criticism from the community and groups such as this, I see no reason why we can't succeed in that field as well as in any other. (Applause)

LIEUT. KREML: Superintendent Johnson, you spoke of making these youngsters conscious of the mechanics of the automobile. I think you and I are thinking about the same thing, but I would like to have you say it for the audience, nevertheless. Aren't these people quite skillful in the manipulation of the automobile? Isn't your big problem teaching them a proper attitude? Isn't that the big part of the job, and don't you use this mechanical approach, or this approach through skills, to accomplish that?

DR. JOHNSON: It is surprising how stupid many people are, and our young people are not much different. There is a woeful lack of knowledge on the part of the average driver as to what happens when he releases the clutch. The grand result is that a great bulk of the drivers push the clutch to the floor, push it out, so to speak, before they use the brake at all. I venture to say any number of drivers are not aware of the fact that the engine can actually help stop the car, and the time to push the clutch out is when your car is almost at a dead stop. Our young people don't know that. There are any number of simple tests we give them; this board here with all these lights shows the youngsters not using the clutch at the right time, not using the brake at the right time. You should see them when they try to back up; it is pitiful.

I think they need some training in the mechanics, too, but I insist the attitude element be worked right in with it. It isn't a question of having lessons on attitudes alone. It is a question of making them all harmonize.

I advocate to parents, and I did as a principal, that they ought to start the youngsters with an ironing board at the age of five or six because you develop an attitude in the home. That little boy or that little girl has a little, private ironing board alongside of mother's and he gets up there and irons the handkerchief or whatever the little item is. It isn't the fact that the ironing of the handkerchief is anything; the point is that the youngster learns what cooperation means. He learns

what it means to work with dad and mother and the rest of them.

The same thing applies in the training of a device so powerful and so instrumental in every-day life as we know it today.

CHAIRMAN WILLIAMS: Frank, I wonder if you had this in mind. I suppose we can distinguish quite a range of mechanical knowledge and skill. That is, in the course of auto mechanics, for example, the student learns all about carburetor, I presume. I don't think the detail of what goes on in the carburetor is particularly needful.

DR. JOHNSON: I didn't mean that at all.

CHAIRMAN WILLIAMS: I wanted to bring that point out. You are not talking about the details of what goes on inside the engine. Next you come, let us say, to the mechanics of the operating mechanism, or what happens when you push the clutch, shift gears or use the brakes. That is important. Then, of course, after that you come to the mechanics of the car on the highway, the significance of speed, the relation between speed and stopping distance, and all that sort of thing which, of course, is very important.

Now we seem to get back to this question of the relation of attitude to skill. Just to gang up on you a little more on that, Frank, and perhaps exaggerate the point you made, there are so many things people do wrong on the highway. Take, for example, the one item of driving over a crosswalk line when stopping at a red light. In Neyhart's work my impression is one of the steps in his training procedure is that the student must learn to stop a car at a given point.

MR. MARSH: Yes, also must learn something I confess I don't know too well right now. I bet a lot of the folks in the audience and right here in the panel don't know it, and that is to know where the limits of the physical structure, which is our means of transportation, are when we do stop. Where is the right-hand edge of that structure? Where is the left-hand edge in relation to center line, in relation to other objects?

CHAIRMAN WILLIAMS: My point is, of course, if the student learns the mechanical skill of stopping that car so the front wheels are near but not over a certain crossline, then the question is, isn't that the best way to develop in him the proper attitude toward not encroaching on a line when he comes to driving in actual traffic? Similarly with the position of the left-hand edge of his car with

regard to the center line. A lot of people drive over the center line of a highway. They just don't know any better. If you teach them to keep their car on the right-hand side of the center line, that matter of habit runs into attitude.

MEMBER: Dr. Johnson, are you giving credits with your driving instruction classes?

DR. JOHNSON: Credit is given to the classes.

MEMBER: What is it for finishing the entire instruction?

DR. JOHNSON: It is a part of the auto mechanics course and takes about half the time, so it would amount to about half a unit per year.

MEMBER: Phoenix (Ariz.) has tried this out for two years. The vocational training instructor volunteered his time after school hours, with the cooperation of the highway patrol and police department cooperating, giving talks on the different rules. It has been very successful so far. Mr. Treat has told me it has been of a character-building nature. In our state a great many of our young students did not know how to drive until they took the course. We found they were very much interested.

DR. JOHNSON: There are several good textbooks out now.

MEMBER: Do you have a textbook in your city?

DR. JOHNSON: We have them on our textbook list. In fact, one of them has been written by two of the instructors engaged in this work.

MEMBER: Is your state furnishing those free or do they have to be purchased by the students?

DR. JOHNSON: We furnish free textbooks in compliance with state law. Students do not buy their own textbooks in any subject in Chicago.

CHAIRMAN WILLIAMS: Mr. Greene, I would like to hear a little more from you as to how the Connecticut Motor Vehicle Department and the motor vehicle departments generally, especially in states where they have a pretty good license law, feel about this work. Do you want the schools to do this job, and how do you want to tie in with the schools?

MR. GREENE: In the East, I think the motor vehicle authorities have been very fortunate, as Mr. Williams knows a good deal about Dr. Herbert J. Stack's work, in having

such an ardent advocate of safety education in the schools. He is constantly talking with boards of education, superintendents of schools and principals, and selling them the idea. In Connecticut, when we became actively interested in it a little less than five years ago and established a safety education section in our department, we found that the ground had been pretty well plowed and harrowed and pretty fertile for our efforts.

We find the school authorities are generally willing to accept that responsibility, and we believe that they should. It is entirely a function of the school. It has nothing to do with our department or police work in general; it is teaching.

We have a law in Connecticut, passed at the last legislature, not made too rigid because the legislature didn't want to place too much on the educators, which requires that one period a week must be devoted to safety education. In the schools it is generally assumed this time shall be spent on a safe driving course which, of course, means theoretical instruction in the classroom followed by actual road instruction.

We anticipate that as time goes on that law will probably be amplified in some way so that there will be more of a distinct instruction, so to speak, placed on the education officials as to what they should do.

There is quite a difference of opinion now. Nevertheless, we find them in a very receptive mood. As a matter of fact, we are rather overwhelmed with queries from schools as to just what we can do to help them and what we think they should do in teaching the coming generation to drive. We were very much embarrassed because we thought that Connecticut had done a pretty good job in insisting on the license law being observed, to find so many students in the secondary school driving from home to school without any license. Of course, that is a matter of attitude.

We stressed to the school officials, if these young people are going to have the wrong attitude toward the motor vehicle laws when we start in, they are very likely to maintain that disrespect for motor vehicle laws. They will run through red lights, and stop lights won't mean anything more than what they do to fathers today.

Just before I came out I was told about one, young, very attractive looking lady from West Hartford, who breezed in over Farmington (a boulevard leading into Hartford), running

through a couple of stop signs or red lights. At one of the red lights an officer blew and she waved gaily to him and continued on her way. She happens to be the daughter of an influential citizen and is under the impression her father's position will absolve her from that violation.

We in Connecticut find that attitude is the big weakness. We find it in the schools. We find it in our drivers' clinic. When we bring the adults back in, after they have accumulated an accident experience record, we question them, talk with them, send them downstairs for another examination. We find that a good many can drive in a mechanical way. They know what to do. Then we have followed them after they left the department and have found that they pass vehicles on the right, make U turns where they shouldn't.

To sum up briefly, the fault we find with both the young and the adult driver is not that they do not know how to operate the car so much, but they do not exercise the knowledge which they know. Of course, you have good, bad and indifferent operators.

We work closely with the educational authorities. We furnish them our statistical summaries so the students can realize what a price we are paying in fatalities and injuries in dollars and cents. We furnish them with problems as regards left turns and intersections, and things of that type, parking on curves, to see if they have any knowledge as to what they should do in these situations.

In two cases in Darien, with a school class, we conducted an experiment, and in Stratford, with an adult education class. It is encouraging to find through Connecticut that adult educational groups are taking a big interest in improving their driving.

I would like to pay tribute to the American Automobile Association because it has been of great assistance to us in Connecticut in that respect, in actually supervising a number of these classes and examining the operators or the students of those classes. We have had very little fault to find with the instruction which has been given by the representatives of the AAA clubs, particularly the Connecticut Motor Club in Southern Connecticut.

We do everything we can to help them. We are working in Hartford now with three high schools, but we believe it is a community problem. We believe each community should furnish the car. In Darien the Chevrolet dealer furnished three cars and took up the

matter of insurance so there wouldn't be any comeback on the school authorities or the state. It has moved along nicely. We were judicious in selecting the places where we broke the young people in.

Strange to relate, and here I differ a little bit with some of the other gentlemen, we were surprised to find out of a group of 60, there were easily 40 per cent that were fairly competent operators, according to the judgment of three inspectors. We were rather fortunate in these inspectors because two of them had been automobile men.

You know, years ago Connecticut was the home of the bicycle manufacturers and automobile manufacturing, and two of these men had had many years of experience with automobile manufacturing, so they were quite competent.

We were surprised at the number that already had got beyond the primary stage in being drivers. Out of the total class of 60, we only flunked eight, and what they needed mainly was more practice.

Connecticut state law makes it mandatory upon state departments and, inferentially, upon city departments to extend all cooperation possible to the school authorities. We have no funds, and, moreover, what we do is make it purely a state board of education matter and then work through the local board. We see that the educational channels are recognized throughout, because it is a school matter. We do everything we can in so far as our finances and personnel will permit.

While we are only scratching the surface, we know we are only in the experimental stages there, we believe this road instruction problem is not so great as it seems to be, and it has been our experience in three schools that you can find in your school personnel, individuals who are more than ordinarily adapted to teaching automobile driving.

CHAIRMAN WILLIAMS: On that last point, in other words you would say that an expert teacher who is a pretty good driver is much better than an expert driver who was only a fair teacher?

MR. GREENE: Right. Of course in Connecticut we have had several who have gone to Professor Neyhart's summer school. We presume that teachers, probably recognizing the future in safety education, particularly in safe driving work, will take advantage of these summer courses, and, with the background of being an educator and a teacher,

can readily assimilate the mechanical knowledge which is essential and become a competent instructor.

CHAIRMAN WILLIAMS: Maybe you covered this, if so, will you say it again explicitly, just what is the step from the driver training in the high school to getting the state driver's license?

MR. GREENE: In the high schools, too, they are giving credits. That is very essential, because the students, we have found, will not take interest in the course unless the school authorities dignify the course by giving credits.

In the Hartford high school they are starting by giving a full credit this year to those who successfully complete the course. We furnish the schools with the various legal phases of it, copies of the motor vehicle laws and regulations, various manuals that we get out and a little booklet, entitled "Facts," which tells anybody who wants to be an operator in Connecticut, what he should know and do.

After we have talked to the principal of the school, we leave it up to the teacher who will have the class to certify those students in the theoretical instruction and, particularly their knowledge of the laws, and so forth. Then we check. This job may grow too big for us, but up to date we have been able to check on those classes on the road ourselves. Then we give the student a certificate of achievement, such as the AAA suggests. That certificate, if presented within one year from its date, is accepted by any of our examiners as entitling the applicant to a license without any further examination. We go the limit in endeavoring to give official cognizance of the worth-whileness and merit of these safe driving courses, feeling that the more official recognition we give, the higher standing it will have in the eyes of the young boys and girls that are taking it.

MR. HILL: Have the insurance companies worked out some kind of general coverage policies that will cover the use of the car owned by the school and demonstrated by the teacher?

MR. GREENE: Not yet. We have taken that up with them. In Darien, the agent who owns the cars said he had the cars covered with a rider of some sort, and he was entirely satisfied with entrusting his cars into our hands, although I have grave doubts, if there should be a serious accident, that his insurance

would have covered. We were careful in selecting the places where we taught these students.

MR. MARSH: That brings up a point which bothers us a little in trying to be helpful to schools and teachers. In connection with the road instruction, we firmly believe, for the protection of the school authorities and everybody involved, including the teacher, that there ought to be adequate coverage or insurance, at least.

It seems most unfortunate that, where this is being placed on a new, high plane, even with the additional protection which such control affords, at the present time (I believe I am correct) it costs about twice as much to get the desired insurance for this type of operation as it does for an individual to get insurance. We have taken this matter up. Of course, we appreciate that the insurance companies have to depend on records, and that their records on driving schools, so-called, have been not very good. But there would be a considerable impetus to this work if it were possible to devise some rating or some method, so that where the work is going to be put on a fine level of thoroughness, which goes way beyond what we generally have had in commercial training schools, some recognition could be given to that in the matter of insurance, which is really quite a thing in some places.

CHAIRMAN WILLIAMS: Here is Walter Paine of the Aetna Life Insurance Company. Why don't the insurance companies write these policies a lot cheaper?

WALTER PAINE: I would suggest that Mr. Marsh, yourself and Lieut. Kreml and maybe Mr. Greene, write a very definite outline of what you think should be done in the way of coverage, and I shall be glad to take that up with the proper authorities. I think that is the only way out.

You have a miscellaneous program here which I would like to cover a little later in summing up, if you will give me five minutes to find out just where you are going, what you are trying to accomplish, how you are coordinating this work, rather than to undertake to develop a field in a rather chaotic condition. I think it is about time we confine ourselves to laying out a very definite program, to know just where we are going, just what we want, and then get the answer to those very definite requests. I will be glad to sum up on that, if you don't mind, later on.

CHAIRMAN WILLIAMS: There are two or three questions on the insurance and liability side of this thing that I think we ought to take up. We haven't time to take them up in any detail, but, first, Mr. Paine has given us a little challenge here. Have we, that is anybody here, a definite program? Do we know where we are going, in a general way? I think we do.

I am going to ask Mr. Marsh to answer that because they have done more than anybody else in promoting this thing nationally.

MR. MARSH: Let me ask you first, does the scope of your question cover the insurance phase only?

CHAIRMAN WILLIAMS: I don't think so. Walter Paine asks what kind of a proposition are we asking insurance companies to insure. Is that right, Walter?

MR. PAINE: Yes.

CHAIRMAN WILLIAMS: Let's answer that, if we can.

MR. MARSH: I don't think, as Mr. Paine points out, we have gotten it properly presented yet but we are asking the insurance companies to take an important part in the development of a much superior method of preparing youth for the use of the car and life in traffic than has ever been contemplated in our development of this country at all.

The general level at which this work is being thought of, as far as I know, by everyone who is giving it thorough attention, such as the National Conservation Bureau and cities like Chicago, and Professor Hill and ourselves, the various ones who are giving it the most attention, is to the effect that we are going to deal with this on a much higher plane, a much greater degree of thoroughness than had been contemplated, say, four or five years ago, and that that would involve a considerable amount of classroom work, so there would be better understanding of basic laws and principles involved in driving. This classroom work can cover quite an extensive period, and we recommend that it should.

Our recommendation is for at least one session per week for an entire year, and preferably more than that, but so that we develop in these youngsters a better understanding of the various things which are fundamental in the operation of a car and also fundamental in the improvement of our traffic situation from the point of view of societal approach which, to my mind, is one of the basic diffi-

culties we have in this country today, that society as a whole hasn't seen the problem in the proper relation and aspect so it is willing to devote the energy and the money and personnel effort to the need.

That is one of the fundamentals which, as far as I know, in all the texts which have been prepared, with educators collaborating with the traffic people, has been given major attention.

In addition to that, the instruction on the road certainly is generally of a vastly superior caliber to that which heretofore existed because, as has been brought out here, the thought is definitely to bring the educator into the job of education, and instead of taking someone who can drive, we are going to get along much faster if we go to the professional teacher.

What we are doing, in effect, is to gradually get educators interested, and they are getting themselves interested, to produce a really educationally planned training work.

On this level, certainly, the probability that we shall develop a better driver and a better citizen in this traffic age, seems to me to be well beyond question. With that as a background, I think we have something which the insurance people, already very active, are going to see in the matter of insurance costs, that they could serve also in helping to further this end.

But it seems to me we have a pretty good idea of where we are going. We certainly know we are only scratching the surface as yet. For instance, Professor Neyhart finds that with high school children, approximately half of the learning time in the car has to do with manipulative coordination and manipulative practices. Therefore, we are seeking, as has Chicago, to develop methods of shortening that, without the necessity of constant instruction and supervision by instructors.

We expect to have developed by the time the New York Automobile Show is under way a manipulative training device which involves some different principles from that used in Lane Tech. It seems to me we have a pretty good idea of where we are going, although we are only just starting.

I for one want to say that we don't know all the answers. We would like to get additional viewpoints.

CHAIRMAN WILLIAMS: Mr. Hill, you answered briefly my question about how you

felt all of this applied in the smaller community. Have you anything to add to that? Do you think this is a practical program, generally speaking, to be worked out gradually in the small communities as well as the large, assuming that some financial help, not complete financing but some help in the way of discounts, loans and what-not may be had, as I think they can be, from the industry, the motor clubs or others? Do you think this looks like a practicable job for the middle sized community as well as the large, or don't you?

MR. HILL: Certainly. I was just pressing the caution signal about our doing this between now and next Christmas. I think we should take a year or two at least.

May I ask Mr. Paine this specific question. We have an instructor in high school. He wants to take one, two, three or four of the people's children out and teach them how to drive on the ordinary streets, the quiet streets of the town. He is an employee of the board of education. If something happens to him or the children, the board of education is liable or he is individually liable.

What we want is a policy that will protect the school board and the instructor and those children against anything that may happen. We think the chances are remote about anything happening, but nobody wants to start a new enterprise out on a limb. That is the type of policy we want.

MR. PAINE: Can we do what you want? Yes. We can do this: There has been provision made for coverage for years on manual training well organized. I work with a number of groups of teachers who are protecting their students on the saw, on the planer and all types of manual training machines. Coverage has been provided for gliders and airplanes in the school to which Mr. Greene refers. The principal of that school has a daughter learning gliding and airplane operation in that school. They are taken care of. But who is training them? A pilot out of the army, a man who has been thoroughly trained, into whose custody the parents are willing to pass their children for training. That is what we want.

We must place in the hands of the school teacher or the driver, our students, our children, to teach them how to drive. I believe when that system is thoroughly worked out, you will have no more trouble in protecting the school from the driving of automobiles

than you do from the operation of manual training equipment and gliders and airplanes. Does that answer it?

CHAIRMAN WILLIAMS: Yes, Mr. Paine, let me get this straight. I understand from you that it is possible now at some rate, maybe a high rate, to insure any such operation as we are talking about. Is that correct? Is it possible to buy insurance, leaving out the question of rate, on an operation such as we are talking about?

MR. PAINE: There has been coverage already provided but it is after individual study.

CHAIRMAN WILLIAMS: But after an individual study, it is possible then. In other words, if anybody in this audience says to you or says to us, "We want to do this in our community but we are not able to get insurance," may I tell him that if he will write, say, to the National Conservation Bureau, he can get the names of several companies that probably would insure him?

MR. PAINE: I should say they could be handled almost on the same basis you are handling the two problems that I brought to your attention, and that should be answered by every individual company. I am not here as the spokesman of the insurance companies. I was asked by Mr. Catlin to appear here as a father and an engineer interested in this subject and also connected with an insurance company.

CHAIRMAN WILLIAMS: We have lots of fathers and engineers but we are a little shy on insurance men at the moment. You certainly know a lot more about insurance than the rest of us. I gather, with some reservations, in characteristic Connecticut Yankee fashion, we can get insurance. Maybe we have to pay too much for it. That brings up the other point in which it seems to me that Mr. Paine's position or the insurance position that he has stated, is well taken; namely, if we want a low rate on this insurance, we have to have a proper set-up with a high grade of instruction, and all that. I guess we don't need to go into that. It is obvious we ought to work along together on it, and the insurance companies, because of the ultimate value of all this to the insurance carriers certainly should be sympathetically disposed to give as low a rate as business considerations will permit.

MR. PAINE: May I answer you very positively on the development that you know? Twelve years ago no one wanted to cover

airplane transportation, passengers in airplanes. A thorough study was made of that. I gave two years with your friend, the Underwriters' Laboratories, Captain Schroeder, at the Ford and other airports. A very careful study was made. The method of training pilots, the care of the machines, the maintenance of the craft, was gone into thoroughly. You don't hear one word of that today. That is what has got to be done with this specific type of work. It can't be gone into chaotically.

I would like to sum up later on just what has been said here this morning to show that we don't yet know where we are going and just exactly what we are doing.

CHAIRMAN WILLIAMS: I am not going to have a final summing up with the statement that we don't know where we are going. Let us have it right now. You have two minutes to tell us that we don't know where we are going.

MR. PAINE: Dr. Johnson brought out a very good point that I think wants very careful consideration. In all this work we are teaching children how to live, and in teaching children how to live, we have to follow the normal process of life. We cannot say that we are going to place an individual under the control of a law officer or under the control entirely of the teacher. It is a combination of the teaching in the school, the home life and law enforcement. That is the reason I say that we haven't yet charted the way, because Lieut. Krenl has challenged the other speakers as to just exactly the procedure which we are going to follow.

In the item that came to us, they asked us to let them know just where we stood on this situation. First, it is this: We are teaching children how to live, so we have to teach them the habits in the elementary school. The National Safety Council blazed the way. The school has followed. It has been splendid in its cooperation.

Therefore, I say we should continue that work in the elementary school which has been proved so effective to date. My other reason for it is this: That over this entire nation the only training that thousands of boys get is what they get in the elementary school. So, mark it, there is a training you have to have as fundamental and basic.

Second, the work in the secondary or high school courses should be so laid out that if the automobile is going to continue to be a dangerous part of life and you are going to

teach young people how to live, then protect them so they can live and don't kill them off.

Therefore, it is just as essential that you take a student and teach him how to live and protect him by a two-years' course in high school as that you take him from the elementary grades through the secondary, and then through college and then kill him on the highway. Is that right? Then we want two years of fundamental training in the high school.

The National Safety Council has led the way. The way has been made chaotic because of lack of leadership, like lots of things in this country today. What we need now is coordination with our work in the high schools. How is this work of two years to be coordinated? The work belongs in the department of education.

We give our children over to you anywhere from one-half to about three-quarters of their living day. We are looking to the schools, rather than to do what the commissioner or the commissioner's representative has said this morning is being done in Connecticut, of passing this thing up in the high school, on the part of some of our principal educators—to insist that they teach these children how to live, not only in so far as it affects the automobile but their health and the general exposures of life.

How are we going to do that? The responsibility rests with the educational department of the state. Now, where do we fit in? The cooperation has got to be on the part of the motor vehicle department of the state. Vice versa, they have to be linked up very solidly in this whole program.

Give me a minute just from the viewpoint of a father. The commissioner's assistant started a school in our community. My daughter was the first to register in that course. It did her a lot of good. She came to me and said, "I am qualified now to take a license test."

I said, "You are not. You aren't to be taught by your father because no father should teach either his daughter or his wife. He hasn't the patience to do it. But you are going to be put in a school for 10, 15 or 20 lessons where you will be educated on practical driving. Then you are going to the motor vehicle department for a license."

I turned her over to the motor vehicle department. The commissioner and the assistant commissioner here knows that. What kind of a reception did she get? She fell into the

hands of an individual that they had inherited, not trained, just a simple rough-and-ready hunkhead, examining these young children coming up for licenses.

He said, "I don't believe in young girls being licensed." He sent her home. We went to the commissioner. The commissioner straightened it out and worked out a coordinating plan. They have put in the right type of examiners, coordinating their state work with the school. It has only begun, but to me that is the way this thing should be carried out.

Next, where do we all fit in, the AAA, the National Safety Council, the National Conservation Bureau and others? We only fit in as coordinating agents to help the various states and municipalities from what viewpoint. From the viewpoint of seeing that there is a better social and economic order.

The responsibility is well placed. When it is organized in that way and then you come along with your practical driving course, you are going to get somewhere.

I would like to make one point here. You speak of the manufacturer's responsibility. He has a responsibility. No purchaser of an automobile, to my mind, is consummated between the salesman and that purchaser until that salesman knows that that purchaser knows how to drive, and he is putting a very dangerous instrument into the hands of someone on our public highways.

One more point and I am through. It is said here this morning that it is not necessary to go into the details of the automobile. From an engineering point of view, and having been associated with this work and mechanics and engineering my entire life, I am saying that it is necessary for everyone who is driving an automobile on the highway to know what operates that automobile and to be able to meet every emergency. Why? The commissioner's department is putting a testing system on the road. We have got to take our automobiles to their testing machines to have them tested up, and they make out a little slip, and they say very definitely, "This should be done. That should be done," and so forth.

My wife received one of those on practically a new car of a high grade manufacture by one of the outstanding manufacturers in the country. What happens? She takes it to one of the best maintenance garages in the city, and when it is brought back, brakes not tested, brakes not adjusted, steering gear not where

it belongs, that is transferred right back to the maintenance department.

Therefore, anybody who is studying this subject must know very definitely, as they go along, what comprises the main features of the automobile. You and I, having gone through these courses, want to have it definitely understood and we should exert every effort to do it, and that is to see that anyone that is called upon to maintain an automobile knows what he is doing in order that we may have a safe working vehicle in our hands when we go on the road.

MEMBER: I would like to ask Mr. Paine from an insurance point of view, which risk the insurance company would prefer, taking out insurance on a car which is operated by a student who has had training in school and who is accompanied by an instructor and who is driving on certain definite streets that are laid out for that test, or whether you prefer to go out, as they do now, and sell insurance to anyone who owns an automobile and anyone who drives, regardless?

MR. PAINE: Speaking from my point of view, in every case that comes before me, I would take your well trained, well supervised and, I should say, selected risk rather than what you will find on your roads today. That is my opinion. It may not be the opinion of other members.

MISS MARIAN TELFORD: All of us appreciate Mr. Paine's unwillingness to refer to his specific company. Because of that, may I say from the Education Division of the National Safety Council at 1 Park Avenue, New York City, you can receive on request a list of insurance companies from which insurance on driver training cars can be purchased?

LESLIE R. SILVERNALE (Cleveland Schools, Cleveland, Ohio): May I ask Dr. Johnson a question? I would like to preface it with a brief explanation. Last year Mr. Marsh came to Cleveland at our invitation and brought Dr. Neyhart, and we instituted the Neyhart course in one of our high schools which was carried on very successfully with the cooperation of the AAA.

We checked at the end of this year of experimentation and found that it cost \$17 per pupil to give the road instruction under the Neyhart system. I would like to ask Dr. Johnson if he now has figures available to tell us how much it is costing at Lane Tech, the actual road instruction, how much it is costing per pupil.

DR. JOHNSON: I really couldn't say because we have been experimenting and have been using materials, and we have spent \$30,000. I suppose it is pretty high to begin with. I presume that that won't cost any more than any so-called shop course would cost in the average high school. I suppose that might run as high as an average of \$3 or \$4 per semester, per student. That is about what it will run.

CHAIRMAN WILLIAMS: I want to ask Dr. Hill once more whether he has any other specific point he would like to bring up, and then I am going to call on Mrs. Hastings again and that will be all.

MR. HILL: I doubt if I should bring it up. I am interested in knowing whether there has been any evaluation of these programs so far. Is there any evidence to show just how much benefit has been accomplished by these driving courses other than just our opinion?

The Department of Superintendence is studying this matter of safety education and has been for a period of two years and expects to put out a yearbook on it. Would it be helpful to the progress of driving instruction of the proper type if this yearbook would attempt to make or find out some methods of evaluating the program?

MR. GREENE: We are keeping a record in Connecticut of every student in the different classes we know of and are following them along for a period of five years. Of course, we haven't actually completed one year yet, but we will by this coming summer. In that way we will have tangible evidence as to what good the course has done in that particular school.

MR. MARSH: Rhode Island has kept such a record. Comparisons for a period of three years have shown, as I understand from the motor vehicle department, very definite and specific results. We have been asking everywhere we have had contacts, that this be done by everyone who is engaging in this activity. It is like Frank Kreml's work. We want to know how much it will produce. I think this suggestion is superb. It is a very great need. We have to know whether the energy put into it is as productive as we think it is. If it isn't, maybe we should change it.

CHAIRMAN WILLIAMS: Contrary to the general conception, one of the most silent members of this panel has been Mrs. Hastings. She says she hasn't had a chance to be otherwise. Mrs. Hastings, have you something to

add at the end? We will give you the woman's last word.

MRS. HASTINGS: There are two thoughts, in my opinion. One is we have been talking all morning practically from the city standpoint, either the large city like Chicago, or the smaller city like Louisville. There is the rural problem. I was wondering who is to do the teaching in the one-room rural school. Many of those schools have children old enough to have licenses, and there is the little, tiny village high school or the country high school. There are almost no resources for that, yet we know there are very definite problems of traffic.

MR. GREENE: In Connecticut we have small towns that can't support a high school, and they have what they call a district high school. It serves two or three or more towns. We are getting in touch with the state police with the idea that the officer in charge of that particular district will furnish a competent member of the force who has been trained, who can visit the schools, and, because of the small number of students in each school, take care of them in road instruction work.

MRS. HASTINGS: There is also the one-room school, many of whose pupils are 15, 16 or 17.

MR. GREENE: You wouldn't have very many students then.

MRS. HASTINGS: There is that whole safety problem. I was thinking if you are going to see the whole problem, you have to include that in the picture.

CHAIRMAN WILLIAMS: You certainly have to get that into the picture.

MRS. HASTINGS: All the way through the discussion we come to the need of the public in this. If the state department, the schools and everybody else are to do effective work, we must all work together. Maybe we can be receptive if we can't be cooperative.

CHAIRMAN WILLIAMS: In closing this meeting I want to give you my conception of what this discussion has crystallized into. It seems to me that we have a general agreement that we do need training of young drivers in high schools.

Second, that it is primarily a school job.

Third, that that does not mean forgetting the need for cooperation of the home as well as other governmental and city agencies.

Fourth, that this instruction should include driving practice as well as classroom work.

Fifth, that we must be sure to have properly trained instructors who know how to teach driving.

Sixth, that this kind of work deserves some financial help, within limits, from business and other interests that are concerned.

Seventh, on the insurance item, that it is to be hoped that, in accordance with the apparent logic of the situation, insurance at reasonable rates may be made available for schools which are properly set-up and operated.

Elements of Traffic Administration

A Series of Four Lessons Presented Before the Traffic School of the Street and Highway Traffic Section

By EARL J. REEDER

Chief Traffic Engineer, National Safety Council

I. Profiting by Accident Experience

The purpose of the Traffic School this year is to show how to make the records of traffic accidents which have occurred point the way to the prevention of other accidents of the same kind. It is to present the "accident experience approach" to traffic safety.

Accidents are the failures in traffic movement. The records of when, where, and how they occur show the patterns with which the traffic engineer, the educator, or the enforcement official must deal in preventing their recurrence.

If accidents occur by chance only, it is not to be expected that they will form a distinguishing pattern as to place, manner, or time of occurrence. However, if they occur from causes which are peculiar to individual street and highway locations or to individual drivers, we shall find them grouped in certain locations or we shall find certain drivers having more accidents than others. This is exactly what we do find, accident prone locations and accident prone drivers.

We find, furthermore, that the accident prone locations have characteristic accident patterns. At one location the vehicles from two directions are most commonly involved in collisions. At another, vehicles making certain turning movements are commonly involved in collisions with vehicles from a conflicting direction. At another we find vehicles from various directions colliding be-

cause traffic is complex and too dense to be handled without special restrictions or control equipment.

Among high accident drivers, some have accidents with vehicles coming from their right. Others have accidents with vehicles from the left predominating. Still others may run into the rear of other vehicles or be struck by vehicles from the rear.

These examples show definite accident proneness following distinguishable accident experience patterns. The accident experience approach identifies this pattern in each case and uses it as the basis for determining what ought to be done to prevent accidents of the same type at that location and at other locations, or involving that driver or other drivers. The value of the accident experience approach is quite as much one of accumulating information concerning remedies that are successful in preventing certain types of accidents as it is one of discovering individual cases of accident proneness.

Of course, not all accidents occur at accident prone locations; nor do all accidents involve one or more accident prone drivers. There can be and are accidents scattered here and there along the highway and drivers with only one or two accidents over a long period of time. Such accidents do not form any special pattern and, except through mass statistics, they yield no clues to the

prevention of others of the same kind. They can be prevented only through general measures of engineering, education, and enforcement. The accidents which group at certain street locations or in the experience of certain drivers, form patterns which can be analyzed and interpreted in terms of corresponding remedies to prevent the repetition of such accidents.

The accident experience approach requires, first of all, good accident records showing where, when, how, and to whom accidents are occurring. Every traffic jurisdiction should have an adequate accident reporting law requiring all accidents involving death, personal injury, or property damage to the apparent extent of \$25 or more to be reported to the proper officials. Reports of fatalities alone are not sufficient for this purpose because they are apt to form no significant grouping—they do not occur with sufficient frequency at any one location or to any one individual. The addition of accidents involving personal injury increases the spread of the accident experience and gives the person who is to make the analyses more evidence on which to work. Furthermore, the addition of the accidents involving only property damage brings into the picture more conflicts in traffic, many of which are practically as significant as those resulting in more serious consequences although the exact conditions may not be present for personal injury or death.

The severity of an accident is little indication as to its importance in accident prevention because a repetition of the same collision with a different number or different group of persons present may easily result in death or injury. The significant thing is that any accident is a traffic conflict and, potentially, a serious one.

The Standard Accident Reporting System has been developed for the use of cities and states in obtaining uniform accident reporting. This is necessary if the records of the accident experiences in different communities are to be comparable so that the experience of one community may be useful to another in preventing accidents. This system or other reports and forms providing the same information should be adopted by every traffic reporting jurisdiction. The original reports should be filed by location for immediate access to the records of any high accident location, and they should be cross-filed by the names of drivers so that

accident prone drivers can be readily identified as their accidents accumulate.

It is not sufficient merely to know that a location or a driver has had numerous accidents. The patterns of the accidents which have occurred should be determined so that the particular problem can be localized. For this purpose graphical representation of the accident experience is desirable. Collision diagrams have been developed for both high accident locations and high accident drivers, showing graphically the manner in which the accidents occur.

The location collision diagram is a sketch of the street location, either an intersection or a section of street, on which are shown the directions from which the vehicles and persons involved in the accidents approach the points of collision. Several accidents are shown on one diagram—all which occurred within the time period for which the diagram is drawn. Significant information concerning dates, times of day, and any special circumstances, is shown on one of the arrows representing each accident. For example, if a driver is intoxicated, the significance of the accident in which he was involved may be somewhat discounted in considering the accident experience of that location. The grouping of the arrows on the diagram shows the accident pattern at that location.

The high accident driver collision diagram is a graphical representation of all of the drivers' accidents on a typical section of highway showing an intersection, a curve to the right, and a curve to the left. The driver for which the diagram is prepared is always considered as going in one direction and the other driver in each accident is shown coming from the right, left, front, or rear, as the case may be. Thus, a number of collisions with vehicles from the right at intersections would be shown at the intersection by arrows pointing toward the intersection from below and from the right. A number of collisions with vehicles from the left would show similarly around the lower left hand corner of the intersection. Any special conditions concerning the drivers in question or the acts of those with whom they collided should be noted so that they may be properly evaluated in considering the accidents thus shown.

The location collision diagram must be interpreted in terms of facts to be gathered

and practices to be observed at the scene of the accident. It is a step in the solution of the accident problem which shows where the observers' efforts should be applied and gives some indication as to the supplementary information which must be gathered. The high accident driver collision diagram gives the investigator some idea of the driver characteristics and practices for which he should look in determining the reason for the particular pattern of accident experience.

The only way to avoid much experimentation and guess work in accident prevention is to make use of the accident records as a guide. A dozen accidents at an intersection in a year show that a problem exists.

* * *

II. Studying High Accident Locations

There are two general purposes of studies of street and highway locations which have developed a significant accident experience:

1. To correct the conditions which have caused the accidents at those locations, and
2. To provide information concerning accident circumstances and patterns for predicting accident experience from observation of conditions where accident data are not available.

The accident experience approach to high accident locations, either individual intersections or sections of street or highway, must start with the accident records. A single accident at any location may be the fault of the driver or the vehicle. Two accidents of the same kind begin to form a pattern. Three accidents of the same kind make that pattern distinctive. However, as the accidents accumulate there is always the possibility that one or two of a small number may have been of a different type. Hence, a good criterion is that when four accidents have occurred at a street or highway intersection or are scattered along a thousand feet of street or highway, a study ought to be made to see whether there is a distinct accident pattern which can be used in preventing accidents of the same kind later.

Out of the many remedies which may be applied at street intersections, the one which is appropriate for that location will depend upon the determination of how and when the accidents occur there. Likewise, out of the many things which might be done to correct the accident proneness of a driver, the one which is to be selected for any given case will depend upon just what kind of accidents he is having. The accident experience approach also aids in the accumulation of data concerning the kinds of accident patterns which can be remedied by different measures and, eventually, in providing the background of experience for predicting the accident pattern which will develop in the absence of the appropriate remedies.

This study ought to consist, first, of a collision diagram showing by arrows in the approximate locations of the accidents the directions in which the vehicles or pedestrians were going when involved and the locations of any fixed objects which may have figured in the accidents. These arrows show directions rather than exact locations of the vehicles in the street and, hence, should be grouped so as to avoid conflict and overlapping. On these arrows should be shown the dates and times of day to the nearest hours. In addition, any particularly significant facts concerning the accident which might discount its value in determining an accident pattern. For example, a collision involving an intoxicated driver is less significant than one involving sober drivers because more fault may attach to the driver and less to the physical conditions at the location.

A collision diagram of a section of street or highway is generally drawn to a larger scale for street width than for length so that there will be more space for lettering and collision arrows without making the diagram too long. Generally, collision diagrams are not drawn to accurate scale, anyway. So long as the general layout and the locations of the accidents along the street are evident, the scale is immaterial.

When the collision diagram has been prepared, the observer is ready to go to the location and study the physical conditions there and the common practices of the drivers. The collision diagram shows him where to look for the troubles, by localizing the problem. He may be able to see at once what it is that fools drivers into accidents. He may have to drive over the section of street in the directions of the vehicles involved, to see what other drivers do and to find out whether any of the indications of hazards are inadequate to give fair warnings. He may have to count traffic before he can determine whether one remedy or another is feasible. He may have to observe speed. If the accidents are at night he should make his observations then to find out whether the location appears the same at night as in the daytime. He should prepare a condition diagram showing the various circumstances and he should record the practices which he observed, for future comparisons after remedies have been applied.

The planner's recommendation for the remedy to be applied to the problem which he diagnoses must be reasonable and practical. It must be designed to prevent the kind of accidents which are occurring and not be merely another restriction or piece of equipment of a type in common use. The planner should remember and take advantage of the fact that there is no better argument for a traffic improvement than the fact that it will prevent accidents of a type which are occurring or will occur in its absence. He must show that his remedy is reasonable and related to the problem.

After the remedy has been applied and a sufficient time has elapsed for a fair trial, say a year, a re-check of accidents should be made, showing what kinds of accidents have been prevented, what kinds have continued, and what kinds may have actually increased as a result of the effort. This is of value not only in determining whether the remedy was successful in that particular location but, also, in gauging its application to other locations.

If a measure is successful in correcting the accident experience at one location it may be expected to be successful under the same conditions in preventing the same kinds of accidents at another location, particularly if the pattern is substantially the same. Of course, if numerous other accidents of a different type are included in the pattern,

other remedies may be necessary. If, for example, it is found that a section of winding road which has had many cases of vehicles running off the roadway at curves, has fewer accidents of this type after the section of highway has been illuminated a certain way by fixed lighting, the planner may be reasonably sure that the same treatment may be equally effective in another section of highway which has accidents of the same kind. The accident experience approach helps him to find out from experience what kinds of accidents different types of measures will prevent and, hence, to avoid applications which cannot be successful because there have been or will be no accidents of the type which they can prevent. Every successful application of an accident remedy is an important bit of experience if the traffic planner identifies the types of accidents which have been prevented.

Sometimes the traffic planner is called upon to recommend restrictions or safeguards for new highways which have had no accident experience. He cannot wait until accidents have begun to occur before he applies the proper remedy. He must be prepared to recommend the necessary safeguards, preferably, before the street is opened at all.

Here, the planner must draw upon his experiences with remedies at other locations of a similar character. Has he had another street of similar width and of the same type of pavement and carrying about the same volume of traffic which he anticipates for this one? Had there been a bad accident experience on that street before he applied some remedy and was the difficulty corrected? Is there an intersection in this street that is similar to one which he has treated successfully at some other point, similar view obstructions, irregular layout, approach grade, and character of the general locality? If so, what was successful there and what kinds of accidents were prevented?

The accident experience approach helps the planner to foresee the accident experience which will occur at some new location if the proper preventive measures are not applied.

The traffic official is confronted by so many remedies which are beckoning for the expenditure of his available money that he must be discriminating. Spending by guess involves him in an endless demand for more and more such remedies. The accident ex-

perience approach helps him to evaluate these remedies and to apply those which will be successful in preventing the kinds

of accidents which have occurred or will occur if the proper measures are not applied.

* * *

III. Studying High Accident Drivers

As in the study of high accident locations, the study of high accident drivers has the same two objectives:

1. To solve the immediate problems of individual drivers as revealed by the accident experience, and
2. To accumulate experience as to accident patterns, personal characteristics of drivers, and the results of applied remedies, as a guide to the prediction of accident proneness.

Of course, the first of these objectives leads directly into the second, but, as in the treatment of high accident locations, there are too many who want to jump over the first step in this procedure and go immediately into the treatment of predicted accident proneness without the background of experience from the many cases of demonstrated accident proneness now confronting them. They often overlook the fact that treatment of the immediate problems provide expertness in the prediction and treatment of those future ones which are not yet revealed by actual accident experience.

The accident experience approach to the solution of high accident driver problems requires, obviously, the segregation of accident records by drivers, whether these are the records of the state motor vehicle administrator, city police department, or the commercial fleet operators. This does not mean that the original accident report should be filed by names of drivers for, at least in a city police department, these should be filed by location. It does mean there should be adequate reference cards for cross-filing by names of drivers so that there can be immediate access to the general records of different drivers and the original reports can be quickly selected from the location files.

I shall not attempt to define accident proneness in terms of the number of accidents which may indicate that it exists. As

a practical matter, however, it can be approached in somewhat the same way as in the study of high accident locations. One accident, alone, is not significant as an accident pattern. Two accidents of the same kind are significant. A fleet operator should consider two accidents by the same driver as a possible indication of accident proneness which should be investigated. If I were a public official and had to deal with the records of many thousands of drivers of varying annual mileages, I should probably wait until any single driver had three or four accidents before making a study of his records. It is a practical matter of available help and the amount of time that can be given to it.

When there is sufficient evidence of possible accident proneness, the driver-collision diagram should be prepared. Such a diagram is a graphical representation of the drivers' total accident record on a typical section of highway. The driver's vehicle is indicated by a separate arrow for each accident with the vehicle of this driver facing the top of the page. Any other driver or pedestrian involved in each accident is shown as coming from the right, left, front or rear, as the case may be. In other words, the diagram is not a representation of any given intersection or location. For one accident the top of the page may be north and for another it may be any other point of the compass. The top of the page is the direction toward which the vehicle of the driver being studied was facing in each accident. Any special circumstances concerning each accident should be given, in addition to the date and time of day.

When this collision diagram has been prepared the examination of the driver to determine what conditions may be responsible for his particular accident pattern, is next. Not every deficiency of the driver may be significant because he may be com-

compensating for deficiencies if he knows about them. There is probably no reason why the discovery of color blindness should be considered the one and only reason for a predominance of accidents at curves. In fact, it might have no relation to the problem and it is certainly not the first thing that would be suggested by an accident pattern consisting of several cases of running off of curves to the left, for example. The diagram helps the examiner to select the significant from the insignificant characteristics of the driver.

A given high accident pattern may not be the result of driver deficiency in every case. He may have a vehicle which is commonly loaded so as to obstruct his view of vehicles approaching from a certain direction. His vehicle may have a "blind spot" which is particularly dangerous from his normal position in the driver's seat. Again, it may have brakes which are out of step with normal performance. Upon discovering such causes for the particular experience, the examiner may help the driver to compensate for these vehicle deficiencies by proper precautions which will compensate for them.

Whatever adjustment is made for the high accident driver, whether physiological, psychological, or mechanical, the accident experience after the adjustment should be compared with that before, to determine whether the effort has been successful. If it has not, a new analysis may be necessary. If it has, here is a definite step toward a criterion for the treatment of similar cases. The accumulation of successful solutions of high accident driver problems develops an experience which gives the examiner greater assurance of success from his subsequent efforts if he applies his experience properly.

The drivers license examiner and the examiner of applicants for jobs as commercial drivers, must be able to identify characteristics of applicants which are evidences that they are likely to be accident prone, although there may be no accident records to consult. In many cases such examinations are now quite superficial, the examiners lacking criteria for deciding in any except the more obvious cases of disqualification. Commend-

able efforts are being made with considerable success by psychologists and others to evaluate the characteristics of drivers so that those who are obviously unfit can be weeded out before they have had a chance to demonstrate their unfitness through accidents. That, of course, is the objective toward which we must strive in all phases of traffic safety, but it is a goal which we can reach only through evaluation of the experiences with actual accidents. Such experiences have shown that drivers with quite serious deficiencies can drive safely if they properly compensate for these shortcomings. That doesn't mean that every deficiency can be compensated for, nor does it mean that every driver with any kind of deficiency shall be prevented from driving. What it does mean is that we must evaluate the probabilities of accidents from different deficiencies and characteristics so that we can use these evaluations in deciding whether a given deficiency in a given driver is justification for prohibiting his driving or applying some particular type of remedy.

While studying high accident drivers, some attention should be given to the accident proneness of the residents of certain communities. In several cities spot maps have been prepared of the residence locations of persons involved in accidents, both pedestrians and drivers. It has often been found that the spots on these maps are more highly concentrated in some areas than in others. Where this is true, it shows that there is an area to which special effort should be given in adapting the educational efforts to the types of persons who live there. If such an area should be largely oriental, for example, with only a small part of the population reading and speaking English, there would be little hope of educating these people concerning safe driving, through the English language press. Such educational work must be done through the agencies which the inhabitants of the accident prone community understand and in which they have confidence. It is another and somewhat different application of the principal of localizing the problem and applying the remedy where it is needed.

IV. Accident Clinic

This session was devoted to discussion of an accident problem submitted by Z. A. Faulkner, City Traffic Engineer of Evanston, Ill. A collision diagram of a T intersection in a business district was placed on the blackboard by Mr. Faulkner and numerous questions were asked concerning other data concerning that location.

The accident pattern revealed by the collision diagram was one of a predominance of left turn accidents. Questions revealed a row of posts beneath an underpass which obstructed the view between vehicles approaching from two right angle directions. Since these supports could not be removed from the roadway without redesign of the railroad bridge, it was concluded that other measures for safeguarding the traffic would be necessary.

The discussion revealed that there were parallel streets which could handle the traffic that might be diverted from the street terminating at this intersection if left turns into this street were prevented. It was concluded that the prohibition of these turns from one direction would be the desirable solution and Mr. Faulkner explained that such action had been taken about two months ago with excellent results so far as accidents were concerned. He said that it had not seriously affected traffic movement.

A discussion of a somewhat similar intersection in Lansing, Mich., followed, in which it was pointed out that diversion of traffic to other streets was not feasible because it would involve serious problems at other intersections.

COMMITTEE REPORTS

Reports of four committees were presented during the sessions of the Street and Highway Traffic Section.

The report on Speed and Accidents, with three appendices containing charts, graphs and tables, is available in pamphlet form. In this volume the appendices of the speed report have been omitted.

The report on Tests for Driver Intoxica-

tion was prepared with two appendices containing legal citations and data on various types of tests. The complete report is available in pamphlet form. The appendices have been omitted here.

The report on Pedestrian Control and Protection and the one on Night Accident Hazards are printed in this volume in their entirety.

Committee on Speed and Accidents

Street and Highway Traffic Section

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Speed and Accidents

Presented by HARRY H. HARRISON

Traffic Engineer, Illinois Division of Highways, and Chairman, Committee on Speed and Accidents

The following is a report of progress of the activities of the Committee on Speed and Accidents. It has been prepared specifically for presentation at the Twenty-Sixth National Safety Congress in Kansas City, and

it should not be considered as a final and conclusive report on this subject. The committee will continue its study during the ensuing year and will present a more complete report at the 1938 Congress.

I. INTRODUCTION

Speed regulation is one of the most important, difficult, and controversial traffic safety problems today. Speed "too fast for conditions" is generally regarded as a frequent contributing cause of accidents, but there is little agreement on what constitutes dangerous speed or how it should be controlled.

Solution of the speed problem must include:

1. An evaluation of the relative importance of speed as a factor in accidents so as to determine the amount of attention that should be devoted to speed regulation.

2. The development and use of methods for determining safe speed values, for conveying the information to the drivers, and enforcing these limits upon those who will not conform.

Results of the first year of factual study by the Committee are given in this progress report. Since available data are inadequate to permit definite conclusions or recommendations, the Committee has presented, first, an analysis of what constitutes safe speed; second, a summary of all available information on the subject; and finally, an outline of the methods that should be most effective for getting information on which to base definite conclusions and recommendations.

II. SAFE SPEED

The speed problem is complicated because of the universal presence of speed (velocity, or rate of motion) and the difficulty of determining whether speed was excessive for the conditions when an accident has occurred. Almost every accident could have been avoided if the vehicles had been operating at sufficiently low speeds. On the other hand, considering that there is only one personal injury accident for every quarter of a million miles driven, it is obvious that most drivers operate at safe speeds most of the time. The problem is to eliminate dangerous speeding without unnecessarily reducing speeds that are not dangerous.

Adequate administrative control of vehicle speeds should permit motorists to move over the streets and highways as rapidly as possible with safety. To accomplish this purpose, motorists must be thoroughly familiar with factors affecting safe speed. They should be provided with highways adequate for the volume of traffic and engineered properly so that hidden dangers or unusual

conditions have been eliminated or adequately marked with uniform traffic control devices. Finally, the motorist must be protected, by means of adequate legislation and enforcement, from other users of the highways who may willfully operate in an unsafe manner.

The whole problem of speed and accidents may thus be stated as—

1. Determining what speeds are safe under various conditions;

2. Conveying this information to drivers so that they may drive at speeds that are within safe limits; and

3. Enforcement to control the minority of drivers that will not voluntarily conform.

The first of these three subjects is especially important because it is necessary to determine more clearly than has yet been done, what speeds are safe before we can hope through either education or enforcement to secure the general understanding and observance of safe speeds. The second subject is closely related to the first, since the effectiveness of signs, zones, *prima facie* limits and other methods for conveying information depends upon the reasonableness of the limits. In a similar manner, enforcement will more nearly be able to cope with the problem when we know what limits may reasonably be enforced for each location and each set of conditions.

What Is a Safe Speed?

A safe speed for any set of driving conditions is a speed at which a motorist can operate and have assurance of safety. Critical speeds are the limiting values for the range of speeds safe for the conditions. If the motorist exceeds the upper critical speed, he has no assurance of safety, since either (1) he is traveling too fast to stay on the roadway or be able to maneuver or stop in the available distance to avoid a collision with pedestrians or other motorists, or (2) other motorists or pedestrians misjudge his approach speed and continue some intended action which, combined with the speed, results in an accident.

The term "critical speed" is preferred to "safe approach speed," because at many times the drivers cannot continue at those speeds with safety, since they may have to slow down further or even stop to avoid collisions. But "critical speeds" are the speeds from which these precautions can be taken, with time for the driver to apply his

brakes and with a sufficient distance in which to maneuver or stop before arriving at the point of collision.

There are differences in the meanings of the terms "critical speeds" and "speed limits." Speed limits are values set by authorities as a guide to motorists and for enforcement purposes. Critical speeds, on the other hand, are the limiting values for the range of speeds within which a motorist has assurance of safety for the conditions which exist at a particular location at the time of operation. Excessive speed or "speed too fast for conditions" is speed in excess of the upper critical speed value, and consequently has a different meaning than the term "exceeding the speed limit."

The upper critical speed is the most important from the standpoint of safety. However, there is a lower critical speed below which, depending upon the amount of traffic, motorists cannot go without seriously impeding the normal flow of traffic and affecting its safety.

Factors Affecting Safe Speed

The factors affecting safe speed may be divided into five groups: (1) physical factors, (2) mechanical factors, (3) personal factors, (4) weather and visibility factors, and (5) share-the-road factors.

Physical Factors—The inherent factors of the highway as regards design, alignment, obstructions, surface smoothness and surface texture, limit the upper critical speed at many locations. These factors determine the value below which the average motorist with the average vehicle must travel if he were the only user of the highway. Intersections, blind curves, and hills are danger points when the other motorists, pedestrians, cyclists or animals are on or near the highway.

Mechanical Factors—Vehicle factors include engine power, ability to hold the road, and the condition of steering mechanism, brakes, lights, and other mechanical parts that are safe only if maintained regularly. The ability of vehicles to accelerate, to stop, and to illuminate the highway ahead at night is an important limitation upon speed.

Personal Factors—These include physical and mental ability, knowledge of sound driving practices, and skill in operation. A person with defective vision, poor coordination, or uncertain judgment in reacting to emergencies must drive at lower speeds to com-

pensate for these deficiencies. In like manner, a person skilled in handling his vehicle can in many places drive faster with safety than a person with less experience and skill.

The physical limitations in the perception of danger and the correct reaction to emergencies are most important when combined with other limitations set by traffic, road and vehicle. However, there is undoubtedly some limitation upon physical ability and skill which sets the upper limit of speed beyond which the average person should not go even under perfect conditions of weather and road, with a perfect vehicle, and with no traffic on the highway.

Reaction time and perception time for both day and night conditions are factors affecting the distance within which a vehicle can be stopped after the danger is first sighted. Effects of such time intervals upon stopping distances are shown in Figure A-6 of the Appendices.

Weather and Visibility Factors—The assured clear course ahead must be considered because of limitations on the stopping ability of vehicles. Darkness, fog, heavy rain or snow decreases visibility and thus reduces the assured clear course. An icy or wet pavement, like poor brakes, decreases the ability to stop. Any of these requires a reduction of speed below what would otherwise be safe under similar conditions of car, highway, driver and traffic. Stopping distances for vehicles under different conditions, at different speeds, and on pavement surfaces with different characteristics are given in Figure A-5 of the Appendices.

Share-the-Road Factors—Pedestrians, cyclists, animals, and other traffic on or possibly approaching the highway present one of the chief limitations upon driving speeds. Speed reduction generally is necessary at hill-crests, intersections, blind curves, drive-ways, and near parked cars and obstructions along the highways to allow for the possible sudden appearance of other highway users in the path of the vehicle. Their potential presence on the highway greatly reduces clear course ahead at many locations.

Little is known of the limitation necessary to take into account the presence of pedestrians. However, some reduction of speed is necessary in areas of high pedestrian density and in residence districts where there is a likelihood of small children playing on or near the roadway.

The general practice regarding speed often establishes both upper and lower critical speed limits. When a motorist approaches at a speed much higher than is general practice, pedestrians or other motorists may misjudge the approach speed and continue some intended action which ordinarily could have been made in safety. Examples are passing movements, left turns at intersections, and movements into intersections in which the driver making the movement misjudges the high approach speed of the other vehicle and the combination of the movement and the speed results in an accident.

In a similar manner, vehicles moving at speeds much lower than is general practice will impede the normal movement of traffic and accidents may result because other motorists become impatient and attempt to pass at locations where or at times when such movement cannot be made in safety. When there is sufficient traffic so that vehicles cannot pass one another at will, there is need for a lower limiting value for safe speeds. By speeding up the slower vehicles so that they exceed the lower critical speed, all traffic will be able to move at a reasonable speed with safety.

Determining Critical Speeds

The point at which speed becomes improper or dangerous is difficult to determine because of variations in combinations of the various factors. Sometimes the only limitations are the conditions of the vehicle and the driver, as may be the case on some open, smooth, rural highway with perfect visibility for miles in all directions. At other times, vehicular traffic limits the critical speed. At some locations, pedestrians provide a further limitation. Determination of critical speeds must take into account all of these factors, and those at each location requiring the lowest limitation should determine the maximum speed at which the average motorist can approach with assurance of safety.

Methods now are available for determining critical speeds at certain types of locations, such as sharp curves, where road factors provide the chief limitation. Methods also are available for calculating critical speeds at locations with obstructions to view, where the visibility distances and the prevailing speeds of conflicting traffic furnish the limitations. Critical speeds for other conditions and at other types of locations depend as yet upon engineering judgment and experience, supplemented by observations of

the actual speeds of vehicles at these locations and studies of the accident experience. These methods are discussed more completely in Section III of the Appendix.

Since there now is no rational solution for determining critical speeds based upon pedestrian and vehicular traffic conditions, there is need for formulation of a basic policy upon which such speeds can be determined. We must decide whether critical speeds are to be determined for conditions which assume that motorists will obey traffic regulations, or whether lower values are to be used which will permit assurance of safety when other motorists run STOP signs, park their cars on the highway near hill-crests, or commit similar infractions of rules of the road. We must decide whether motorists are to have some faith in the road continuing ahead without obstruction, or whether they must operate at speeds sufficiently slow to permit them to stop within the distance ahead which they can see in clear.

A definite policy is needed regarding the rights and privileges of the pedestrian, especially on rural highways where speeds will be greatly limited at many locations if motorists are to have assurance that they will not strike pedestrians. Another problem is whether zoned speed limits are to take into account weather, visibility, and other temporary conditions such as parked vehicles and heavy pedestrian or vehicular traffic, or whether such speed limitations should be set for permanent hazards and daylight conditions only. Also, if some factor of safety is to be used in the calculation of critical speeds, it must be evaluated. Until such principles have been established it will be difficult to develop adequate methods for determining critical speeds, conveying this information to drivers, and directing enforcement at dangerous speeds.

Accident experience is an important clue in planning corrective treatment and in determining speed limitation. When no accidents have occurred in a particular section, it is apparent that most motorists have been adjusting their speeds to the conditions and it is reasonable to use the speed at or below which 80 or 90 per cent of the vehicles travel as a criterion of critical speed. When there are locations with concentrations of accidents, a careful study of the accident experience at these locations may reveal the need for highway relocation, removal of view ob-

structions, or other corrective treatment. When hazardous conditions cannot be corrected by other means, speed reduction by means of posted limits, properly enforced, may be the only solution.

Available statistical data and other information, summarized in the following section, throw some light upon the seriousness of the speed problem and the values of speed safe for different conditions. More reliable data are needed. The committee recommends that city and state departments undertake studies suggested in the fourth section of this report so as to obtain such information.

III. FACTS ABOUT THE SPEED PROBLEM

A great deal of information on the speed problem has been accumulating during the many years officials have been dealing with it. General statistical information, mass statistics on speeding accidents, speed observation data and experiences of officials with different speed control methods are types of available information. The committee has studied these thoroughly, has undertaken special analyses of certain data, and has summarized the available information in this section and related sections of the Appendix.

General Statistical Information

Motor vehicle fatalities, as a measure of the size of the accident problem, have increased 73 per cent between 1925 and 1936, the corresponding increases in urban and rural areas being 17 per cent and 120 per cent, respectively. During this same time, motor vehicle registrations have increased 41.5 per cent and gasoline consumption, as a measure of mileage driven, has increased 110 per cent. Figures on mileage driven in urban and rural areas are not available, but it is probable that mileage has increased more in rural areas than in cities.

Urban—Urban fatalities have decreased 10 per cent since 1930, there being a 33 per cent decrease in urban daylight fatalities and a 10 per cent increase in deaths occurring after dark. Heavy pedestrian and vehicular traffic, parked vehicles, more frequent intersections, and other city conditions require that speeds in cities generally be limited to values that are below the potential ability of the vehicles. City streets are lighted, engineering attention has been directed at dangerous locations, and there generally are sufficient enforcement officials

to permit some enforcement of traffic regulations.

Rural—Rural fatalities have increased 32 per cent since 1930, there being a 15 per cent increase in rural daylight fatalities and a 48 per cent increase in deaths at night. This tremendous increase can be attributed largely to increase in miles traveled, but the increase in speeds of operation over rural highways during the same period undoubtedly has had some effect upon this record. The greater increase in rural night time fatalities indicates the need for special consideration of the rural night speed problem.

Pedestrian—Urban pedestrian fatalities have decreased 7% since 1930, but rural pedestrian deaths have increased 64 per cent during this time. Because the hazards of pedestrian traffic are entirely different from the hazards of vehicular traffic, it is necessary that special study be given pedestrians and their effect upon allowable speeds.

Speed Information on Accident Reports

Speeding as an element in accidents and the approximate speeds of involved vehicles are items included on most accident report forms. These data have limited value as a measure of the importance of speed and its relation to accidents, because the reports are made by drivers involved or by officials not trained in making a true evaluation of speed. Estimates of travel speeds are so faulty that very few states tabulate them. The reported percentages of speeding drivers shown in statistical summaries generally include only those cases of flagrant violations of arbitrary limits which generally are not related to critical values of speed safe for the conditions.

Samples of summary information on speeding accidents and tables of reported speeds of vehicles in accidents are presented and discussed in Section I of the Appendix. Although such summary information is inadequate as a measure of the importance of the speed problem, it does show the variations in methods used in different states for reporting speeds and indicates the need for more uniform and reliable methods.

Some worthwhile information, however, may be obtained from available accident reports through special study of the circumstances of those accidents with reported speed limit violations. A comparison of circumstances and types of speeding and non-

speeding accidents will reveal data on the importance of speed as a factor in accidents and its relationship to other contributing circumstances. Results of a study of this kind, sponsored by the Committee, are reported in a later part of this report.

The State Accident Reporting System that has been developed by the National Safety Council, and recently adopted in Indiana, Minnesota, Iowa, and a few other states, has a speed section which undoubtedly will permit more accurate and complete reporting of speed as a factor in accidents. Information required for each involved vehicle includes (1) approximate speed before accident, (2) approximate speed at impact, (3) safe speed, and (4) legal speed. Summary analyses are to be made of those accidents investigated by trained enforcement officers, with separate compilations for urban and rural experience. The recommended section on the summary sheet for tabulating speed as a circumstance, is shown in Table A-5 of the Appendix. The more complete use of such a system for reporting and analysis will permit the accumulation of some really worthwhile mass statistics on the relationship between speed and accidents.

Special Study of the Speeds of Vehicles in Accidents

The California Department of Motor Vehicles has reported the results of a special

study of the reports of those fatal accidents for which the estimates of speeds of involved vehicles were believed to be more reliable than on the usual report. Of 742 deaths occurring in all types of fatal accidents, both urban and rural, 239 occurred in accidents in which all vehicles were traveling at speeds less than 45 m.p.h. However, in 501 of the deaths, there was at least one of the vehicles traveling 45 m.p.h. or faster, which indicates that in more than two-thirds of the deaths, at least one of the vehicles involved in the fatal accident was traveling in the higher speed bracket.

In contrast, fatality data from accident report summaries of the Michigan, Ohio and Virginia Motor Vehicle Departments indicate that only about 15 per cent of those vehicles for which an estimated speed was given, were reported as exceeding 50 m.p.h. While these data are believed to be unreliable and are not directly comparable with the California data, the extreme variation indicates the need for addition special study.

The case study method, following reliable accident investigation procedure, will permit the collection of more accurate data on the speeds at which accidents occur and the circumstances contributing to speeding accidents. The committee now is sponsoring cooperative accident investigation projects in several enforcement departments and rec-

TABLE I Speed And Severity 10,000 New Jersey Accidents for 1936 Fatal results occur more frequently in the reported speeding accidents, and a greater per cent of the speeding accidents exceed \$100 property damage, indicating that speeding accidents are more severe.		
Type of Accident*	Ratio to Fatal to Non-Fatal Accidents	Per cent of Accidents in which over \$100 Property Damage was Reported
URBAN		
Speeding Accidents**	1 to 41	48.3
Non-Speeding Accidents	1 to 51	28.1
RURAL		
Speeding Accidents**	1 to 11	57.2
Non-Speeding Accidents	1 to 15	42.1

*All are non-pedestrian accidents, since only about 1 per cent of reported speeding accidents include pedestrians.

**Accidents involving reported speed limit violations, Statistical Bureau, National Safety Council.

ommends that still other departments undertake such an activity.

Speed and Severity—Available reliable data indicate that severity of accidents increases as speeds of the vehicles involved in the accidents increase. Quoting from the 1937 edition of "Accident Facts"—

"Present day reports of actual speeds in motor vehicle accidents are not believed to be reliable. There are sufficient data, however, to determine that in any group of accidents the chances of a fatal result increase rapidly as speed mounts. Whereas in all motor vehicle accidents it is estimated that there are 35 injuries for every fatality, in accidents occurring at speeds of less than 20 m.p.h. this ratio increases to 61 non-fatal accidents for every fatal accident and at speeds of 50 m.p.h. the ratio falls and one accident in every 11 proves fatal."

Additional data on speed and severity were developed for the Committee in a special analysis of 10,000 New Jersey accidents. These data, shown in Table I, indicate that the chances of a fatal result are greater in accidents involving vehicles exceeding the speed limit. Also, more property damage is reported in the speeding accidents.

It is a known fact that the amount of energy required to bring a vehicle to a stop increases as the square of the speed, so it is to be expected that damage and accident severity be greater at higher speeds. However, a study of severity does not indicate whether accidents actually occur more frequently at higher speeds. Reliable information on the frequency of all types of accidents occurring at different speeds would be very helpful in a proper evaluation of speed as a factor in accidents.

New Jersey study of Speeding Acci-

TABLE II
A Comparison Between Reported Speeding and Non-Speeding Accidents As to Type of Accident
10,000 New Jersey Accidents in 1936
(A speeding accident is an accident with a reported speed limit violation)

Types	URBAN			RURAL		
	Non-Speeding Accidents			Non-Speeding Accidents		
	Accidents Involving Speed Violations	Non-Pedestrian Accidents*	All Accidents	Accidents Involving Speed Violations	Non-Pedestrian Accidents*	All Accidents
Pedestrian	.6%	—	32.6%	1.0%	—	11.2%
Other Motor Veh.	98.2	85.0%	57.5	94.0	78.1%	69.4
Horse-Drawn Veh.	1.1	.7	.7	—	.5	.4
Railroad Train	.1	.4	.2	—	.3	.3
Street Car	—	1.6	1.1	.3	.2	.2
Bicycle	—	3.1	2.1	—	2.1	1.8
Fixed Object	1.0	6.1	4.1	2.6	13.6	12.1
Non-Collision Op.	.1	2.3	1.5	2.1	4.7	4.2
Non-Operating	—	.2	.1	—	.1	.1
Miscellaneous	—	.2	.1	—	.4	.3
Total	100.0%***	100.0%	100.0%	100.0%***	100.0%	100.0%

*Since accidents involving a speed violation are predominantly non-pedestrian, the speeding accidents are more properly compared to Non-Pedestrian, rather than all non-speeding accidents.

**671 Urban Speeding accidents.

***381 Rural Speeding accidents.

Statistical Bureau, National Safety Council.

dents—A thorough study of 10,000 accidents, about one-third of the 1936 New Jersey accident experience, was recently completed by the Statistical Bureau of the National Safety Council. As one phase of the study, a special analysis was made of speeding accidents so as to furnish the Committee with data on circumstances contributing to speeding and non-speeding accidents. The most significant data are summarized here. Supplementary information is included in Section I of the Appendix.

The predominant type of accident involving a reported speed limit violation, as shown in Table II, is a collision between two or more motor vehicles. Pedestrians were involved in only one per cent of the reported

rural speeding accidents and 0.6 per cent of the reported urban speeding accidents. Although this indicates that speed in excess of legal limits is not a major contributing cause of pedestrian accidents, it also reflects the probability that drivers submitting accident reports rarely admit that they have been speeding.

The most important information developed from the New Jersey Study is data substantiating the belief that speeding violations themselves are not a direct cause of accidents, but that vehicular defects, faulty actions, and other violations generally are necessary to bring the speeding driver to grief. In Table III, it may be observed that violations of non-speeding drivers involved

TABLE III
A Comparison of Contributing Circumstances in Speeding and Drinking Accidents
10,000 New Jersey Accidents in 1936

Per Cent of Drivers for Which the Circumstance Was Reported
(A speeding accident is an accident with a reported speed limit violation)

Circumstance	Drivers in Speeding Accidents		Drivers in Non-Speeding Accidents*	Drivers in *** Drinking Accidents		Drivers in Non-Drinking Accidents*
	Speeding Drivers	Non-Speeding Drivers		Drinking Drivers	Non-Drinking Drivers	
	Per Cent	Per Cent	Per Cent	Per Cent	Per Cent	Per Cent
Total Driver Violations						
Urban	100.0**	43.0	41.3	79.5	13.9	45.0
Rural	100.0**	58.6	54.1	88.3	19.8	56.4
Total Vehicular Defects						
Urban	10.0	4.6	4.3	6.8	3.5	4.7
Rural	10.6	5.7	7.3	8.6	4.8	7.6
Total Driver Defects						
Urban	23.3	18.1	14.2	100.0***	4.3	12.5
Rural	31.4	21.7	23.9	100.0***	4.8	21.5
Left Turn Movements						
Urban	1.0	15.9	9.4	8.3	4.4	8.7
Rural	2.9	31.9	10.6	7.6	4.2	10.1

*Non-Pedestrian accidents used for comparison as in Table II.

Speed limit violations. *Had been drinking.

Statistical Bureau, National Safety Council.

in speeding accidents are almost three times as frequent as violations of non-drinking drivers in drinking accidents. Also, violations of non-speeding drivers in speeding accidents are more frequent than violations in non-speeding accidents. If speed were a direct cause of accidents, it would be expected that non-speeding drivers in speeding accidents would be relatively less "guilty."

Left turn movements, driver defects, and vehicular defects are shown to be reported much more frequently in speeding than non-speeding accidents. For example, Table III shows that 31.9 per cent of non-speeding drivers in rural speeding accidents were reported making left turns as compared with a 10.6 per cent normal left turn movement. This indicates that speeding accidents occur more frequently at intersections, which is substantiated by data on road location. 78.8 per cent of the urban speeding accidents were at intersections as compared with a normal 58.7 per cent for non-speeding accidents. Similarly, 49.3 per cent of rural speeding accidents were at intersections while only 27.7 per cent of rural non-speeding accidents were at intersections.

Similar special analyses of speeding and non-speeding accidents should be made in other states and cities so that additional quantitative data on circumstances contrib-

ing to speeding accidents can be obtained. The Committee recommends such studies and will be glad to furnish instructions for making them.

Vehicle Speed Observations

Observations of speed practices of vehicles furnish an indication of the speeds that motorists think are safe for the existing conditions. Most of the observations made by city and state departments have been made for purposes of enforcement, traffic capacity, or merely to find out how fast vehicles were traveling so that speed practices of different areas could be compared. Generally, the observations were made under favorable weather and traffic conditions on level, open sections of highway where high speeds would be expected. As a result, most available speed observation data are of little help in evaluating the relationship between speed and accidents.

Summary results of speed observations made in several cities and states are shown in the following table. Data for such states as California, Indiana and Iowa were obtained under conditions especially favorable to high speed, while observations in other states represent the average of observations taken under a variety of conditions. Supplementary speed observation data are shown in Section II of the Appendix.

TABLE IV Speed Observation Data Obtained in Traffic Surveys and Special Speed Studies Compiled from Information Furnished the Speed Committee				
STATE or CITY	Date of Observations	Average Speed in M. P. H.	The 20% Speed in M. P. H.*	The 90% Speed in M. P. H.*
California	1936	44.0	35	54
Connecticut	1934	40.0	33	53
Indiana	1934	50.1	41	65
Iowa	1935	49.0	42	63
Michigan	1936	45.4	29***	49.1****
Ohio	1934	43.0	35	55
Rhode Island	1934	33.8	28	45
Minneapolis	**	22.6	14	32
Knoxville	**	28.9	21	41
Providence	**	23.0	19	28
Several Cities in N. J.	**	28.0	22	38

*The Speed at or below which 20% or 90% of the vehicles travel.

**Data from 1935 REPORT of National Safety Council Speed Committee.

***Average of the slow 15 per cent.

****Average of the fast 15 per cent.

The city speed observation data in Table IV show that urban speeds are considerably less than those in rural areas. The observations in Providence show that only 10 per cent of the vehicles exceeded 28 M.P.H., and that 70 per cent of the vehicles were observed traveling in the nine mile speed range from 19 to 28 M.P.H. Speed zoning and strict enforcement has prevailed in Providence for a number of years, and the average speed of vehicles in Providence has decreased from 26.1 in 1933 to 24.2 in 1936.

Information on the relationship between physical conditions and observed vehicle speeds is very meager. Some special studies have been made in Connecticut, Rhode Island, California and in other places to measure speeds on curves, at intersection approaches and at railroad grade crossings, but little if any data have been collected to show the relationship between observed speeds and critical speeds at such locations. A sample of available significant data obtained during the recent Michigan Highway Planning Survey, is shown in Table A-10 of the Appendix.

Observations of the obedience to posted limits in speed zones have been made in Rhode Island, Michigan, and Illinois, and are summarized in Section II of the Appendix. It has been found that the lower speed zone limits are disobeyed much more frequently, which indicates the need for more careful selection of these zones and adequate enforcement of the limits.

Vehicle Condition Survey

The Illinois Division of Highways is now completing a comprehensive study of braking ability and headlight efficiency in an effort to determine upper critical speed values for night driving conditions. Preliminary data indicate that 50 MPH is as fast as the average vehicle should be operated if the motorist is to be able to identify a pedestrian or fixed object in the roadway and come to a stop before colliding with it. When two vehicles are meeting, the further reduction in visibility permits speeds not more than 30 MPH.

As one phase of the study, vehicles were stopped on the highway and the condition of the brakes and the lights were tested. Of 22,528 vehicles, 14.2% were found to have both deficient brakes and faulty lights. Only 10.9% were found to have brakes and lights both in good condition. More data are now

being obtained so as to permit a recommendation on safe night driving speeds for the average vehicle. The tremendous increase in the night accident problem, especially in rural areas, points to the need for more definite control of night driving speeds.

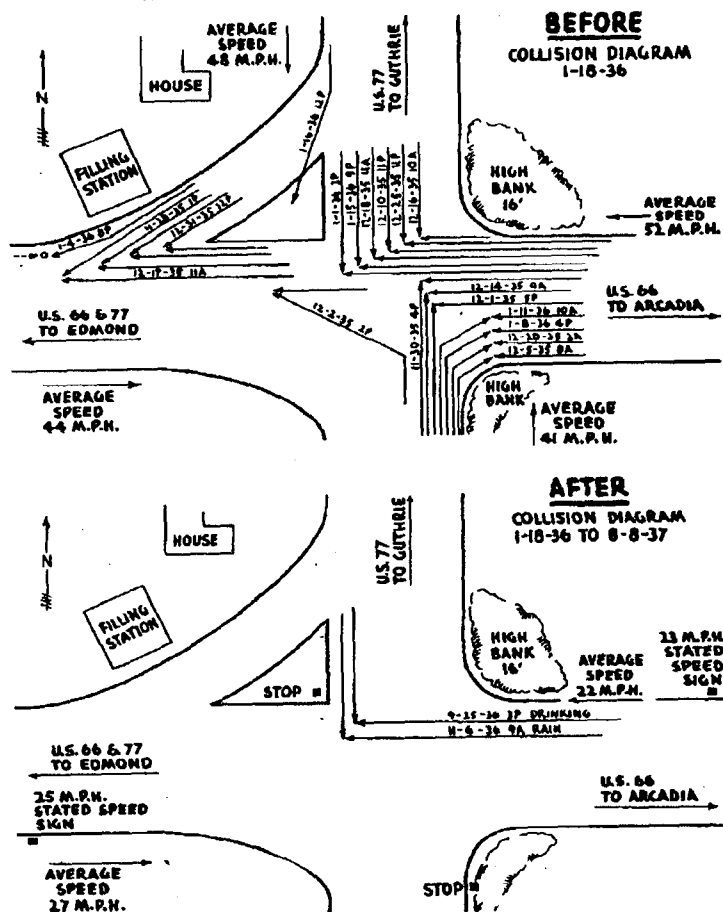
Speed Observations Related to Accidents

The relation between speed practices and the accident records of vehicle owners was investigated as a part of the 1934 Connecticut speed survey. License numbers of each of about 1,000 vehicles observed in the two speed ranges (35 to 45 M.P.H. and over 50 M.P.H.) were recorded and the accident records of the owners of each vehicle were investigated by consulting the driver files of the State Motor Vehicle Department. It was found that about 30 per cent more of the operators who traveled at the higher speeds had accident records. Also, owners of the vehicles in the fast group had been involved in about 45 per cent more accidents than those in the slow group. The investigation did not include special study of the possible effects of differences in vehicle mileage, ages of the vehicles, and other circumstances which may possibly have had some bearing upon the extent to which speed alone was a factor.

The best available information on the relationship between speed and accidents has been obtained in case studies of high accident locations, using the collision diagram method of analysis. The before and after study of speeds, conditions, and accidents at a rural intersection of two major rural highways, made for the committee by the Oklahoma Department of Public Safety and shown in Figure 1, is a striking example of the effectiveness of speed control in reducing accidents at locations where it is not economically feasible at the time to eliminate hazardous conditions by road improvement or similar remedy.

Motorists apparently had been accustomed to traveling along the open rural highways at high speeds and had not been aware of the necessity for decreasing speeds to such low values at this intersection. After the signs indicating necessary speed limitations were erected, the average approach speeds were greatly reduced, and accidents at this location were practically eliminated. Similar case studies for other locations in Oklahoma are shown in Figures A-3 and A-4 of the Appendixes.

FIGURE I
SPEEDS AND ACCIDENTS BEFORE AND AFTER
INSTALLATION OF SPEED CONTROL SIGNS AT RURAL
HIGHWAY INTERSECTION IN OKLAHOMA



There is definite need for additional data obtained through the use of the accident experience approach to the speed problem. Most motorists are able to adjust their speeds to average driving conditions, but at locations where there are unusual conditions, they need help. Spot maps reveal the types of locations where accidents tend to concentrate. Collision diagrams and studies of speed practices and conditions at these locations show whether the hazard can be removed or reduced or whether speed reduction through special speed control methods is needed.

After speed control signs or other methods have been adopted, the accident records will reveal whether they have been effective in reducing accidents.

Several cities and states are undertaking special studies of speed, conditions and accidents, following the general procedure prepared for the Committee. It is only after comprehensive data of this sort have been gathered that we can intelligently plan zoning programs, determine enforcement policies and educate drivers to operate vehicles at speeds safe for the conditions.

SPEED CONTROL METHODS

Progress in speed regulation during the past few years has been rapid, although it has not kept pace with vehicle and highway developments. Few studies of speed control methods have been made—progress has been based almost entirely upon past experience, each jurisdiction learning through trial and error. Legislation has been greatly improved and engineering and enforcement methods have been developed, but there still is need for more progress if speed control methods are to be adapted to present day conditions.

In planning speed control methods, there should be proper recognition of highway construction and maintenance as preferred methods for eliminating hazardous conditions. Highway engineers are constructing new highways and eliminating danger spots in old highways as rapidly as funds become available so as to permit higher and more uniform speeds with safety. Whenever hazardous conditions can be corrected through improvement of the roadway or the conditions surrounding the roadway, that method should be preferred to speed limitation.

Speed control methods that have been used or suggested, either alone or in combination are (1) speed legislation, (2) speed zoning,

(3) education, (4) enforcement, (5) traffic signal systems and (6) governors or other vehicle limitation.

Speed Legislation—The trend in speed legislation is toward the speed provisions in the 1934 edition of the Uniform Vehicle Code. These provide, (1) a basic rule that "no person shall drive a vehicle on a highway at a speed greater than is reasonable and prudent under the conditions then existing," (2) numerical prima facie limits as a guide for drivers and enforcement officials, and (3) authority for the alteration of prima facie limits by the erection of signs, after engineering and traffic investigations have shown such alterations desirable.

Maximum lawful limits were used for many years prior to the development of the Uniform Code provisions, but were generally conceded to be unsatisfactory because the limits generally did not fit the conditions. This resulted in hardships upon both motorists and officials, because a motorist traveling faster than the maximum lawful speed was violating the law even though the speed may have been safe for the conditions. As a result, many states abolished all numerical limits and adopted the basic speed rule. It then was possible to make arrests for unsafe speeds, but it was very difficult to obtain convictions. Now, many states have supplemented the basic rule with prima facie limits as recommended in the last edition of the Uniform Vehicle Code.

Exceeding a prima facie limit is unlawful unless the motorist proves that he was traveling at a speed safe for the conditions. In contrast, a violation of an absolute limit is always unlawful and it is necessary only to prove that the speed was exceeded. Thus, a motorist can exceed the prima facie limits when conditions permit faster speeds of operation with safety, but he must be careful when exceeding these limits because the burden of proof will be upon him in the event of trouble. Motorists must also operate at speeds lower than the prima facie limits when conditions warrant, but in such cases, the city or state must prove that the speeds were unsafe.

The present practice with regard to speed legislation is shown in Table V. Speed legislation in several states was brought into conformance with the Uniform Code provisions within the past year. However, there are still many states with obsolete speed provisions.

TABLE V

State Speed Limits for Passenger Vehicles
October, 1937Compiled from State Motor Vehicle Laws and
Data Furnished by Officials of State Departments

State	Equiv. of Basic Speed Rule	General State-Wide Speed Limits						Authority to Fix Other Limits			
		Values in M.P.H.					Types	Power of State to Zone State Highways*		Municipalities Power to Fix or Alter Limits	
		Rural	Sub-urban	Res. Dist.	Bus. Dist.	Other		Prima Facie Limits	Absolute Limits	Prima Facie Limits	Absolute Limits
Ala.	x	—	—	25	15-20	(a)	x	—	—	x (j)	—
Ark.	x	—	—	25	20	(a)	x	—	—	x (j)	—
Cal.	(c)	45	—	25	20	(a)	x	—	—	—	—
Colo.	x	60-20	—	30	25	(a)	x (g)	x (h,g)	—	—	—
Conn.	x	50 (d)	—	25	25	—	x	—	—	—	—
Del.	x	45	—	25	25	—	x	—	—	—	x (b)
Fla.	x	45	—	25	15	—	x	—	—	—	—
Ga.	x	40	—	20	15-20	(a)	x	—	—	x (j)	—
Idaho	x	35	—	25	20	—	x	—	—	—	—
Ill.	x	—	35	25	20	—	x	—	—	—	—
Ind.	x	—	—	30	20	—	x	—	—	x (j)	—
Ia.	(c)	—	—	25	20	—	x	—	—	—	—
Kans.	(c)	—	—	25	20	—	x	—	—	—	—
Ky.	x	40	40	20	15	(a)	x	—	—	x (b)	—
La.	x	—	—	25	20-15	(a)	x	—	—	—	—
Maine	x	35	—	25	20-15	(a)	x	—	—	x (i)	—
Md.	x	45	—	25	20	35 (r)	x	—	—	—	—
Mass.	x	30	30	20	20	(a)	x	—	—	—	—
Mich.	x	—	—	20	15	—	x	—	—	x (c,a)	x (c,a)
Minn.	(c)	45	30 (u)	30 (u)	30 (u)	30 (e)	x	—	—	—	—
Miss.	x	50	—	20	20	(a)	x	—	—	—	x (k)
Mo.	x	25	—	—	—	—	x	—	—	(n)	—
Mont.	x	—	—	25	20	—	x	—	—	—	—
Nebr.	x	50	—	25	20	—	x	—	—	—	—
Nevada	x	(d)	—	25	20	(a)	x	—	—	—	—
N. H.	x	40	—	20	20-15	(a)	x	—	—	—	x (m)
N. J.	x	40	—	25	20	(a)	x	—	—	—	—
N. M.	x	—	40 (d)	25	20	(a)	x	—	—	x (b)	x (k)
N. Y.	x	45	—	25	20	—	x	—	—	—	—
N. C.	x	50	—	25	25	(a)	x	—	—	—	—
N. D.	x	45	35	25	20	(a)	x	—	—	—	—
Ohio	x	—	—	25	20	(a)	x	—	—	—	—
Okl.	x	—	—	—	—	—	x (c)	x (c)	—	—	—
Ore.	x	45	—	25	20	(a)	(i)	—	—	(v,i)	—
Penn.	(c)	30	35-25	35-25	35-25	(a)	x	—	—	(p)	x (n)
R. I.	x	35	—	20	20	—	x	—	—	(p)	—
S. C.	(c)	55	—	35	25	—	x	—	—	x (h)	x (h)
S. D.	x	40	—	20	20-15	(a)	x	—	—	—	—
Tenn.	(c)	—	—	30	30	(a)	x	—	—	x (h)	—
Texas	x	45	—	25	20	(a)	x	—	—	—	—
Utah	x	50	—	25	20	(a)	x	—	—	—	x (j)
Vt.	x	30 (c)	—	—	—	—	x	—	—	—	—
Va.	x	45	—	25	15	(a)	x	—	—	—	—
Wash.	(c)	50	—	25	20	(a)	x (u)	x (h)	—	—	x (k)
W. Va.	x	45	25	25	20	(a)	x	—	—	x (j)	—
Wis.	x	—	25	20	15	—	x	—	—	—	x (j)
Wyo.	x	35	—	—	—	—	x	—	—	—	x (k)

(a) Special limits for obstructed curves, intersections and/or at schools. (b) Questionable—Not officially confirmed. (c) New law in 1937. (d) Department regulation. (e) Limit in unincorporated places. (f) 50 mile night limit in 60 mile zone. (g) Enforced as absolute limits. (h) Authority to decrease limits only. (i) Authority to increase limits only. (j) Authority to adjust within values specified in state law. (k) May increase speed on signalized streets. (l) May post 25 or 35 m.p.h. limits. (m) No definite authorization in motor vehicle law, but signs indicating safe speeds have been erected on curves and/or sections of street or highway. (n) Special absolute limits. (o) Special prima facie limits. (p) Interpreted as absolute limits by Department. (q) Indicated speeds—penalties for violation of the basic speed rule are greater when indicated speeds are exceeded. (u) Also prima facie evidence of reckless driving. * 20 States have special authority to set absolute limits at bridges.

x = yes

— = none

? = not known

Minnesota recently adopted a 50 mile night prima facie limitation for those speed zones with a sixty-mile day limitation. Oklahoma is considering a special night driving limitation, to be enforced as a department regulation. Sufficient data are not available for the Committee to recommend a definite night driving limitation but states should consider its desirability.

Although prima facie limits permit much greater flexibility, they are often more difficult to enforce than absolute limits. When states use adequate engineering methods based upon critical speed values for selecting speed zones, it probable that absolute limits for speed zones will be much more effective in speed control. As shown in the table, new laws in six states provide for absolute limits in speed zones. However, unless adequate engineering methods for speed zone selection are to be used, prima facie limits still are desirable.

Speed Zoning—Establishment of speed zones based upon engineering and traffic investigation of conditions is a recent speed regulation development. Outstanding examples of this development are in Rhode Island, Illinois and Connecticut. A large number of state departments, as shown in Table V, now have authority for the establishment of speed zones, and many of them have traffic engineering departments for making the necessary engineering investigations.

Caution, warning and regulatory type signs are generally used in present traffic control systems to inform motorists that they are approaching hazardous conditions where speed reduction may be necessary. Warning signs are used at locations of permanent hazard such as at curves or narrow bridges. Caution signs are used at locations where hazards exist only part of the time, such as at cattle crossings, pedestrian crossings or open cross roads. Stop signs, as one regulatory type sign, are placed in approaches to those intersections where safety requires that vehicles come to a stop before entering the intersection.

Stated speed slow signs are warning type signs, while other speed signs are generally of the regulatory type. Like other warning signs, stated speed signs inform the motorist of a change in conditions ahead and in addition, indicate to him the speed at which he can approach with assurance of safety.

Speed zones generally are established at

locations where unusual conditions require that speeds be lower than prima facie limits, or where the conditions permit speeds greater than these limits. Their purpose is to specify reasonable limits suited to special conditions so as to obtain greater voluntary obedience and permit enforcement directed at speed "too fast for conditions." Speeds may be stated for intersection approaches, curves, or other individual locations, but generally a speed zone consists of a section of highway over which motorists can operate at a fairly uniform speed. When a section is zoned for a uniform speed, there may be intersections and other locations in the zone where reductions below the zoned speeds are necessary.

The Uniform Vehicle Code provisions now recommend state-wide prima facie limits for business and residential districts with definitions of the terms "business district" and "residence district" sufficiently flexible to permit speed regulations adapted to the conditions. Authority also is given municipal officials to zone certain streets after engineering and traffic investigation have shown that special limitations are desirable. This zoning authority is especially helpful in speed control on through streets and at entrances to municipalities.

Table V shows that of the 37 states in which municipal limits are specified by state law, only five have given the municipal authorities power either to increase or decrease the limits upon certain streets or at specified locations. However, in at least 13 other states, municipalities can increase the general limits.

Case studies of the accident experience often indicate the desirability of adopting special speed limitations at individual locations. Stated speed slow signs for use at intersections, curves, hillcrests and other hazardous locations have been recommended for some time by the National Conference on Street and Highway Safety. Although additional data are needed to determine their effectiveness in speed control and accident reduction, there is sufficient information available to show that they have been effective at many locations.

Recently, the Missouri Highway Department inaugurated an experimental speed control project involving the marking of curves with signs indicating the critical speeds. A special instrument adapted from an airplane bank indicator was used to deter-

mine on a uniform basis the critical speed values for every important curve on one of the federal highways across the state. Reflectorized critical speed signs were erected at the approaches to these curves. Once a motorist becomes accustomed to the zoned values, he can adjust his speed to a value above or below the limits, depending upon his personal limitations. Data on the effectiveness of this installation are not yet available, but there are indications that motorists are helped by the speed signs.

When motorists approach urban areas on rural highways they lower their speeds gradually as they approach the more congested parts of the municipality. Graduated speed zones, with the zoned limits decreasing in steps and conforming to the practices of average careful motorists, have been successful when they have been intelligently applied and reasonably enforced. Further study of graduated speed restrictions at entrances to municipalities are necessary so that uniform methods for their application can be developed and used as the basis for speed control programs.

Studies of methods for the selection of speed zones have been undertaken by graduate students in the University of Illinois, University of Maine, and Harvard University in an effort to identify the best procedure for selecting such zones. A cooperative project of the Highway Research Board and the Bureau of Public Roads has just been completed although data are not yet available. Experimental zoning projects also have been started by highway departments in Michigan and Minnesota. Additional studies are recommended so that uniform methods may be adopted and used in each city and state. One of the important jobs before the Committee is the promotion of research studies of the effectiveness of various speed zoning methods in securing voluntary obedience and accident reduction.

The need for the formulation of the basic principles for determining critical speeds has been pointed out in section II of the report (page 4). Until such principles have been established, it will be difficult to develop uniform, objective methods for the selection of speed zones.

Driver Education—The education and training of drivers so that they will have a greater appreciation of sound driving practices and their own abilities and limitations will be an effective means for obtaining bet-

ter voluntary speed control. High school driver training, mass driver training programs, public educational methods and education through intelligent enforcement, all should be extensively developed.

Speed control information for use in driver training programs generally must make use of engineering data. Much information on the relationship between speeds and stopping distances, energy and impact, are available now and such information should be incorporated in the educational program. However, it will be much more effective after adequate and uniform methods for zoning of the highways for safe speeds have been developed and applied to the highway system. Then, motorists can be educated for the proper use of uniform engineering aids furnished them.

Enforcement—Information on enforcement practices in cities and states was obtained for the Committee through questionnaire study, and it indicates that most present day enforcement still is directed at speed limits that are 5 and 10 miles above the legislative limits, with some departments making arrests only after legislative limits are exceeded by 20 miles. Many cities and a few states have absolute limits, but the majority have the basic speed rule with *prima facie* limits. A study of the data indicates that there is better enforcement in jurisdictions where the speed zones and limits are adapted to the conditions.

Enforcement campaigns directed at high speeds have been undertaken in a few jurisdictions. The California Highway Patrol undertook a special drive on speed during the month of July, 1937. Patrolmen were instructed to arrest all motorists traveling over 50 M.P.H. The rural motor vehicle fatality record for this month showed that there were 32 fewer fatalities than the corresponding month of the previous year, representing an 18 per cent reduction. The drive was not continued because of the danger to highway patrolmen when traveling at high speeds to overtake speeding vehicles.

Enforcement of a 30 M.P.H. maximum speed restriction has been undertaken in campaigns by police departments in St. Louis, Minneapolis and St. Paul. The 30 mile campaign in St. Louis showed a substantial reduction in accidents, injuries and fatalities, but was discontinued after one month. The enforcement programs in Minneapolis and St. Paul are still under way. Fatalities,

as compared to those similar periods of the preceding year, have been reduced in Minneapolis but have increased in St. Paul.

Such enforcement programs directed at speeds in excess of a single arbitrary limit will undoubtedly have value if they lead to the development of a continuous program directed at speed "too fast for conditions." However, it is probable that motorists are unduly restricted at locations where speeds faster than 30 m.p.h. are safe, even though accidents are reduced at these locations. Also, it is probable that both speeds and accidents will increase at locations where a 30 m.p.h. speed is too fast for conditions. Studies of the accident distribution by means of spot maps, prepared for similar periods before and after the enforcement drive, should give a better indication of the effectiveness of the program.

There is need for development of a method of enforcement directed at drivers operating at speeds "too fast for conditions," rather than enforcement directed at speeds in excess of arbitrary limits. Available engineering information on critical speed values has not been used in the enforcement program. Much of this information could be used now, although it will be much more effective when uniform engineering methods for speed zoning are used universally.

When properly engineered speed limits are available, schedules of critical speeds for each section of street and highway in a city or state can be furnished to enforcement officers, prosecutors and judges. General zoned limits and stated speed values at hazardous locations will be posted for the information of the driver. Officers then can make arrests only in cases where critical speed values are exceeded. In this way, reasonable and effective enforcement programs can be developed for controlling speed both in urban and rural areas.

There is need for a study of methods for securing evidence of speeding violations. Most officers now are required to follow a motorist for several blocks so as to be able to say how fast the motorist was traveling. However, Kansas City recently has been experimenting with radio as a means for identifying speeding motorists. As limits are revised and made more reasonable, consideration should be given the admissibility of information obtained through speed traps. Such information is not allowed to be admitted as evidence in many states today.

Traffic Signal Systems—Flexible, progressive signal systems, properly designed to permit uniform movement at a reasonable, yet safe speed, are ideal as a means for speed control on important city streets where there is sufficient traffic to warrant the installation. There is a definite trend toward their use to control speed as well as to facilitate traffic movement.

Governors or Power Limitation—Mechanical governors have been proposed to limit the speed of passenger vehicles to 50 or 55 M.P.H. Their use will prevent motorists from operating at exceedingly high speeds, but cannot prevent operation at speeds "too fast for conditions," when critical speeds are less than the limit at which each governor is set. Present day governors limit the flexibility of operating a vehicle, especially when driving at a speed near the governed limit and additional power is needed to pass another vehicle. Governors may encourage a totally wrong attitude on the part of the public towards speed control, because they may lead a driver to believe that he is safe when he stays below the governed limits.

Governors have been used successfully on some commercial fleets where there is rigid control of the operators, and there is evidence available that they have helped to reduce accidents. The Bureau of Motor Carriers of the Interstate Commerce Commission is now undertaking a thorough questionnaire study to obtain experience of interstate fleets with speed governors. As yet, there are few statistics available to show whether governors would be effective in the control of passenger vehicles. Those that are available for government owned passenger vehicles indicate that they are not especially effective. Further information on this point will be collected by the Committee.

Difficulties involved in a nation-wide program of compulsory installation of governors, education of drivers to their use, and enforcement of compulsory provisions greatly overshadow the questionable benefits that may be obtained from their nation-wide use. It should be even more difficult for a single city or state to require governors, and the possible benefits undoubtedly would be still more questionable. For the present, the Committee does not recommend their use, but suggests that data be gathered to determine their effectiveness both for passenger vehicle fleets and for vehicles of chronic speeders and accident repeaters.

Limitation on the power of vehicles so that they cannot be operated at excessively high speeds, has been suggested. However, such limitations would also affect acceleration, which often is helpful in avoiding accidents. Indications are that the public would be adverse to a reduction in vehicle power. More information is needed to determine whether such limitation would be practical and effective.

The compulsory use of governors in urban areas or in certain mountainous or heavily congested states has been suggested. In such localities, the governed speed possibly could be set at values which correspond to the critical speeds of a large percentage of the vehicle mileage. These limitations would not be desirable unless methods can be developed for this type of governor control, satisfactory to motorists as well as to officials. If such methods were to be developed, governors for night driving, in operation when headlights are required might be a possibility.

Control of Slow Speeds—Slow moving vehicles impede the free movement of traffic, especially when the volume of traffic or the topography of the territory make it difficult for vehicles to pass one another. Slow moving vehicles also are an accident hazard when motorists behind them become impatient and attempt to pass at locations where the passing movements cannot be made with assurance of safety.

Many states have the Uniform Vehicle Code provision which states that it is a misdemeanor to continue to operate at such slow rates of speed as to seriously impede the normal movement of traffic. With the exception of warnings, however, there generally has been very little enforcement of the provision.

Trucks are among the most serious offenders, especially upon grades. Ultimately, it may be necessary to adopt legislation requiring that trucks in their normally loaded condition have the ability to ascend grades that are typical in the area, at speeds of 20 M.P.H. or greater. However, more study of power requirements, loads and speeds of such vehicles on different grades is necessary before a definite recommendation can be made.

More data on the relative importance of slow moving vehicles as a factor in accidents, and data on the effectiveness of different methods for dealing with slow moving ve-

hicles are needed before the Committee can make any definite recommendations regarding control of slow moving vehicles.

IV. PRESENT AND PROPOSED SPEED RESEARCH STUDIES

The Committee has developed five different types of field speed studies which city and state departments have undertaken or are undertaking as cooperative projects. These studies, all based upon the accident experience approach to the speed problem, are outlined below. Instructions for undertaking these studies will be furnished by the Committee.

STUDY A—Case Study of Accidents with Complete Engineering Investigation. This study involves the complete engineering investigation of typical cases of urban and rural traffic accidents. The investigation will go considerably further than usual police investigations. An attempt will be made to evaluate the underlying fundamental causes in addition to determining whether there have been violations of motor vehicle laws. Speed "too fast for conditions" will be evaluated as one of the contributing causes, and will be correlated with other circumstances contributing to the accidents.

STUDY B—Case Study of Accidents with Special Speed Investigation. This study involves the special investigation of speed as a factor in the accidents which enforcement officers now attend. It is intended that this study enable officers to obtain valuable information on speed without much additional time and expense. Supplementary speed report forms and instructions will be furnished so that officers can make reasonably accurate estimates of (a) vehicle speed before accident, (b) lawful speed, and (c) safe speed for the conditions. Correlations will be made between speed "too fast for conditions" and other contributing causes, such as defective equipment, stop sign violations, etc.

STUDY C—Study of Relation Between Speeds, Conditions and Accidents. High accident locations in a section of street or highway are selected and studies are made of roadway and traffic conditions at these locations to determine critical speeds of operation. Speed observations are made at these locations and at nearby accident free locations so as to evaluate changes in speed practices as dangerous locations are approached. Differences between critical speeds and actual speeds are related to accident

concentrations. Accident studies will be made by means of collision diagram analysis.

When special speed control signs have been erected or a hazard removed as the result of a study, the study procedure should be repeated later so as to evaluate the effectiveness of the remedy in obtaining voluntary obedience and reducing accidents.

Distinct types of the study include the following:

1. Study of speeds, conditions and accidents in an experimental section, with controlled conditions, so as to evaluate the effectiveness of speed zoning methods.

2. Studies of the effects of improvements in physical condition of the highway upon speeds and accidents.

3. Studies of voluntary obedience to limits in existing speed zones.

4. Studies of speeds and accidents at individual high accident locations.

STUDY D—Study of Effectiveness of Speed Enforcement. Engineering methods are used to determine critical speed values for sections of street or highway in an area and these values are used in an enforcement program directed at speed "too fast for conditions." When possible, speed observations at selected points should be made before and after the enforcement to determine the effectiveness of enforcement in reduction of dangerous speeds. Also, before and after studies of accident records, using collision diagram methods of analysis if possible, should be made to evaluate the effectiveness of the enforcement program in accident reduction.

STUDY E—Accident Records of Vehicle Owners and Relation to Speed Practices. Observations of license numbers of vehicles in moderate and high speed groups are made at several different locations. The numbers are used in determining vehicle ownership. Accident records in the State Motor Vehicle Departments are checked to determine whether the owners of the vehicles in the high speed group have been involved in more accidents than the owners of vehicles traveling at lower speeds. If possible the age of the cars and the driving experience of the owners should be considered. This study is possible only in states or cities where adequate driver records are available.

Statistical Studies—In addition to field speed studies, city and state departments with access to accident records should undertake

statistical studies of speeding accidents, similar to the reported New Jersey Speed Study. Such studies should include a comparative analysis of actions of vehicles not speeding, as well as an analysis of actions of speeding vehicles. In addition, special study should be given the slow vehicle and its effect upon accidents.

V. REPORTS OF COOPERATIVE PROJECTS

Officials in 16 states and 16 cities have indicated their willingness to undertake one or more special speed studies as a cooperative project with the Committee. These officials were furnished with general instructions for making these studies. Some of the researches have been completed, others are in progress, and some of the data obtained are included in the factual sections of this report. The research program in many jurisdictions has been delayed, in others, it has been dropped. It is expected, however, that a great deal of factual data will be collected during the coming year. Following is a brief summary statement of each of the cooperative projects:

1. The Kentucky Highway Patrol is now undertaking Study B—Special accident investigation by highway patrol members. Progress has been slow because of inadequate personnel.

2. The Ohio State Highway Patrol is also undertaking Study B, using a modified procedure in estimating actual speeds of vehicles involved in accidents.

3. The Oklahoma Department of Public Safety has completed parts of Study C and has furnished the committee with data on several case studies of speeds, conditions and accidents.

4. The Illinois Division of Highways is now undertaking a complete speed research program and has already furnished preliminary data on voluntary obedience in different classes of speed zones. Data also have been furnished on experience with governors on state-owned vehicles.

5. The Ohio State Highway Department has been undertaking a study of the effectiveness of different types of slow and warning signs in obtaining voluntary speed reduction at hazardous locations and the data will be available to the Committee.

6. The South Carolina Highway Department has been undertaking the study of speeds, conditions and accidents for a nine-

mile section of highway and the data will be available soon.

7. The California Highway Department has furnished data on speed practices and the frequency of different types of accidents for several sections of rural California highway.

8. The Buffalo Department of Public Safety has completed a special study of speeds, conditions and accidents for several sections of city streets.

9. The Memphis Department of Public Safety has completed a study similar to that made in Buffalo.

10. The South Carolina Motor Vehicle Department has completed a comparative accident analysis showing before and after experience on a 75-mile section of rural highway, where enforcement was directed at excessive speed.

11. Other city and state departments that have indicated willingness to undertake special speed studies have not made a recent report of progress.

12. The Bureau of Motor Carriers of the Interstate Commerce Commission is undertaking a questionnaire study of the effectiveness of governors on interstate commercial vehicles. Copies of the questionnaire will be furnished the Committee so that the ex-

perience of passenger vehicle fleets of National Safety Council members can be gathered.

13. The Statistical Bureau of the National Safety Council has completed an analysis of 10,000 New Jersey accident reports, including a special study of circumstances contributing to accidents involving excessive speeds.

VI. PROGRAM FOR FUTURE ACTIVITY

1. Continue cooperation in present speed studies and promote additional researches of a fact-finding nature.

2. Develop more detailed procedure for the researches so as to insure obtaining more uniform and accurate data.

3. Collect, study and analyze all speed data as they become available.

4. Formulate the underlying principles upon which critical speeds are to be determined so as to permit the development of uniform, objective methods for speed zone selection.

5. When information becomes available, prepare tentative standards for speed legislation, speed zoning and enforcement programs directed at speed "too fast for conditions."

References made in this report pertain to data contained in the appendices. The complete report, with appendices, is available

from the Bureau of Information of the National Safety Council, 20 North Wacker Drive, Chicago.

Committee on Tests for Intoxication

Street and Highway Traffic Section

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Tests for Driver Intoxication

Presented by HON. HARRY H. PORTER

Chief Justice, Municipal Court, Evanston, Ill., and Chairman, Committee on Tests for Intoxication

The following is a report of progress of the activities of the Committee on Tests for Intoxication. It has been prepared specifically for presentation at the Twenty-Sixth National Safety Congress in Kansas City,

and it should not be considered as a final and conclusive report on this subject. The Committee will continue its study during the ensuing year and will present a more complete report at the Twenty-Seventh Congress.

INTRODUCTION

Persons driving or walking on public highways under the influence of alcohol are one of the most serious of present day traffic safety problems. Not only is intoxication an important primary cause of traffic accidents, but test methods, legislation, court procedure and public opinion generally have not been developed to an extent sufficient to permit officials in all parts of the country to deal adequately with the problem.

The following are important phases of the problem:

1. It is difficult to identify drivers that are under the influence of alcohol until after they have committed some driving error or are involved in an accident.

2. It is difficult to prove that "had been drinking" drivers or pedestrians are under the influence of liquor and that their driving or walking ability has been impaired to an extent sufficient to require that they should be kept off the streets and highways.

3. There are so many pathological conditions that may produce symptoms similar to alcoholic influence that it is difficult to

obtain evidence sufficiently convincing to get convictions.

4. Legal definitions and court interpretation of the terms "intoxication" and "under the influence" are so inadequate in many states that it generally is difficult to obtain convictions for any except persons who are obviously drunk.

5. In some states, penalties are so heavy that officials hesitate to arrest or convict persons for driving while under the influence of liquor.

6. Officials often fear to press a charge of driving while under the influence of liquor because public opinion and court cooperation have not been developed to a sufficient extent.

This Committee has been appointed to make a thorough study of the problem and to recommend improvements in methods for dealing with drinking drivers and pedestrians. The following data, information and tentative recommendations are presented as a report of committee progress.

ACCIDENT STATISTICS Information on State Accident Report Summaries

Reported percentages of "had been drinking" or "intoxicated" participants in fatal accidents in 26 states during 1936 average only 7 per cent for drivers and 11 per cent for pedestrians, but the differences in reported percentages for the different states indicate that these percentages underestimate the true situation.

For example, Arizona reports 18.4% of the drivers involved in fatal accidents in 1936 as "had been drinking," while Massachusetts reports 10% and New York only 1.8%. Virginia reports that 20.4% of pedestrians fatally injured during 1936 were under the influence of alcohol, while Utah finds only 3.2% in that condition. Obviously, these differences in percentages reflect incompleteness of reporting rather than real differences in the number of drinking drivers or pedestrians.

Case Studies of Accident Victims

Special examinations of drivers and pedestrians injured or killed in traffic accidents have revealed that the percentage of accidents involving drinking is higher than indicated in official reports. Dr. Herman A. Heise, in reporting the results of case studies of 119 consecutive automobile accidents, has classified 60% of them as "alcohol

accidents"—those in which a responsible individual had more than 0.02% of alcohol in body fluids. A study of 110 cases in Cuyahoga County, Ohio, by Dr. S. R. Gerber, revealed that 58.6% of both drivers and pedestrians killed in accidents during 1936, excluding children under 15, had been drinking. In 45% of the total number of cases, alcoholic concentrations of more than 0.10% in the body fluids were found. A blood-alcohol concentration of 0.10% is used by Doctor Gerber as an intoxication borderline.

Doctor Gerber, with the cooperation of ten of the leading hospitals in Cleveland, also has recently completed a study of 194 additional cases of persons injured or killed in traffic accidents. Of this number, 59.8% showed no presence of alcohol and 40.2% showed alcohol to be present in varying concentrations. Sixty-seven of the cases, 30.6% of the total, showed alcoholic concentrations in body fluids greater than 0.10%.

A similar hospital study of alcohol incidence in traffic accident victims is now being carried on in the hospitals of Evanston, Ill., with the cooperation of the Evanston Police Department. Although the results have not yet been summarized, data for almost 600 cases have been obtained and results will be available soon.

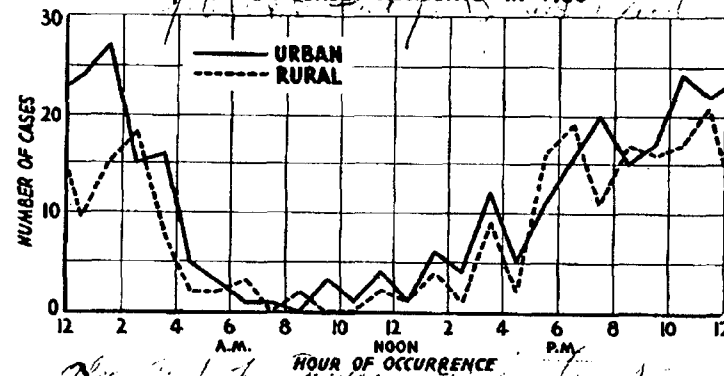
The extreme variation between percentages obtained in these special studies and those shown on official reports demonstrates the great need for additional study to evaluate the real part played by alcohol as a contributing cause of traffic accidents.

Special Analyses of Accident Reports

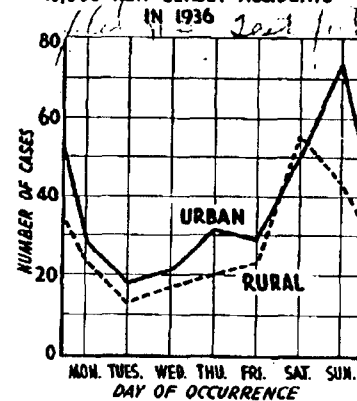
City reports indicate that most accidents involving "had been drinking" drivers occur at night. Official reports of Honolulu for 1936 show that 24.7% of the drivers involved in night accidents had been drinking as compared with 4.9% for those involved in day accidents. Similarly, data from Dallas show that 42.2% of all night accidents occurring in August, 1937 involved drinking drivers. The worst single hour was from 11 p.m. to midnight, when one out of every two drivers involved in accidents had been drinking.

Dallas also has made a study of improper driving practices of "had been drinking" drivers involved in accidents and reports that 28.4% of these drivers were speeding, 27.0% were on the wrong side of the road

RELATIONSHIP BETWEEN TIME OF DAY AND ACCIDENTS
INVOLVING DRIVERS REPORTED AS HAD BEEN DRINKING
10,000 NEW JERSEY ACCIDENTS IN 1936



RELATIONSHIP BETWEEN DAY OF WEEK
AND ACCIDENTS INVOLVING DRIVERS
REPORTED AS HAD BEEN DRINKING
10,000 NEW JERSEY ACCIDENTS
IN 1936



and 20.0% struck cars parked at the curb due to misjudgment or lack of control. These percentages indicate that "had been drinking" drivers generally get into accidents as a result of their own driving errors.

A thorough study of 10,000 accidents, representing about one-third of the 1936 New Jersey accident experience, was recently completed by the Statistical Bureau of the National Safety Council. As one phase of the study, a special analysis was made of accidents involving drinking drivers so as to furnish the Committee with data on circumstances contributing to accidents involving drinking and non-drinking drivers.

The New Jersey data indicate that the typical accident involving a "had been drinking" driver is a collision between two motor vehicles, generally at night and most frequently on week-ends, in which the drinking driver is guilty of a driving error while the non-drinking driver is rarely at fault. Pedestrians are involved in only two per cent of the rural accidents involving "had been drinking" drivers and 3.2% of similar urban accidents, indicating that drinking drivers are not a major contributing cause of pedestrian accidents.

The most important information developed in this New Jersey study is data that definitely indicate that alcohol is in itself a primary cause of accidents. Data in Table No. 1 show that non-drinking drivers in accidents involving "had been drinking" drivers generally did nothing to contribute to the collision whereas non-speeding drivers in speeding accidents are guilty of violations just as often as are drivers in non-speeding accidents.

In this New Jersey study only 12.6% of the "had been drinking" drivers were less than 25 years old, whereas 27.2% of all other ("had not been drinking") drivers involved in non-pedestrian accidents were less than 25 years old. Further details of the New Jersey study will be found in the appendix.

Similar special analyses of drinking and non-drinking accidents should be made in other localities to secure additional data. The committee recommends that they be made and will be glad to furnish instructions to cities and states desiring to make them.

THE EFFECTS OF ALCOHOL

Both alcoholic intoxication and fatigue produce temporary impairment of a person's ability to act as he would under normal conditions. Intoxication, however, affects a person's judgment as well as his physical condition. Fatigued drivers generally are aware of their decreased efficiency and compensate by operating at lower speeds. In contrast, persons under the influence of liquor generally are not able to compensate for their decreased ability because of faulty

TABLE I A Comparison of Contributing Circumstances In Speeding and Drinking Accidents. 10,000 New Jersey Accidents in 1936 Showing Per Cent of Drivers with the Reported Contributing Circumstances.						
Circumstance	Drivers Speeding Accidents		Drivers Non-Speeding Accidents*	Drivers Drinking Accidents		Drivers Non-Drinking Accidents*
	Speeding Drivers	Non-Speeding Drivers		Drinking Drivers	Non-Drinking Drivers	
	Per Cent	Per Cent	Per Cent	Per Cent	Per Cent	Per Cent
Total Driver Violations						
Urban	100.0**	43.0	41.3	79.5	13.9	45.0
Rural	100.0**	58.6	54.1	88.3	19.8	56.4
Total Vehicular Defects						
Urban	10.0	4.6	4.3	6.8	3.5	4.7
Rural	10.6	5.7	7.3	8.6	4.8	7.6
Total Driver Defects						
Urban	23.3	18.1	14.2	100.0***	4.3	12.5
Rural	31.4	21.7	23.9	100.0***	4.8	21.5
Left Turn Movements						
Urban	1.0	15.9	9.4	8.3	4.4	8.7
Rural	2.9	31.9	10.6	7.6	4.2	10.1

*Non-Pedestrian accidents used for comparison. **Speed limit violations. ***Had been drinking.
Statistical Bureau, National Safety Council.

judgment and generally are very dangerous behind the wheel.

Results of many independent investigations indicate that relatively small amounts of alcohol are sufficient to cause some impairment of a person's ability to act as he would under normal conditions. Several of these investigations are summarized in the book "Alcohol and Man," edited by Dr. Haven Emerson of Yale University.

Drinking is not a moral issue from the safety standpoint, but public opinion definitely is against the person who drives while under the influence of liquor. The public is very hesitant to identify the borderline at which driving becomes dangerous, but is generally recognizes that beyond a certain point, a person who drives while intoxicated is a menace on the highway.

Persons who are so drunk that they can hardly stand can be dealt with easily. It is the driver near the borderline, with sufficient alcohol to affect his muscular coordination and emotional state, that is the most dangerous. Consequently, methods that will obtain uniform results and be effective in securing convictions are necessary for examining these persons.

More specifically, the problem becomes (1) the determination of the borderline beyond which the "had been drinking" driver is dangerous, and (2) the development and use of methods for identifying this condition and obtaining evidence which will secure convictions in court. Better examination methods are necessary so that more convictions can be obtained for arrests now made, fewer unwarranted arrests will be made and more arrests will be made for recognized intoxication cases which formerly were charged to "reckless driving" or other charges because of difficulty in obtaining convictions for driving while under the influence.

DEVELOPMENT OF PUBLIC OPINION

Although public opinion recognizes to a limited extent that the driver under the influence of liquor is a menace on the highway, there is need for an educational program to inform the public in a more specific manner of the dangers of driving after drinking. Such a program should point out the effects of alcohol both upon a person's physical condition and upon his judgment. It should stress particularly the impairment

of judgment which occurs before physical condition has been noticeably changed.

After adequate and uniform methods for determining intoxication are in general use, the educational program can point out the limits above which impairment of driving occurs and arrests are made. Until that time, it may be well to stress the desirability for adhering to the slogan "If you drive—don't drink; if you drink—don't drive."

The development of public opinion to recognize in a more specific way the hazards of driving after drinking may ultimately reduce the need for extensive test methods and involved court procedure. However, until this public opinion has been developed through educational methods, more scientific methods of determining intoxication may be needed for nearly all cases.

LEGAL PHASES OF THE PROBLEM

Legal problems include: (1) legal definition of the phrases "intoxication" or "under the influence"; (2) penalties for driving while "under the influence"; and (3) legality of the various methods for obtaining evidence and presenting it in court.

Definition of "Under the Influence"

The legal control of intoxication in the United States rests mainly with state and city courts. The attitudes and definitions of "intoxication" and "under the influence" differ greatly as established by precedent. The Committee, through its chairman, has undertaken a thorough study of the definitions used in the various states, and a complete summary of these is given in Section II of the Appendix. One of the best definitions for "under the influence" is found in Arizona, and is as follows:

The expression "under the influence of intoxicating liquor" covers not only all the well known and easily recognized conditions and degrees of intoxication, but any abnormal mental or physical condition which is the result of indulging in any degree in intoxicating liquors, and which tends to deprive him of that clearness of intellect and control of himself which he would otherwise possess. If the ability of the driver of an automobile has been lessened in the slightest degree by the use of intoxicating liquors, then the driver is deemed to be under the influence of intoxicating liquor. The mere fact that the driver has taken a drink does

not place him under the ban of the statute unless such drink has some influence upon him lessening in some degree his ability to handle said automobile. *Steffani vs. State* 42 Pac. (2nd) 615.

The general acceptance of this definition by courts in the various states, especially in states without an adequate definition, should be a tremendous help in dealing with the intoxication problem. The committee recommends that prosecutors secure the adoption of this or similar definitions.

Ultimately, an entirely new definition for "under the influence," which possibly may be a part of the motor vehicle law, can be formulated. Such a definition could establish fairly definite borderlines, which would make it much easier for enforcement officials to obtain convictions than is now the case. Until data are available to permit a more definite recommendation, the committee suggests that such a definition consist of the following two parts:

(1) A basic rule defining "under the influence" as impairment of the ability to operate a motor vehicle, regardless of whether the person was driving in a dangerous manner.

(2) Supplementary statements or prima facie clauses outlining (a) a combination of general indications and (b) a definite percentage of alcohol in the body fluids, either of which will be prima facie evidence that the person is "under the influence" according to the intent of the basic rule.

Penalties

State and municipal ordinances prescribing penalties for driving while under the influence of liquor often have been very severe, with the result that it is much more difficult to obtain convictions. More reasonable fines and jail sentences, with suspension or revocation of driving privileges, should result in the securing of many more convictions for this offense. Later, when public opinion, test methods and procedure for handling cases of intoxicated drivers have been developed to a sufficient extent, penalties may be increased.

Legality of Methods

The legality of using medical evidence has often been questioned, and some courts will not permit its use. Generally, however, most courts will accept evidence obtained from physical examinations that have been made with the subject's consent,¹ and in some

cases, evidence obtained without consent or knowledge has been accepted.² Also, results of chemical tests of body fluids are generally admitted as evidence if the specimens are taken with the consent of the accused persons.³

Past experience indicates that urine tests offer no legal problem, since accused persons are always glad to give specimens to prove their innocence. Blood tests offer some legal difficulties because of the possible danger involved in drawing samples, although they have been used in some recent cases in this country. Blood tests are official in Sweden and are mandatory in Germany for persons involved in automobile accidents. A legislative committee in Maine is now considering the feasibility of permitting such tests in that state.

There is need for clarification in law and improvement in court procedure so as to permit the more general use of evidence obtained through chemical tests and through clinical examinations by physicians. The general adoption of scientific test methods will undoubtedly help to bring about this improvement.

PRACTICAL PROBLEMS

To obtain convictions for the offense of driving while under the influence, it generally is necessary to prove the following:

1. The person was operating on a public highway.
2. His physical condition or judgment had been impaired so that he was not in possession of his normal faculties.
3. This impairment was caused by the influence of alcohol.

Medical authorities state that there are about 60 pathological conditions that produce one or more of the same symptoms in the human body as alcohol. To be able definitely to pronounce a man as under the influence of alcohol, these pathological conditions must generally be ruled out. The use of specific questions, in the presence of witnesses, with answers recorded as given, will generally permit the collection of suffi-

1. See 5 Ohio O 434.

2. *New Jersey Case*—143 Atlantic 750.

3. The Supreme Court of Arizona has just reversed an order granting a new trial to a person convicted for driving while under the influence of intoxicating liquor. The Court holds that the results of a chemical analysis of urine are admissible as evidence, even though the defendant did not know why he was asked to give a sample. (*State vs. Duguid*, No. 859, Oct. 5, 1937.)

cient evidence to rule out these conditions. Lay witnesses then can testify successfully as to the impairment of the person's condition.

Suggested questions for collecting this evidence are given in the attached examination report form (page 10). The committee recommends that every intoxication examination include such questions.

METHODS FOR DETERMINING INTOXICATION

Four general methods are now used, either singly or in combination, for determining when a driver of a car is under the influence of liquor. These are:

1. *General observations by officers and witnesses.* These are made by police officers and witnesses at the scene of the accident or violation and at the police station. These persons appear in court and testify by giving their opinion as to whether the accused was under the influence of liquor.

2. *Special examination by officers with a written report.* The officers supplement the general observations by noting specific actions such as ability to walk, ability to stand, speech, odor of breath, tremor of hands, condition of hair, condition of eyes, color of face, marks or injuries, and unusual acts. Specific questions are asked and general coordination is measured by observing the ability to perform simple tests. Generally, the answers to questions and results of observation and tests are recorded on a special examination report form.

3. *Clinical examination by police surgeon or other physician.* Special examinations are made by police surgeons or other physicians. These generally include the detailed examination listed above and, in addition, a general clinical examination for the purpose of distinguishing genuine illness from intoxication. A physician's certificate usually is prepared stating the results of various tests and certifying whether or not the person is under the influence of liquor.

4. *Chemical tests of body fluids or breath.* Chemical tests are made for determining the percentage of alcohol in the body fluids or breath. By showing specifically the amount of alcohol present in the body fluids, these tests establish the fact that alcohol was present in a quantity sufficient to cause the impairment indicated in the physical examination. Test results also protect the innocent person suffering from some illness or injury.

Methods Now in Use

The result of a questionnaire study, undertaken to learn of methods now in use in various cities and states, is reported in detail in the Appendix. It indicates that over half of the city and state departments still rely upon the general observations of officers and witnesses in securing evidence of intoxication. There is a definite trend toward the use of more scientific methods. Many departments recently have adopted special examination forms for use by officers in recording answers to questions, and results of physical examinations and coordination tests. Many of the large cities reporting to the committee have police surgeons that make clinical examinations. In Denver, Dallas and several other cities, the physician's certificate generally saves personal appearances of physicians in court.

The most surprising thing was the growing number of city and state departments making use of chemical tests of urine or breath. State departments in Vermont, Ohio, Indiana and California have made use of these tests in some cases, while police departments in Cleveland and other northern Ohio cities, Indianapolis, Honolulu, Lincoln, Phoenix and Berkeley have used evidence from chemical tests in the securing of convictions.

Dr. Herman A. Heise pioneered in the use of urine tests in western Pennsylvania several years ago. The results are reported in the Transactions of the 1934 National Safety Congress. In addition to obtaining excellent results in the securing of convictions for driving while under the influence, he found evidence of a very close correlation between chemical test results and physical symptoms as observed by trained examiners.

Dr. Herman M. Gunn of Ashland, O., has used results of urine tests in a large number of medico-legal cases in the northern part of Ohio. Results in Table II on page 8 show that urine tests are very successful when the services of a medical man, well versed in medico-legal phases of alcohol, are available for making the necessary court appearances. After the first few cases, Doctor Gunn found that it was rarely necessary to make a personal appearance in court because pleas were changed to guilty and his certificate was accepted in court as evidence.

TABLE II

Results with Use of Urine Tests in 100 Ohio Cases
of Driving While Intoxicated

Tests made by Dr. Herman M. Gunn, Ashland, O.

		Cases with Ohio State Highway Patrol	Cases with Local Police Departments	Total Cases
		Number	Number	Number
Accident Cases Involving Intoxication.....		22	30	52*
Non-accident drinking-driving cases.....		28	20	48
TOTAL CASES TESTED.....		50	50	100
PLEAS:	Guilty.....	26	18	44
	Not guilty.....	24	30	54
	No prosecution.....	0	2	2
FINAL DISPOSITION:	Found guilty.....	43	36	79
	Pending.....	3	8	11
	Acquitted.....	4**	3***	7
	No prosecution.....	0	3	3
RESULTS OF URINE TESTS OF THOSE FOUND GUILTY:		Per Cent	Per Cent	Per Cent
Average Per Cent of Alcohol found in Urine		.30	.28	.29
Calc. Equiv. in Blood		.22	.21	.21

*Includes 2 Pedestrian accidents, 12 single vehicle accidents and 38 collisions of two or more vehicles. ** 1 acquitted by test (.05% in urine). 2 cases of driving not proven. *** 3 in collisions acquitted—tests showed only traces of alcohol.

The Vermont Department of Health acts as a clearing house for urine tests in that State. According to the State Motor Vehicle Department, results have been excellent, urine tests being used in about 19% of the state cases.

Chemical Tests

Scientific investigators have pointed out and repeatedly verified the fact that the concentration of alcohol in the body fluids is one of the most reliable and objective criteria of intoxication. Many of these investigators have determined the relationship between brain alcohol concentrations and concentrations in spinal fluid, blood, urine, saliva, and breath, so that the degree of alcoholic influence can be evaluated closely when the concentration of alcohol in breath or in the body fluids is known.

Blood-alcohol concentrations closely par-

allel brain-alcohol concentrations and are one of the best criteria of intoxication. Urine-alcohol concentrations are sufficiently significant for practical purposes since there is a fairly definite relationship between concentrations of alcohol in the blood and in the urine. This relationship is fairly constant one to two hours after drinking, with approximately 1.35 parts of alcohol in the urine to 1 part in the blood. Recent tests by Dr. R. N. Harger have shown that the relationships between concentrations in the breath and in the blood and urine also are sufficiently definite for practical purposes.

The Committee is studying the relationship between impairment and alcoholic concentration so as to permit the fixing of definite borderline limits in terms of alcoholic concentrations in the body fluids and breath. The Committee suggests the use of

two limits; (1) a top limit above which a person should be considered as definitely under the influence of liquor from the standpoint of impairment of ability to operate a motor vehicle, and (2) a lower limit below which a person should be exonerated from the standpoint of such impairment. The guilt of persons with concentrations between the two limits could be determined by considering external evidences of intoxication.

Until more data are available, the Committee suggests an alcoholic concentration of 0.15% by weight in urine (0.11% in blood or equivalent in saliva or breath) as the top limit, and a concentration of approximately 0.10 per cent in the urine or equivalent as the lower limit. Later, the Committee may find it desirable to recommend lower limits as additional information is revealed through further study.

The preliminary report of the American Medical Association's Committee that is studying problems of motor vehicle accidents states that it is important that chemical observations of alcohol in the blood, urine, saliva or breath be used to confirm obvious intoxication. The report also points out that levels of alcoholic concentration even less than 0.15 per cent by weight in body fluids are associated with definite impairment of judgment.

A summary of the various methods that are available for chemical analyses of blood, urine, saliva and breath is given in Section I of the Appendix. The committee is studying the practicability and effectiveness of these methods and will report on them in the next report.

Improving Test Methods

Officers' reports will be much more valuable when the officers have been adequately trained in questioning suspects, making the physical examination, recording the information on the form and testifying in court. The committee recommends the thorough training of officers in this examination procedure.

There is definite need for more complete information on the effectiveness of different methods in obtaining convincing evidence and in securing convictions. This information should be obtained for cities of different sizes and in different localities, because of differences in public opinion and cooper-

ation of courts in different parts of the country. It is logical to expect that evidence obtained by police officers will be sufficient in localities where courts are sympathetic and public opinion has developed to the point where it is willing to back the enforcement department. For example, the Minnesota Highway Patrol reports that such methods are satisfactory in that state. In many states and cities, more definite evidence is needed, and generally will have to be obtained through improved officer examination, physician's examinations or chemical tests. Possibly chemical tests for all cases may be only a temporary measure, used for a time sufficient to develop public opinion and court cooperation. Later, the officers' reports may prove sufficient except for personal injury and other difficult cases, when chemical tests or physician's examinations may still be necessary.

The committee is undertaking a more complete and thorough study of the various methods. Forms (see Section I of the Appendix) will be furnished enforcement departments so that they can submit the monthly reports of results obtained in the use of these methods. In this way, it is expected that the committee can collect information which will permit more definite recommendations for cities of various sizes and for different conditions.

An Officers' Examination Report form, included as a part of this report, has been prepared by the Committee and is recommended for use either in complete form or in part, by enforcement departments. This will be furnished several state and local enforcement departments with a recommendation that it be used to gather evidence in intoxication cases.

THE PEDESTRIAN

Very little attention now is devoted to pedestrians that are under the influence of liquor on streets and highways. Since available data indicate that intoxication of pedestrians is one of the most serious contributing causes of fatal pedestrian accidents, especially at night, the committee recommends that educational and enforcement methods should be directed at drinking pedestrians as well as at drinking drivers.

RECOMMENDED PROCEDURE FOR DETERMINING INTOXICATION

Until additional data are collected to determine the effectiveness of the various

Driver Passenger Pedestrian MOTOR VEHICLE INTOXICATION REPORT Case No. _____ Station _____									
Name _____ Address _____									
Age _____	Sex _____	Race _____	Occupation _____	Dr. Lic. No. _____			A.M. P.M.		
Violation or Accident _____		Type _____	Location _____	Date _____	Time _____	A.M. P.M.			
Arrest _____		Charge _____	Officer _____	Date _____	Time _____	A.M. P.M.			
Witnesses to driving _____ QUESTIONS: Have you been drinking? What? _____ Quantities? _____ Commenced _____ A.M. _____ P.M. Stopped _____ P.M. Where? _____ Are you ill? _____ Are you under a doctor's care? _____ If so, who? _____ Are you taking medicine? _____ If so, what? _____ Last dose _____ A.M. Do you have diabetes? _____ Are you taking insulin? _____ P.M. Have you been on a device? _____ If so, when? _____ Are you using a mouth wash? _____ Are you hurt? _____ Did you get a bump on the head? _____ How much sleep did you have last night? _____ How much today? _____ Have you been drinking since the accident? _____ What? _____ Quantities? _____									
EXAMINATION:—(Draw circles around words describing observed conditions)									
BREATH		No odor of alcohol Odor of alcohol—light, moderate, strong							
COLOR OF FACE		Apparently normal Flushed Pale Blushed							
CLOTHING		Cleanly Dirty Humidly Partly dressed (Odor of alcohol) (Unkempt) Soiled by vomit Soiled by urine							
MENTAL STATE		Alert Dull Excited Talkative Impulsive Sensitive Reserved Inebriated Stupefied Combative Dull Delirious Silent							
USUAL ACTIONS		Thorough Superficial Rhythmic Jerky Voluntary Involuntary Deliberate Impulsive Subliminal Unconscious Convulsive Involuntary							
EYES		Apparently normal Watery Bloodshot Clouded Pupils Reaction to light Pupils Reaction to light Pupils Reaction to light							
BALANCE		Fair Swaying Wobbling Sagging Heaving Falling Unable to stand Unable to stand							
WALK & TURNING		Fair Swaying Stumbling Staggering Staggering Staggering Unable to stand Unable to stand							
FINGER-TO-NOSE TEST		Right—None Uncertain Soft—None Uncertain							
SPEECH		Fair Stuttered Stuttering Confused Incoherent Whispering Jolty							
Knowledge of time and place _____									
Signs of illness or injury _____									
CONCLUSION: EVIDENCE OF ALCOHOL—Apparently none Light Moderate Extreme ABILITY TO DRIVE—Apparently is Able Unable Incompetent									
Examined by _____ A.M. P.M.									
Witnesses to examination _____									
NOTE: USE OTHER SIDE FOR REMARKS. When physician's examination is made or sample taken for chemical test, record in proper place on other side.									

(FRONT)

REMARKS: _____	

Names of Officers or persons making the remarks	
INSTRUCTIONS FOR COORDINATION TESTS Do not have suspect perform any test unless willing to do so. When tests are not made, record conditions from general observation but do not check the squares. A square is to be checked only if test is made.	
1. Pupils of eyes—Flash a bright light in the eyes of the suspect and compare the reaction of his pupils with the reaction obtained when a light is flashed in the eyes of another person. 2. Balance—Stand erect with heels together, eyes closed, and head back, to observe balance. 3. Walking and turning—Walk a straight line, toe of one foot against the heel of the other, then turn and walk back again. 4. Finger-to-Nose Test—Stand erect, eyes closed, extend arms horizontally to side, then, one arm at a time, touch the tip of nose with the tip of the index finger. 5. Speech—Repeat the following test phrases: ELECTRICITY, METHODIST EPISCOPAL, AROUND THE RUGGED ROCK THE RAGGED RASCAL RAN. 6. Obtain a statement in writing of the cause of the accident or arrest, signed by the suspect, so that handwriting can be compared.	
PHYSICIAN'S REPORT: Examining physician, if any _____ A.M. Physician's Diagnosis _____ P.M. Name _____ Address _____ Time Examined _____ Signature of Physician _____	
SAMPLE FOR CHEMICAL TEST: (Blood) (Urine) Specimen: Taken in the presence of _____ By _____ (Breath) at _____ A.M. _____ P.M. Scaled by _____ Witness _____ Date _____ Time _____	
Tests made by _____ Date _____ Witness _____	
CASE SUMMARY: Where taken _____ Charge _____ Court _____ Judge _____ Trial Date _____ Disposition and Penalty _____ Remarks: _____	
National Safety Council, Inc., 10 N. Wacker Drive, Chicago	

(BACK)

test methods, the following is suggested as a procedure in obtaining and presenting admissible evidence.

A. Part by Enforcement Officers

1. Establish, by means of questions in the presence of witnesses, with signed statements of witnesses when possible, that:

- (a) The person was operating a motor vehicle on a public highway when arrested.
- (b) The accused is not a sick man nor is he under the immediate care of a doctor.
- (c) He has not been drinking since the accident or the arrest.
- (d) His actions are not the result of injuries in an accident.
- (e) He does not have diabetes and has not been using insulin.
- (f) He has not been to a dentist nor has he been using an alcoholic mouthwash recently.

2. Establish, by means of general observations and physical tests of coordination, that the accused is not in possession of his normal faculties. Do not make coordination tests unless subject is willing.

3. Record answers to questions, observations of physical conditions, and results of coordination tests on an examination report form. In addition, secure signed statements of witnesses when possible.

4. Furnish the prosecutor with a copy of the examination report so that he can direct questions from it. Have the officers use the information on this form to refresh their memory when appearing in court.

B. Clinical Examination

When the services of a police surgeon or other physician are available and local conditions are satisfactory, the clinical observations of these physicians as a supplement to general observations of officers and witnesses may be desirable, especially for cases of injury, illness and other questionable cases. A certificate, signed by the physician, certifying whether or not the person is under the influence of liquor should be prepared. In many cases, the physician's certificate will result in pleas being changed to guilty and it will be accepted in court as evidence. In others, the physician necessarily will have to make personal appearance. Physicians' examinations will generally not be necessary when chemical tests are made.

C. Chemical Tests

1. When the services of an expert chemist and physician are available, chemical analyses of urine, blood or breath may be desirable for cases of illness and injury and other difficult cases or in localities where it is difficult to secure convictions by other methods. Secure samples of urine, breath, saliva or blood for a chemical test, seal in the container, and be able to prove that the sample came from the accused. These should be secured as soon as possible after the arrest, after advising the suspect of his constitutional rights. In many localities samples may be mailed to a central laboratory for analysis.

2. Follow a reliable procedure in determining the alcoholic content of the sample, and be able to interpret the test results in terms of alcoholic concentration in the brain. Have reliable information available to interpret the percentage found in terms of the average number of drinks.

3. The evidence obtained from chemical tests may be presented in Court by personal appearance, explaining in simple terms just what is meant by the various percentages of concentration of alcohol. After the procedure has developed to a sufficient extent, certificates, stating the percentage of alcohol, may be instrumental in having many pleas changed to guilty and may be accepted as evidence in court.

The information obtained by enforcement officers should be sufficient in those cases where definite impairment was shown and the persons did not complain of illness or injury.

When the person has been injured or complains of illness, clinical examinations by a physician or chemical tests of body fluids are a desirable supplement to the officer's examination to distinguish between the effects of alcohol and those of illness or injury. In some localities, physicians' examinations or chemical tests may be needed for all cases.

PROGRAM OF FUTURE ACTIVITY

The following program will be undertaken by the committee during the coming year:

1. Continue the cooperative projects with the Indiana State Police and Police Departments in Berkeley, Phoenix and Evanston.

2. Furnish special forms to other enforcement departments so that adequate records

of arrests, test methods and disposition of all cases in which alcoholic influence is suspected, can be kept.

3. Arrange for additional research studies of hospitalized accident cases so as to obtain additional data on the size of the drinking driver problem.

4. As the data become available, prepare standards for proposed drinking driver laws, definitions of "under the influence," examination report forms, and procedure for use in examining persons suspected of being under the influence of liquor. Recommend methods for use by departments in cities of different sizes and in different parts of the country.

SUMMARY OF RECOMMENDATIONS

Until additional data are available to support more detailed statements, the Committee makes the following recommendations:

1. Every intoxication examination should include questions asked at the scene of the accident or violation so as to collect evidence for ruling out any false defenses of illness, injury, taking of medicine, drinking since the accident, or non-operation of a motor vehicle.

2. Officers should be thoroughly trained in examination procedure and should use a special report form for recording answers to questions and observations of physical condition.

3. Chemical tests of body fluids or breath, or clinical examinations by physicians, are recommended as a supplement to the officer's examination in those cases when the person has been injured or complains of illness. In some localities, these methods may be necessary for all cases until public support has been developed sufficiently and officers trained in examination procedure.

4. Chemical tests of body fluids or breath should not be undertaken unless the services of a person competent to testify regarding the meaning and value of the test, are available when court appearances are necessary.

5. City and state enforcement departments should cooperate with police surgeons, physicians, hospitals, and departments of health in the establishment of improved procedures for examining persons suspected of being under the influence of liquor.

6. The intoxication examination report form, included as a part of this report, (page 10) is recommended for use in city and state enforcement departments. Parts of the report that are not adapted to local conditions may be omitted so as to shorten the form.

7. Legal definitions of the phrases "intoxicated" and "under the influence" should be improved, clarified and made more uniform. The committee suggests the general adoption of the Arizona definition (see page 5) as the first step in improving legal definitions. When additional data are available, a new definition, to be composed of a basic rule supplemented by *prima facie* clauses, should possibly be incorporated in the motor vehicle law.

8. Educational and enforcement methods should be directed at drinking pedestrians on streets and highways as well as at drinking drivers.

9. More specific information should be obtained on the relationship between alcohol and accidents and the effectiveness of the various methods for dealing with the intoxication problem.

10. Educational information should be prepared to inform the public in a more specific manner of the hazards of driving after drinking and to develop public support.

References made to charts and tables pertain to data contained in the appendices. The complete report, with appendices, is

available from the Bureau of Information of the National Safety Council, 20 North Wacker Drive, Chicago.

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Pedestrian Control and Protection

Presented by LESLIE J. SORENSON

City Traffic Engineer, Chicago, and Chairman, Committee on
Pedestrian Control and Protection

The following is a report of progress of the activities of the Committee on Pedestrian Control and Protection. It has been prepared specifically for presentation at the Twenty-Sixth National Safety Congress at

Kansas City and it should not be considered as a final and conclusive report of this subject. The Committee will continue its study for the ensuing year and will present a more complete report at the 1938 Congress.

INTRODUCTION

Of all traffic deaths those resulting from collisions between pedestrians and motor vehicles are the most outstanding. In 1936, 15,100 or 40% of the total of 37,800 motor vehicle deaths were pedestrians. Collisions between two or more motor vehicles accounted for 9,400 or 25% more. In slightly more than 18% the vehicles overturned, ran off the road or were otherwise involved in non-collision accidents. Less than 9% of the deaths resulted from collisions with

fixed objects, less than 5% from collisions with railway trains and slightly more than 3% were caused by collisions with bicycles, horse-drawn vehicles, and street cars.

The pedestrian problem has caused increasing concern in rural districts. While urban districts have been able to reduce their pedestrian deaths 7% since 1930, such deaths in rural districts have increased 64%. Although the exposure of pedestrians is much higher in the cities, 7,950 pedestrian deaths occurred in urban communities of

more than 10,000 population in 1936 as compared to the 7,150 that happened in rural areas, including cities under 10,000 population.

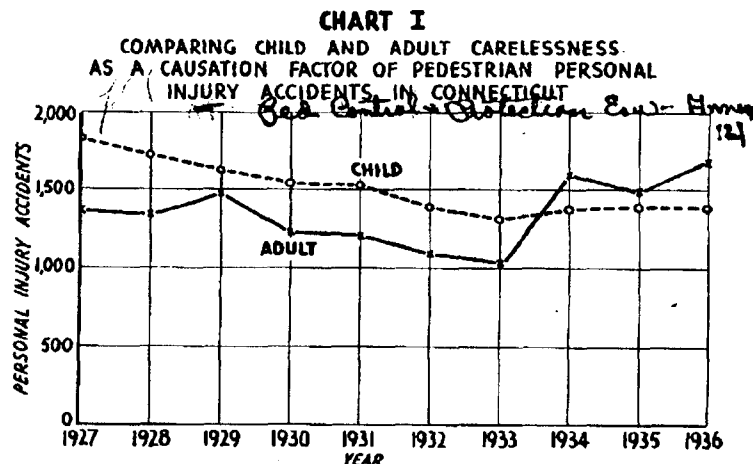
The ratio of pedestrian deaths to pedestrian accidents is also much higher in rural areas. A study of 10,000 New Jersey accident reports showed that 32.8% of the pedestrian rural night accidents were fatal and 9.2% of the pedestrians involved in rural day mishaps were killed. These corresponding percentages of fatalities in urban accidents were only 6.5 by night and 3 by day.

However, in spite of the increase in rural pedestrian accidents the pedestrian problem remains one of primary importance to the city. While better traffic control and regulation have been able to reduce deaths from collisions between motor vehicles 21%, pedestrian fatalities have been reduced but 7% and, in 1936, were 67.5%. In the larger cities this percentage is even higher. In the rural sections the fatalities from collisions between two or more motor vehicles have increased 118% while pedestrian deaths have increased 64%. Consequently, rural pedestrian deaths represent only 27.5% and fatalities resulting from collisions between two

or more motor vehicles constitute 28.6% of the total motor vehicle deaths.

From the large numbers of pedestrians being killed each year it would appear that the pedestrian is being mercilessly run down by the motorist. However, statistics from five states show that 55% of the pedestrian deaths resulted from accidents chargeable principally to the fault of the pedestrian himself. Pedestrian accidents are also much more severe than other motor vehicle mishaps. In all motor vehicle accidents, including pedestrians, one person is killed for every 35 persons injured. In pedestrian accidents alone one person is killed for every 22 injured. When a car averaging 3,000 pounds in weight traveling approximately 40 miles per hour strikes a pedestrian weighing only 150 pounds and moving about 3 miles per hour there is no doubt about which will get the worst of it.

Intoxication is an important factor in pedestrian accidents. The 1937 edition of ACCIDENTS FACTS shows that 11% of the pedestrians involved in fatal motor vehicle accidents are classified as "had been drinking." This average was compiled from figures of only 21 states and there is a possi-



bility of differences in reporting, and, in some cases, serious under-reporting. The percentages of "had been drinking" pedestrians ran as high as 20% for some states and as low as 3% for others. Dr. S. R. Gerber, Coroner of Cuyahoga County, Ohio, reported from a study of 110 cases that 45% of these pedestrians and motorists who were victims of fatal motor vehicle accidents in that county in 1936, excluding children under 15 years of age, had more than 0.10% alcohol in body fluids. This percentage of alcohol was considered by him as an average borderline for intoxication.

The study of 10,000 New Jersey accident records for 1936 shows that drinking is, for the most part, a night time hazard. In New Jersey 11.8% of the pedestrians involved in urban night accidents and 22% of those in rural night mishaps "had been drinking."

Experience in the operation of motor vehicles appears to be a safety asset for pedestrians. Data from Connecticut show that 1,238 pedestrians were killed in the last four years. Of these, 1,031 were eligible from an age standpoint to have drivers' licenses, but only 48, or less than 5%, were licensed

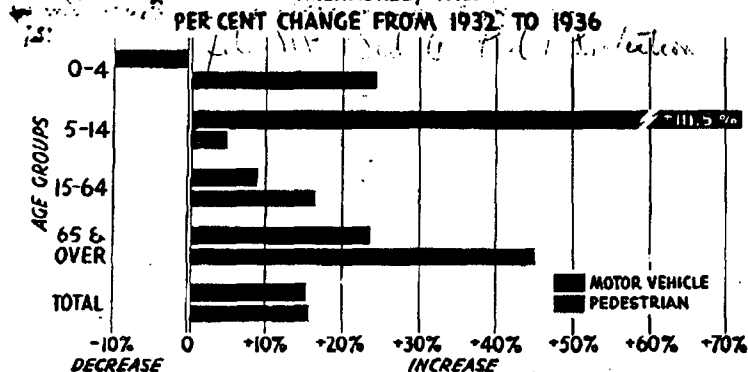
operators. Similar investigations should be made from the accident records of other jurisdictions. If such studies show that non-drivers are more susceptible to accidents than the pedestrians who drive, this will serve further to define the problem of pedestrian education and protection.

In localities where safety has been taught in schools, the value of child education in pedestrian safety has been shown by the reductions which have occurred in traffic deaths and accidents among children of school age. A Connecticut survey indicates that fewer children are being killed from carelessness on their own part. A study of the age groups of pedestrian accidents in Milwaukee also shows a downward trend in the 5-14 year age group. Similar information from Providence, R. I., also portrays the same trends. In these three communities the person above 50 years of age is increasingly susceptible to automobile accidents. This older person probably over-estimates his ability to get out of the way of the faster and quieter modern motor car, and physical deficiencies impair his safety.

Education and social status seem to affect the incidence of pedestrian accidents. In

CHART II

A COMPARISON OF CHANGES IN PEDESTRIAN AND MOTOR VEHICLE ACCIDENTS BY AGE GROUPS FOR MILWAUKEE, WIS.



the traffic surveys of Springfield, Ill., and Vancouver, B. C., spot maps of the residence locations of pedestrians involved in accidents showed a definite grouping in those districts containing people of poor education and usually those persons of a rather backward social plane. Often they are in foreign districts where the normal activities of English speaking educational and social agencies are not effective. Such spot maps focus attention on those locations where safety education is needed and where the educational dollar may be most effectively spent.

Remedies

In approaching the pedestrian problem it ought to be recognized that, except in a few cases of suicide, pedestrians do not want to be injured or killed in traffic. It should also be admitted that drivers do not want to injure pedestrians. Accidents occur where unexpected conditions arise or traffic becomes so complex that normal walking habits and ordinary precautions do not supply the necessary protection.

In earlier days when the lower speeds of horse-drawn traffic and the smaller number of traffic units on streets and highways made

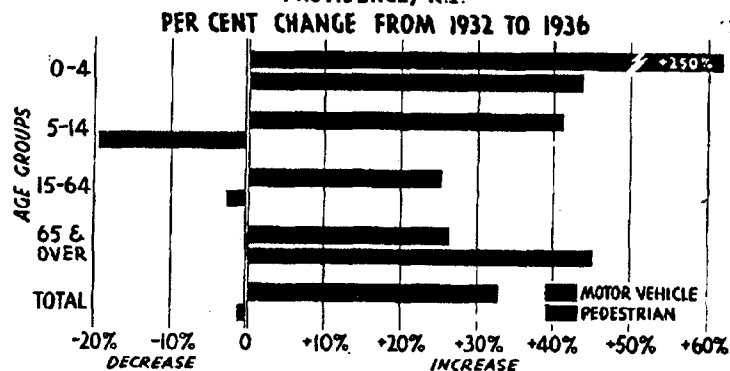
it safer for pedestrians to mingle with vehicular traffic, pedestrian accidents were few. It was not difficult to cross a street, except in the densest traffic, because a space of 100 feet between vehicles furnished an opportunity for a pedestrian to walk entirely across a normal street. Walking along a rural highway, even at night, did not present the same difficulties as it does now.

The introduction of higher speed vehicles and the great increase in their number has made it much more difficult for the pedestrian to be safe in walking along or across the streets. However, accident records and spot maps show that pedestrian accidents group at certain locations or in limited zones and that there are considerable sections which are almost if not entirely free from them. It is obvious that, except for irresponsible infants, aged and infirm adults and intoxicated pedestrians, normal walking habits and ordinary precautions enable pedestrians to avoid accidents in a great many of the traffic situations they face.

Where traffic conditions become more complicated, the differential in speeds between vehicles and pedestrians places the latter at a disadvantage in traffic and re-

CHART III

A COMPARISON OF CHANGES IN PEDESTRIAN AND MOTOR VEHICLE ACCIDENTS BY AGE GROUPS FOR PROVIDENCE, R.I.



quires supplementary measures for their protection. Such measures range from ordinary designation of cross walks by painted lines on the pavement surface to define better the proper place of the pedestrian in the streets and to call the attention of the drivers to it, to complete separation of vehicular and pedestrian traffic by pedestrian tunnels or bridges.

Such supplementary measures are to be considered aids to the pedestrian traffic rather than restrictions except where it is necessary to require their use. Any such measure which constitutes a serious inconvenience to pedestrian traffic creates the impression that pedestrian privileges are being greatly subordinated to the privileges of other traffic and results in general disobedience.

Pedestrian Crosswalks

One of the most commonly applied remedies for pedestrian protection is the marked crosswalk. Generally, its value is largely directional because it is seldom that pedestrians are legally required to use these crosswalks and to cross the street at no other places. However, when they are properly placed they do indicate to the pedestrian that the need for some pedestrian protection is recognized, and that it has been determined that if the pedestrians cross within the confines of these walks it will be safer than if they cross elsewhere. It is not generally desirable to mark all crosswalks at all intersections. In fact, it is not economically feasible to do so. Such special designations should be reserved for those places where pedestrian accident problems exist as indicated by the accident record or by comparison with other similar locations where pedestrian accidents have been reduced by such measures.

Pedestrian Right-of-Way

The Uniform Vehicle Code, recommended by the National Conference on Street and Highway Safety for adoption by all states and cities, defines the relative rights and privileges of pedestrians and motor vehicle drivers. It provides that in the absence of traffic control signals the driver of a vehicle should yield the right of way, to the point of slowing down or stopping, if necessary, to a pedestrian who is crossing the roadway within a marked crosswalk or within the area which is usually considered the crosswalk at an intersection. In return for this concession it requires that if pedestrians

cross a roadway at any other point than a marked crosswalk or the area usually considered a crosswalk at an intersection they shall yield the right of way to vehicles which are upon the roadway. It prohibits the crossing of a street or highway by pedestrians between adjacent intersections at which traffic control signals are in operation, except where a specially marked crosswalk is provided. To protect pedestrians who are crossing in crosswalks, either marked or unmarked, it is made illegal for one vehicle to pass another which has stopped to allow pedestrians to cross. It further requires every driver to exercise due care to avoid collisions with pedestrians in the roadway, regardless of whether the pedestrians may be crossing in conformance with these restrictions.

This Uniform Vehicle Code has been quite generally adopted by cities and states. The effectiveness of its provisions is dependent upon the education, publicity and enforcement which they are afforded. The Committee urges that the motorist and the pedestrian be given every opportunity to learn their relative rights and privileges and that this be followed up by enforcement measures to require those who will not conform voluntarily to do so under compulsion.

Stop and Go Signals

For several years cities in different parts of the country have had varying successes with the regulation of pedestrian traffic by Stop and Go signals. Some cities have had not only legal requirements but a large measure of voluntary obedience, and in such sections the actual control of pedestrian traffic by signals is usually successful. In other cities general opinion is that such control is not practical and cannot be imposed upon pedestrians. One generally accepted principle is that unreasonable delays due to unnecessarily long cycles of operation of Stop and Go signals are conducive to disobedience by pedestrians. This has been one of the large factors in reducing the length of cycles to the minimum which will handle traffic successfully.

Pedestrian Walk Lights

Another development in the use of Stop and Go signals for pedestrian aid and protection is the pedestrian walk light. Formerly, this was incorporated into the cycle as a separate phase for pedestrians to walk in all directions during which no vehicular traffic might move. However, this tended to

increase greatly the total length of the cycle because it added to the time required for vehicles to move the time required for pedestrians to move in all directions and did not enable pedestrians to take advantage of the opportunity to cross with the green light. This type of special pedestrian signal has generally been discarded in favor of the type which operates in conjunction with the green light at the ordinary four-way intersection. It allows pedestrians to cross in the same direction and at the same time as the vehicles with the exception that the special pedestrian light (usually white or purple) goes off a few seconds before the green changes to yellow because it requires a longer time for pedestrians than for vehicles to clear the intersection. At special types of intersections where there is almost a continual flow of vehicles across the crosswalks, it is necessary to install special pedestrian walk signals if there is appreciable pedestrian traffic and protection is necessary. In such a case it is usually necessary to operate the walk signals as a separate phase of the cycle.

To be most successful for pedestrian obedience a Stop and Go signal should have a face toward each direction of pedestrian movement. If signals do not face all movements, the pedestrians going in certain directions will have to depend upon the indications of signals at right angles to their direction and, thus, be in danger of becoming confused and disobeying the signals inadvertently.

Pedestrian Actuated Signals

The use of push button actuated Stop and Go signals is applicable to those locations where pedestrian movements are intermittent or confined to certain times of the day and cross movements of vehicles are few. The interruption of the vehicular flow periodically when there are no pedestrians to cross is not desirable because it is unnecessary, and it breeds disrespect for the signal by drivers who can see that no pedestrians are waiting to cross.

Pedestrian Islands

In wide, densely traveled streets the pedestrian faces unusual hazards. It is difficult for him to find adequate intervals in traffic in both directions simultaneously to enable him to cross the full width of the pavement safely. The installation of raised islands to separate different traffic movements and give the pedestrian a place of

refuge to which he may cross and wait momentarily for an opportunity to complete his crossing, aids pedestrian safety. These have been used at street centerlines and sometimes at other locations in large intersections.

Tunnels, Bridges, and Subways

Pedestrian tunnels and bridges involve some problems in making and keeping them fit and advantageous for pedestrian use. They are apt to be little used by adult pedestrians if they involve ramps or steps at both ends. However, if the opposite ends can be at different levels and pedestrians can reach a level before crossing the street which they would otherwise have to reach after crossing, the tunnel or bridge is likely to be extensively used. However, the tunnel does require proper drainage and lighting and adequate maintenance to keep it in safe and sanitary condition. By the use of school boy patrols, school children may be required to use the tunnels or bridges in lieu of crossing at street level although they may come back to the same level on the opposite side of the street. Pedestrian tunnels are more apt to be successful for use by school children than by adults.

Rural and Suburban Walkways

Along rural and suburban roads very few pedestrian walkways have been provided. Along a large percentage of such roads they may not be necessary because there are so few pedestrians and traffic is yet relatively sparse. However, in suburban areas, in rural locations adjacent to schools, summer resorts and in other places where pedestrians are common, walkways are necessary to enable pedestrians to have a convenient and comfortable place to walk separated from the regular pavement surface. If such walkways are not comfortable and convenient, pedestrians will continue to use the pavement. Warrants should be established and standards provided for construction of side-walks along rural and suburban highways based upon the nature and volume of the vehicular and pedestrian traffic.

Marked progress has been made in the protection of pedestrians upon rural highways by encouraging or requiring them to walk facing oncoming traffic rather than walking in the same direction. This gives the pedestrian an opportunity to see the approaching traffic, particularly at night, and to know constantly how close he may be to danger.

Special lighting of streets and highways is sometimes desirable to make the pedestrian more visible to the approaching motorist and enable him to know better where he may walk in safety.

FUTURE PROGRAM

One of the problems before this Committee is to evaluate the various measures of pedestrian protection and establish criteria for their use. These must be based upon the experiences of traffic jurisdictions in all parts of the country. The Committee proposes to be a clearing house for studies of comparative accident experiences before and after the installation of protective measures, and invites traffic engineers and police

officials to cooperate by making such studies in their own communities.

A list of projects and the corresponding procedures is being prepared by the Committee for guiding such studies to insure comparable results. The procedures will provide the information which is necessary for determining the results of the measures which are applied in terms of pedestrian observance and obedience and accidents prevented. They will provide the kind of information which traffic officials need for their own guidance in subsequent installations. They will pertain either to existing installations for which the necessary accident records and other information are available

TABLE I

A Table Comparing Various Numbers, Rates and Percentages of Pedestrian and Motor Vehicle Statistics

Year	All Deaths	Pedestrian Deaths		Death Rate per 100,000 Population	
		No.	%	Total	Ped.
1927	25,800	10,820	41.9	21.8	9.1
1936	37,800	15,100	39.9	29.4	11.7
Percentage changes since 1927	+47%	+40%		+35%	+29%

Year	Death Rate Per 10,000 M. V.		Death Rate per 10,000,000 Gals. Gas	
	Total	Ped.	Total	Ped.
1927	11.1	4.6	23.5	9.9
1936	13.4	5.3	21.0	8.4
Percentage changes since 1927	+21%	+15%	-11%	-15%

TABLE II

A Table Showing Pedestrian Death Rates per 100,000 Population

Year	Baltimore	Boston	Buffalo	Chicago	Cleveland	Milwaukee
1932	12.3	11.5	12.9	18.1	14.4	8.7
1933	11.4	10.8	13.1	18.7	17.8	8.7
1934	13.8	14.6	14.7	19.6	18.7	6.5
1935	12.2	13.9	14.4	16.9	17.2	7.0
1936	11.0	12.8	13.5	17.3	16.6	9.3

Year	Providence	Louisville	Dallas	Los Angeles	Philadelphia	Pittsburgh
1932	7.8	10.5	11.7	18.5	9.9	12.1
1933	6.6	11.1	11.1	17.8	—	11.6
1934	—	18.6	7.9	19.9	12.7	10.2
1935	7.8	15.1	10.1	22.8	10.6	12.6
1936	10.2	16.7	11.1	23.2	9.4	13.9

for comparable periods before and after application, or to proposed installations. The procedures will be applicable to individual intersections, limited sections of streets or highways, or more extensive areas and, hence, are adaptable to communities of all sizes with the proper accident records.

The experiences with the same remedies at different locations will be studied taking into account the different conditions for the purpose of determining why they are more successful at certain locations than at

others. The effects of differences in traffic volumes, street layouts, topography, and types of application of the different remedies on their effectiveness will be determined. These studies should reveal the conditions under which the different remedies are successful and other conditions which prevent them from providing the protection which is desired. Such research should help greatly in deciding some of the important questions concerning pedestrian protection which now confront traffic officials.

TABLE III

A Table Showing Pedestrian Personal Injury Accident Rates per 100,000 Population (Rates of different cities are not comparable due to differences in accident reporting. Compare only figures for different years of the same city.)

Year	Louisville	Milwaukee	Providence	Los Angeles	Dallas	Philadelphia	Pittsburgh
1932	196.0	283.0	340.0	—	—	404.0	143.0
1933	187.0	307.0	284.0	314.0	156.0	411.0	196.0
1934	185.0	302.0	—	330.0	166.0	399.0	250.0
1935	228.0	296.0	299.0	322.0	179.0	362.0	224.0
1936	215.0	324.0	336.0	355.0	187.5	364.0	200.0

TABLE IV

A Table Showing Per Cent Pedestrian Deaths to Total Motor Vehicle Deaths

Year	Baltimore	Boston	Buffalo	Chicago	Cleveland	Milwaukee
1932	73.0	77.0	76.5	73.9	67.0	63.5
1933	71.5	77.5	64.5	72.6	76.0	71.2
1934	73.5	80.5	73.5	69.5	72.0	59.0
1935	73.0	79.5	78.5	74.4	78.7	63.7
1936	72.0	75.0	75.0	75.6	70.4	80.0

Year	Providence	Louisville	Dallas	Los Angeles	Philadelphia	Pittsburgh
1932	66.6	62.4	71.0	54.5	71.6	65.5
1933	81.0	50.0	70.5	52.3	—	65.3
1934	—	72.0	56.5	56.4	73.6	65.1
1935	100.0	66.5	56.0	61.0	77.0	64.0
1936	86.7	74.7	67.4	62.5	74.0	65.0

TABLE V

A Table Showing Per Cent of Pedestrian Personal Injury Accidents to Total Motor Vehicle Personal Injury Accidents (Rates of different cities are not comparable due to differences in accident reporting. Compare only figures for different years of the same city.)

Year	Louisville	Milwaukee	Providence	Los Angeles	Philadelphia	Pittsburgh
1932	44.6	51.7	57.1	—	49.4	37.4
1933	41.5	56.2	55.5	26.6	33.2	38.9
1934	41.0	49.0	—	28.1	32.2	33.5
1935	39.6	54.0	52.5	28.3	33.4	44.5
1936	42.7	51.7	50.0	29.2	36.4	44.0

TABLE VI

A Table Showing Per Cent of Pedestrian Deaths to Total Number of Pedestrian Personal Injury Accidents
(Rates of different cities are not comparable due to differences in accident reporting. Compare only figures for different years of the same city.)

Year	Louisville	Milwaukee	Providence	Los Angeles	Dallas	Philadelphia	Pittsburgh
1932	5.3	3.1	2.3	—	—	2.5	8.5
1933	5.9	2.8	2.3	5.7	7.2	—	5.9
1934	10.0	2.2	—	6.0	4.8	3.2	4.1
1935	6.6	2.4	2.6	7.1	5.6	2.9	5.6
1936	7.8	2.9	3.0	6.5	5.9	2.6	6.9

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Night Accident Hazards

Presented by RALPH W. EATON

Public Service Engineer, Providence, R. I.

The following is a report of progress of the activities of the Committee on Night Accident Hazards. It was prepared specifically for presentation at the Twenty-Sixth National Safety Congress in Kansas City and it should not be considered as a final and conclusive report on this subject. The Committee will continue its study for the ensuing year and will present a more complete report at the 1938 Congress.

INTRODUCTION

Night traffic accidents have increased rapidly during the past few years. Reports from five states used in preparing the 1937 edition of ACCIDENT FACTS show that from 1930 to 1936 the number of traffic fatalities at night have increased 28%, while the number during the day have increased only 11%. Accidents during hours of darkness, too, have more serious consequences than those occurring during daylight. Other data show that while 48% of personal injury accidents happen at night, 60% of the total deaths occur during hours of darkness. On the basis of traffic the situation is even more alarming. Less than 30% of the total highway traffic moves during hours of darkness while it is during these hours that three-fifths of traffic fatalities occur. (See graph.)

There are many conditions that make highway travel at night more hazardous than during the day. To attack the problem of night accidents properly it is necessary to collect data covering numerous night accidents, to analyze these, and thereby to determine the influence of the various factors. It will then be possible to suggest the

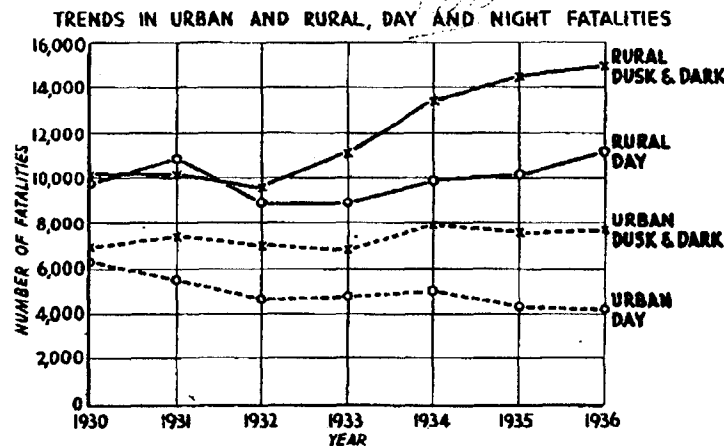
remedies needed for making night travel safer.

With these objectives in mind the Committee on Night Accident Hazards has collected certain information and presents it herewith with a discussion of the numerous factors encountered in an analysis of night accidents.

ACCIDENT DATA

Table I was prepared from an analysis of nearly 10,000 traffic accidents from the records of the State of New Jersey for 1936. It shows the incidence of different circumstances of accidents by day and by night, separately, for both urban and rural areas. From this table it is seen that some circumstances occur more frequently in accidents at night than during the daytime. Taking into account the predominance of traffic during hours of daylight, which is 70 to 80% of the total traffic for 24 hours, the frequency of night accidents is higher than that of day accidents for every classification.

The various circumstances influence the night and day accident records in different ways. Some bear little relation to the difference in visibility between night and day.



VISIBILITY

Variation in visibility is the major difference in driving conditions at night and during the day. This factor has a marked influence on accidents. When sleepy and drinking drivers are omitted, most of the other circumstances are of a type affected by the degree of visibility. For example, the high frequency of night pedestrian accidents and collisions between motor vehicles and fixed objects is associated with lowered visibility at night. Similarly, the prevalence of night accidents involving vehicles on the wrong side of the road and those that were driven off the roadway is also a consequence of this impaired visibility. Again, the higher frequency of accidents during fog, rain or snow as compared with those during clear weather, and the higher frequency of accidents on wet, muddy, snowy or icy roads as compared with those on dry roads at night result from decreased visibility and the greater difficulty of distinguishing between safe and unsafe conditions under certain circumstances.

The fact that not more than 20% to 30% of the total number of vehicle miles are traveled at night shows, at once, that driving experience is in most cases obtained under daylight conditions. Drivers normally form their driving habits through practice in daylight visibility. In such driving the light source is general and objects are readily visible both upon the highway and adjacent to it. Although the driver may have numerous distractions that bear no relation to conditions that govern his driving, daylight makes visible to him those conditions which do affect his driving and which are not hidden by obstructions to view.

At night visibility is made possible only by localized sources of illumination, vehicle lights either alone or supplemented by fixed lights on or adjacent to the highway. The type of visibility changes many times during a trip at night. As a result the driver is confronted by widely varying conditions of visibility as contrasted with the normally uniform distribution of daylight.

The importance of this is accentuated by a newly recognized factor effecting nighttime visibility called night-blindness. The ability of the eyes of some persons to adjust themselves to varying intensities of light at night lags materially behind normal and in some cases to extreme degrees. Tests

For example, the number of drivers involved in accidents who fell asleep in night driving was more than two and one-half times the number of those who fell asleep during the daytime. The number of drivers who had been drinking and became involved in accidents was nearly four times as great at night as during the day. However, these conditions accounted for a relatively small part of the total, not enough to compensate for the greater frequency of night accidents in general. Less than one-half of one per cent of the drivers in urban night accidents and slightly less than one and one-half per cent of the drivers in rural night accidents were reported as asleep. Four per cent of the drivers in urban night accidents and six and one-half per cent of the drivers in rural night accidents were reported as "had been drinking." Among pedestrians, drinking is a more common factor in accidents although the total number of pedestrians injured is considerably lower than the number of drivers involved in accidents. The New Jersey figures showed 13.8% of the pedestrians in urban night accidents and 22.1% of those in rural night accidents were reported as "had been drinking."

Although these data are for the State of New Jersey only, they do indicate the extent of the night accident problem in this one jurisdiction. Other states need the same type of studies to evaluate their night driving problems and to compare with the data of New Jersey so that the most representative picture will be assured.

It seems probable from a study of accident statistics that "speed too fast for conditions" is the important element in the increase in night accidents, particularly with reference to those resulting in fatalities. For example, a study of 10 fatal accidents occurring in a particular section on Route 6A in Connecticut during 1936 shows that seven of them were at night, and that in five of the seven the cars were traveling at high rates of speed, in several cases estimated to be 70 miles per hour.

Other important elements in night accidents are carelessness and inattention. The hours of darkness are frequently the hours of relaxation when motorists on the highways are in the pursuit of pleasure and entertainment. No data covering these elements are available at the present time, but the proper agencies of several of the States should be requested to collect such information.

of several thousand men and women from all walks of life made by two Philadelphia physicians showed about 15% were suffering from night-blindness.

SPEED AND VISIBILITY

Visibility for operators of motor vehicles at night is not constant but is intermittent and changes rapidly. This is an important difference between night and day driving.

Because of these variations in visibility it is ordinarily necessary to reduce speed at night in consideration of safety. That this is recognized by drivers is shown by speed data obtained in Connecticut in 1933-1934 in connection with the highway traffic survey conducted by the U. S. Bureau of Public Roads and the Connecticut State Highway Department. Observations made on more than 73,000 cars showed that the average

TABLE I

Circumstances of 9,876 Accidents From the New Jersey Accident Records for 1935
Compiled by National Safety Council

CLASSIFICATION	URBAN			RURAL			TOTAL		
	In Day Accidents	In Night Accidents	Ratio Night/Day	In Day Accidents	In Night Accidents	Ratio Night/Day	In Day Accidents	In Night Accidents	Ratio Night/Day
TOTAL ACCIDENTS	3673	3143	0.85	1612	1448	0.90	5285	4591	0.87
COLLISIONS WITH—									
Pedestrians	1036	969	0.93	131	177	1.35	1167	1146	0.98
Other Motor Vehicles	2311	1877	0.81	1225	989	0.81	3536	2866	0.81
Fixed Objects	107	151	1.41	154	179	1.16	261	330	1.26
Other Accidents	219	146	0.67	102	103	1.01	321	249	0.77
SEX OF DRIVERS									
Male	5376	4677	0.87	2453	2264	0.92	7829	6941	0.89
Female	569	271	0.48	380	151	0.40	949	422	0.44
AGE OF DRIVER									
Under 18	78	75	0.96	40	22	0.55	118	97	0.82
18-34	2636	2572	0.98	975	1036	1.06	3611	3608	1.00
35-50	1626	1228	0.76	695	489	0.70	2321	1717	0.74
50-over	487	272	0.56	316	129	0.41	803	401	0.50
CONDITION OF DRIVER									
Asleep	8	22	2.75	14	35	2.50	22	57	2.59
Drinking	54	199	3.69	38	159	4.19	92	358	3.89
View Obstructed	582	469	.80	257	232	0.90	839	701	0.84
Confused	297	218	.73	285	177	0.62	582	395	0.68
Blinded by Lights	—	77	—	—	114	—	—	191	—
THE MOTORIST—VIOLATIONS									
Reckless Driving	76	117	1.54	104	150	1.44	180	267	1.48
Speeding	400	281	0.70	240	144	.60	640	425	0.66
Wrong Side of Road	328	336	1.02	273	327	1.20	601	663	1.10
Right-of-Way	460	296	0.64	342	138	.40	802	434	0.54
Cutting In	183	124	0.68	47	32	.68	230	156	0.68
Failed to Signal	268	148	0.55	168	68	.41	436	216	0.50
Drove Off Roadway	82	97	1.18	188	199	1.06	270	296	1.09
Hit-and-Run	102	180	1.76	12	58	4.82	114	238	2.08
Following Too Closely	282	179	0.63	164	123	.75	446	302	0.68
Other	160	139	0.87	62	56	.90	222	195	0.88

speed in the daytime was 40.6 miles per hour and at night 36.6, a reduction of four miles per hour. However, it is not believed that this relative reduction in speed is sufficient in view of the great difference in conditions of visibility during the day and at night.

The State of Minnesota recently enacted speed legislation making 50 miles per hour the prima facie speed limit at night in zones in which the limit is 60 miles per hour in the daytime. A problem before this Committee is to determine whether legislation or driver education will be the more effective.

TABLE I (Continued)

CLASSIFICATION	URBAN			RURAL			TOTAL		
	In Day Accidents	In Night Accidents	Ratio Night/Day	In Day Accidents	In Night Accidents	Ratio Night/Day	In Day Accidents	In Night Accidents	Ratio Night/Day
DIRECTION OF TRAVEL									
Going Straight Through	4010	3414	0.85	1851	1758	0.95	5861	5172	0.88
Turn Right	200	165	0.82	79	35	0.43	279	200	0.72
" Left	441	444	1.00	316	186	0.59	757	630	0.83
Backing	170	64	0.38	36	19	0.53	206	83	0.40
Parked or Standing Still	468	461	0.99	171	214	1.25	639	675	1.06
Slowing Down or Stopping	278	163	0.59	115	61	0.53	393	224	0.57
Skidding	414	300	0.73	270	163	0.60	684	463	0.68
TYPE OF VEHICLE									
Passenger	4435	4343	0.98	2233	2061	0.93	6668	6404	0.96
Other	1516	669	0.43	602	367	0.61	2148	1036	0.48
DAY OF WEEK									
Sunday	357	596	1.67	286	347	1.20	643	943	1.46
Monday	533	415	0.78	216	178	0.82	749	593	0.79
Tuesday	527	284	0.54	183	127	0.70	710	411	0.58
Wednesday	527	402	0.77	211	136	0.64	738	538	0.73
Thursday	525	429	0.82	204	181	0.90	729	613	0.84
Friday	533	438	0.82	221	171	0.77	754	609	0.81
Saturday	666	573	0.86	289	304	1.05	955	877	0.92
LOCATION									
At Intersection	2090	1792	0.86	584	326	0.56	2674	2118	0.79
Not at Intersection	1583	1351	0.85	1028	1122	1.09	2611	2473	0.95
WEATHER									
Clear	3163	2298	0.72	1369	1106	0.81	4532	3404	0.75
Fog, Rain, Snow	510	845	1.66	243	342	1.41	753	1187	1.58
ROAD CONDITIONS									
Dry	2875	2041	0.71	1192	1036	0.87	4067	3077	0.76
Wet, Muddy, Snowy, Icy	796	1101	1.39	418	411	0.98	1214	1512	1.25
THE PEDESTRIAN									
Drinking	13	114	8.75	4	39	9.75	17	153	9.00
Crossing at Intersection	265	380	1.44	8	33	4.13	273	413	1.51
In Street or Road									
Not at Intersection	336	337	1.00	60	111	1.87	396	448	1.13
Playing in Street	154	77	0.50	24	10	0.42	178	87	0.49
Coming From Behind Parked Car	255	161	0.63	34	17	0.50	289	178	0.62
Not in Roadway	26	14	0.54	5	5	1.00	31	19	0.61

tive in securing the required reduction in driving speeds for safety at night. Furthermore, the extent of these necessary reductions must be determined from actual conditions. It is conceivable that these will vary with automobile headlight design, the presence or absence of fixed lighting, and the general location and type of the highway.

AUTOMOBILE LIGHTING

Lights on motor vehicles are the only means now provided for night visibility on the vast majority of the highways. Insofar as highways have been free from night accidents, it is obvious that headlights have served their purpose quite satisfactorily for accident prevention. However, improvements for greater convenience and comfort of drivers, and provisions for better visibility at points where accidents are now occurring will be desirable.

One important consideration in determining the success of vehicle lights in providing night visibility is the way the accidents are distributed along streets and highways. Spot maps of night accidents show that they group at certain points in certain zones or areas and these are often separated by considerable sections of highway that have few, if any, accidents. Not only do these high accident and low accident zones often have the same volume of traffic, but they are traversed by the same vehicles. A comparison of the day and night spot maps shows that sometimes the night-time accident zones are the same as those for the daytime. In other cases the night and day high accident zones may be at entirely different locations. Again, they may be the same locations with abnormally high accident experience at one time or the other.

Wherever a distinguishable accident pattern indicates that there is a problem of insufficient visibility, localized supplementary measures must be taken to provide the additional visibility that is required. Such measures may cover a wide range depending upon the local conditions. At the one extreme is the distinctive marking in the roadway to reveal to the driver by reflection from his own headlights the path which he should follow. On the other extreme is the fixed street or highway lighting that enables the driver to distinguish objects in the road ahead by silhouette or reflection and that makes his own headlights necessary

mainly as a means of further identifying his car to other drivers.

Since so many miles of highways depend on vehicle lights for illumination at night and will probably continue to do so for many years, the important problem in headlight design is to provide adequate illumination of the highway to insure visibility of objects on it for the driver and, at the same time, to avoid blinding other drivers coming from the opposite direction. Poor adjustment as to focus or aim increases the difficulty in both cases because it may limit the visibility of one driver and momentarily blind the other. Permanence of adjustment is desirable, and this has been the aim in recent improvements in headlight design. Substantial research is now being conducted to improve the design further from the standpoint of permanence of adjustment and better direction of the light upon the highway.

USE OF HEADLIGHTS

Official and periodic safety inspection of motor vehicles is effective in the maintenance of headlights in good condition. This tends to insure that the best performance of which any headlight design is capable is obtained. The Automobile Manufacturers' Association is encouraging automobile dealers to give more attention to the condition of headlight in their service to automobile owners. This should be an important aid in maintaining a high standard of headlight performance.

As headlighting, supplemented by measures to make it more effective at certain points, appears to be the only available means of illumination for large sections of highways for some time to come, drivers should learn to use the headlights of the motor vehicle effectively. They should be taught to watch the right-hand side of the road and avoid looking directly toward the headlights of approaching vehicles. In this way they will ordinarily allow a greater clearance between passing vehicles than would otherwise be the case, and at the same time they will reduce the amount of adjustment which their eyes must make to lights of varying intensities. Then, too, drivers should learn to watch for indications as to the direction from which vehicles are approaching in order to discover the alignment of the highway ahead which may not be visible. During the last several hun-

dred feet of the approach of two vehicles the alignment, grades, hill-crests and objects on the roadway are normally visible if the driver watches for such indications and studies his driving. Organizations that are promoting highway safety should strongly emphasize these important features of night driving.

FARM AND OTHER HORSE-DRAWN VEHICULAR TRAFFIC

While headlighting and other means of identification between two or more motor vehicles are vital to safe night-time traffic, the problem of the unlighted, horse-drawn vehicle should not be forgotten. It is true that this type is in the minority upon the highway, but the Committee stresses the danger it presents to the occupants of the unlighted, slow-moving vehicle as well as to those riding in the approaching automobile. The Committee recommends that all states without adequate legislation requiring the use of front and rear lights on wagons, carts and other such vehicles should take steps immediately to enact such laws, and those states having satisfactory laws should provide consistent enforcement.

THE HIGHWAY AND ITS MAINTENANCE

Statistics reveal that the element of surprise is an important factor in accidents. The location, design and maintenance of highways have an important influence on this element. Even the best constructed highways may still have traffic hazards, and these will be more dangerous at night due to lowered visibility. Therefore, it is the duty of street and highway officials to have adequately indicated any unusual and dangerous features of the highway so that they will not constitute a menace to traffic.

This can be accomplished by the use of various types of signs properly designed, suitably illuminated and so placed that the drivers of motor vehicles will be given sufficient warning of traffic hazards. If these points are observed carefully in the maintenance of highways, the effect of surprise in night accidents will be greatly reduced.

Vividly marked street centerlines or pavement edges show drivers where they should go, particularly at curves and turns. These lines should be made of materials of texture and color that provide good reflection of headlights and are strongly in contrast with

the remainder of the pavement surface. Reflector buttons in small metal domes have been used effectively for this purpose, but these should not extend so high above the pavement as to be a traffic hazard in themselves. Well painted guard rails often accomplish more in showing drivers the road alignment than in actually stopping vehicles which run off the roadway although they are important for the latter purpose in many locations.

Reflector buttons in signs have added materially to the visibility of important messages. Unless a sign is designed and maintained in such a way as to have its message clearly reflected by the vehicle headlights, or is adequately illuminated by some fixed lighting, reflector buttons should be used to make the sign as clearly visible by night as by day. Good maintenance of signs for night visibility is necessary.

Obstructions in the street or highway present special problems of visibility. The former practice of marking the obstruction by fixed light or some type of reflector, without showing clearly the roadway past the obstruction, in general, has not been successful. By contrast with the light or reflector, the roadway has often been quite invisible. Lighting of the interior of underpasses and special lighting of roadways past pedestrian islands and safety zones have often been necessary to prevent the accidents that have occurred from failure to miss such obstructions.

A development in highway design which reduces the effect of poor headlight adjustment at the same time that it reduces the conflict in traffic movement, is the separation of roadways of four or more lanes by dividing strips. Particularly if these dividing strips are wide, the drivers are not subject to the direct rays of headlights of cars approaching from the opposite direction. Wide dividing strips also provide a place of refuge for left turning and crossing traffic which is not provided by the narrower strips.

The light absorbing and reflecting qualities of the different pavement surfaces are elements to be considered in the design of highways. Some of these surfaces, especially when wet, reflect light in such a way as to seriously hamper visibility. This is a question for further study by the Committee.

STREET AND HIGHWAY LIGHTING

Street and highway lighting has been a subject of considerable research and development in recent years. Especial efforts have been made to direct light upon the highway and minimize the light that is dissipated into unimportant space. Types of light sources and spacings along the highway have been developed towards obtaining the proper illumination with the minimum amount of glare. These are problems of illuminating engineering design, and their solutions have been attempted as the character of highway lighting problems have been revealed.

Considerable research is yet required to determine the places where highway lighting is needed for safer motor vehicle operation. Studies must be made of accident experiences before and after the installation of highway lighting or the improvement of existing installations to determine the kinds of accidents that are reduced following such installations or improvements and the types that persist. There have been numerous trial installations of highway lighting in many parts of the country that were intended to demonstrate the value of such installations in night driving. Unfortunately, there have been no installations from which adequate detailed studies of accidents before and after installation were available to show the effect upon various types of accidents and, thus, to make their results valuable as guides for other installations.

Such installations should be made where accident experience has demonstrated that there is a substantial number of night accidents of a type which highway lighting can be expected to correct. Then the accident experiences before and after such installations should be compared for a sufficient length of time to determine the types of accidents which have been reduced or eliminated and the types which have occurred, and, possibly, increased. In this way the value of such installations in accident prevention will be demonstrated.

The advantage of this type of study is twofold; first, it furnishes a means of determining whether the individual installation has been a success in actually preventing accidents. Second, it serves as a guide for future installations by revealing more clearly the types of accidents that can be prevented by highway lighting, and subsequently, the kind of locations at which lighting may be

considered necessary even in the absence of detailed accident experience.

FURTHER INFORMATION NEEDED

To determine from an analysis of night accident problems the types of remedies that are effective, the Traffic Engineering Bureau of the National Safety Council has prepared a procedure for comparing the accident experience before and after the installation of different remedies. Collision diagrams are employed. These show the sections of highway under consideration with the individual accidents represented by standard symbols. Separate diagrams should be made for day and night accidents so that the patterns can be compared both before and after the adoption of corrective measures.

General comparisons of the numbers of night accidents before and after the installation of some corrective measure are not adequate for applying the resulting experience to other locations. The fact, for example, that an installation of highway lighting was followed by a reduction in night accidents does not necessarily mean that every installation of that type will produce equal reductions wherever there are night accidents.

There is no doubt that highway lighting can be effective in reducing night accidents of certain types and in certain locations. Just what these types and locations are like must be determined by research of a type which has not yet been carried on to the knowledge of this committee.

FUTURE PROGRAM

This committee strongly recommends the accident experience approach to the solution of night accident problems. There is great need for the evaluation of the different night accident remedies and the determination of the conditions to which they are especially applicable.

The work of this Committee must be carried on largely through the correlation of data obtained from many local studies on highway accident problems and the effectiveness of the remedies which were applied. A list of research projects and a recommended procedure is being prepared and will be supplied to jurisdictions in which studies can be made of the effectiveness of night accident prevention measures. Such meas-

ures need not be extensive to qualify for this research for it is desired to determine the effectiveness of the simple remedies as well as the more elaborate and expensive ones.

No jurisdiction can hope to make rapid progress in the solution of its night accident problems from its own experience alone. An interchange of data is needed, and to provide this, studies to determine the results of both successful and unsuccessful measures are required. Through the staff of the National Safety Council this Committee desires to provide a clearing house for such

information. Advice will be given on the application of the accident experience approach to individual local problems, as well as detailed procedure for conducting studies on the results of local measures. The resulting information will be gratefully received and compiled with other data from various sources to provide a comprehensive study of the night accident problem.

With reliable and sufficient data for analysis, the Committee feels that it will then be possible to offer methods that will prove helpful in solving the night accident problem.

ADJOURNMENT

Commercial Vehicle Section

Officers 1936-37

General Chairman—R. C. HAVEN, Continental Baking Co., New York City.
Vice-Chairman—W. F. BURK, The Canton Repository, Canton, Ohio.
Vice-Chairman—J. W. LORD, Atlantic Refining Co., Philadelphia, Pa.
Vice-Chairman—J. R. STEELE, Oklahoma Gas & Electric Company, Oklahoma City, Oklahoma.
Secretary and Chairman Engineering Committee—DWIGHT M. McCracken, Liberty Mutual Insurance Company, Boston, Mass.
Chairman Membership Committee—CHARLES G. MORGAN, JR., American Trucking Associations, Inc., Washington, D. C.
Chairman Program Committee—H. D. SCHEFFER, Auto Owners Insurance Company, Lansing, Mich.
Executive Committee at Large—
MARCUS A. DOW, Greyhound Management Company, Cleveland, Ohio.
CHARLES H. RUTH, Evening Star Newspaper Company, Washington, D. C.
A. N. LUNDSTEADT, Bowman Dairy Company, Chicago, Ill.
C. C. ROSENBERGER, G. I. Service, St. Louis, Mo.
P. D. SHINGLETON, Atlantic Greyhound Lines, Charleston, W. Va.

Officers Elected for 1937-38

General Chairman—R. C. HAVEN, Safety Engineer, Continental Baking Company, 630 Fifth Avenue, New York City, N. Y.
Vice-Chairmen—
W. F. BURK, Traffic Manager, The Canton Repository, 508 Market Avenue South, Canton, O.
J. W. LORD, Safety Engineer, Atlantic Refining Co., 3144 Passyunk Avenue, Philadelphia, Pa.
J. R. STEELE, Superintendent of Safety, Oklahoma Gas & Electric Co., 321 No. Harvey Street, Oklahoma City, Okla.
Secretary; Engineering Committee Chairman—DWIGHT M. McCracken, Assistant Chief Engineer, Liberty Mutual Insurance Company, 1100 Park Square Bldg., Boston, Mass.
Membership Committee Chairman—EARL D. PORTER, Director of Safety & Personnel, Hayes Freight Lines, Inc., 119 N. 15th Street, Mattoon, Ill.
Program Committee Chairman—P. D. SHINGLETON, Director of Safety & Personnel, Atlantic Greyhound Corporation, 1100 Kanawha Valley Bldg., Charleston, W. Va.
Executive Committee at Large—
MARCUS A. DOW, Manager, Dept. of Safety & Personnel, Greyhound Management Co., 920 E. Superior, Cleveland, Ohio.
T. B. JOHNSON, Manager, Delivery Division, Marshall Field & Company, 601 W. Polk St., Chicago, Ill.

- H. J. JONES, Director of Safety, Automobile Shippers, Inc., Ryan Road at Nevada Avenue, Detroit, Mich.
 H. H. KELLY, Section of Safety, Bureau of Motor Carriers, Interstate Commerce Commission, Washington, D. C.
 A. E. LUNDSTEADT, Claim Adjuster, Bowman Dairy Company, 140-158 West Ontario Street, Chicago, Ill.
 A. W. MEINKE, Engineer, Travelers Insurance Company, Insurance Exchange Bldg. 175 W. Jackson Blvd., Chicago, Ill.
 CHARLES G. MORGAN, JR., Manager, Safety Division, American Trucking Associations, Inc., Investment Building, Washington, D. C.
 H. D. SCHEFFER, Safety Director, Automobile Owners Insurance Company, Lansing, Mich.
 H. B. VAUGHAN, JR., Major, Corps of Engineers, Munitions Bldg., Washington, D. C.

TUESDAY MORNING SESSION

October 12, 1937

The meetings of the Commercial Vehicle Section opened with a "get acquainted" breakfast at which R. C. Haven, Safety Engineer, Continental Baking Co., New York City, and General Chairman of the

Commercial Vehicle Section, National Safety Council, presided.

A short address was given by J. W. Lord, Vice-Chairman of the section. All those present were introduced.

THE VEHICLE AND THE DRIVER

The meeting was called to order by General Chairman R. C. Haven, who presided, introducing the speakers and directing the discussion.

Safe Maintenance of the Vehicle—Managements' Responsibility

By H. R. GRIGSBY

Superintendent of Transportation, Oklahoma Gas & Electric Co., Oklahoma City

Safe maintenance should begin with the selection of the vehicle. It should first be determined just what it will be required to carry. If it is a freight hauling truck, the maximum load must be determined. If it is a special purpose car, such as a public-utility truck used for a crew, it should be determined what it will be required to carry in the

the way of materials, tools, winches, pole derricks, etc., and the conditions under which it will operate, having in mind the type of roads it will have to negotiate.

With this information, the vehicle should be selected with the proper carrying capacity, tires of sufficient size to carry the load properly, and with the proper wheelbase and

body dimensions to give the correct load distribution. It is extremely important to get a vehicle that will handle correctly on the highway. If it does not handle properly, it is not safe.

The proper design of the body also is important, and special attention should be given to getting the center of gravity as low as possible. This is not a hard task on the types of bodies that are now becoming popular with the public utility companies for use by their crews.

In other than platform and van bodies, the aversion to the use of wheel housings has largely disappeared. This not only allows the lowering of the center of gravity, but makes for much easier access to the interior of the body, which in itself makes safer handling of materials and lessens the chances for personal injury to members of the crew.

In the selection or designing of the vehicle, it is important that the cab have good visibility both forward and to the sides. It also should be equipped with an adequate rear view mirror so located that its range will not be obstructed. The cab should be so constructed that the driver sits in a comfortable position and has plenty of room. All of the controls should be so located that they are in easy reach designed to operate easily.

The cab doors should be hinged at the front. This not only is a safer door while driving, but it is very helpful to the driver when he finds it necessary to back up his vehicle. If the vehicle is of such size to require it, brakes should be power operated or power amplified.

Special attention should be given to the ventilation of the cab and the elimination of exhaust gases.

The windshield should be equipped with two power-operated wipers. The vehicle should also be equipped with defrosters and heaters.

The Interstate Commerce Commission requires adequate lighting and safety equipment.

Another important item in the purchasing of vehicles is their roadability. Considerable consideration should be given to how the vehicle steers on the pavement, on gravel roads, in rutty roads and in mud. Consideration also should be given to the ease of steering and turning radius.

The proper steering gear ratio either makes for hard or easy steering. Steering

gears with high numerical ratios are considered safer than lower ratios because the high ratio discourages cutting in and out of traffic at sharp angles and at high speeds.

The vehicle should be selected with the proper rear axle gear ratio to handle it in the particular district in which it will be used. If the proper truck is selected for the job, it should have enough power to properly handle it. A vehicle which does not have enough reserve power to pass another vehicle quickly is hazardous.

Cars painted a light color have better visibility at night than dark ones. Some operators have painted the rear ends of their vehicles with contrasting colors. This makes the vehicles more conspicuous, reducing somewhat the possibility of rear end collisions at night.

In our company, we have adopted black and yellow stripes running diagonally across the rear end of our trailers, the majority of which are pole trailers, and in addition, have painted our pole-trailer tongues with the same colors to make them stand out.

When traveling with an empty trailer, persons not expecting a trailer behind a truck could easily miss seeing the tongue, as they are usually constructed of 5" pipe and are approximately 16' long, allowing the trailer itself to be considerable distance behind the truck. This, we feel, is a good precaution in the interest of reducing accidents.

Maintenance of Vehicles

Safe maintenance is largely the responsibility of the managements, and is not a hard problem if the proper inspection schedule is worked out and rigidly adhered to. The driver is a vital factor in securing safe maintenance. All well organized operators now supply their drivers with a manual of safety instructions. Drivers can assist materially in the proper maintenance by turning in a written report on the condition of their vehicles at the end of each run; or in case of vehicles that are operated locally and return to their garage each night, a report nightly should be turned in.

The written report puts the responsibility for the repairs upon the maintenance department.

Inspection of Vehicles

The maintenance department should have a well defined inspection system so designed

that the responsibility for the condition of the vehicle when it leaves the garage is definitely placed.

Different types of operations require different types of regular inspection schedules.

All schedules should have two types of inspection. A short inspection form for the important items that require frequent checking up and a long form for the less frequent inspections. This long form should be very complete and very thorough.

Vehicles on scheduled long runs should have a short form inspection at the end of each run, supplemented by the long form at definite mileage periods.

Vehicles in fleets of low mileage and located at central points can best be scheduled on a time basis rather than on a mileage basis.

Scattered fleets can best be served by the use of traveling inspectors who are mechanics and can make many of the necessary mechanical adjustments.

Our fleet is scattered and the average mileage per vehicle is low. We maintain eight garages located at our principal operating points and serve all vehicles located within a reasonable radius.

Our schedule is a short inspection each thousand miles, and a long inspection each five thousand miles.

Ours are primarily mechanical inspections with other items included in the interest of safety. By doing this, our regular inspectors take care of both mechanical and safety items. The additional labor involved in checking the items vital to safe operation adds but very little to the cost of maintaining our fleet and saves many times its own cost.

Our short inspection includes such items pertaining to safety as brakes, lights, steering gear adjustment, and steering control parts, rear view mirror, horn and brake fluid level in hydraulic brakes, checking the tires for nails and slugs, and for correct air pressure.

Our long inspection form includes many items pertaining to mechanical conditions of various units under the general headings of motor, lubrication system, cooling system, ignition system, electrical system, fuel system, clutch, front end assembly, steering gear, rear axle assembly, frame and fittings, brakes and tires and body.

Under the heading of engine is included exhaust leaks.

Under the heading of electrical system

come such items as lights, windshield wipers and horn, battery and generator, all vital units for safe operation.

Under the heading of fuel system is included the item of governor.

With this schedule, we have only had three accidents in the past fifteen years which could be attributed to mechanical failure.

Our fleet, at this time, consists of 400 vehicles and has not been less than 300 vehicles in the past ten years. The average mileage for the fleet during the ten years' period is 4,500,000 miles per year. This, we feel, justifies the statement that safe maintenance can reduce the number of accidents caused by mechanical failure.

The Travelers Insurance Company reports their experience indicates five per cent of all automobile accidents can be classed as being caused by mechanical failure.

The cost of repairs caused by accidents to our company-owned vehicles for the past three years is as follows:

	Total Cost	Cost Per Mile	Cost Per Vehicle	% Of Total Cost
1934 ...	\$ 803.16	.00019	\$2.19	.4%
1935 ...	984.57	.00023	2.66	.39%
1936 ...	1387.01	.0003	3.65	.5%

Managements' Attitude and Responsibility

The managements' interest in safety is easily reflected in:

1. Public relations and advertising
2. Improved operation
3. Reduced maintenance costs
4. Reduced insurance costs

Every piece of transportation equipment is either an asset or a liability. It is an asset when kept clean, well painted and in good condition, and operated by a careful, courteous, conscientious driver. It is a liability when the reverse is true.

Many \$50,000 damage suits have resulted from the careless and indifferent operation of a light \$1,000 truck.

Thousands of dollars are spent in advertising and in building good public relations, while thousands more are wasted by careless and indifferent operation of the equipment.

Drivers should be as carefully selected as vehicles. They should pass a thorough

physical examination and should be mentally sound and alert. They should know the traffic regulations.

A driver who handles his vehicle correctly will materially reduce its maintenance cost as well as accidents.

In our own organization, we have learned that the development of pride in the organization and pride in the vehicle is a great aid in obtaining careful operation and is developing good public relations.

Drivers who have a well-developed pride in their jobs and a sense of responsibility will not only drive safely but will improve vehicle life and operating economy. It is a well-known fact that safety and efficiency both result from the same effort, and the operation and maintenance of fleet vehicles is no exception.

An operator who takes the attitude that his insurance protects him from all losses due to fire, theft, accidents, and liability has evidently done very little logical thinking on the subject. For one reason, insurance may protect the business against excessive losses due to high damage claims, but there are many hidden costs not borne by the insurance carriers. These include property damages usually borne by the insured, tie up of vehicles in the repair shop, loss of time, delays in schedules, and frequently loss of time of officials investigating accidents, appearing at hearings, etc. Furthermore, it is possible to obtain desirable credits on the insurance rates because of good accident experience over a period of time. This saving alone is worthy of serious consideration by the managements.

Driver Selection and Training Methods

By FRED L. STRUGGLES

Assistant Manager, Department of Safety and Personnel, Greyhound Management Co.

Any fleet safety program to be a success must start with the selection and training of the drivers and the same care, deliberation and patience used as if selecting vehicles for your fleet. A definite procedure for the selecting and training of drivers should be established and rigidly followed. In the case of a large organization with men located in various cities, the final approval should rest with those responsible for the safety record of the company, so as to assure full compliance with regulations governing the selection of drivers. If control of final approval is not centralized, but left to the judgment of each regional superintendent, there is the danger of breaking down the set standards.

It is a comparatively easy matter to set up safety specifications for a vehicle, as we have definite tests, but in the case of the driver we are dealing with the human element. No two men are exactly alike and, consequently, it is difficult to devise any sure specifications and tests to assure a safe driver. I regret that I am unable to present a foolproof method of selecting and training men to be safe drivers. However, I can present the methods used for the past seven

or eight years, with very gratifying results, by the Greyhound Management Company in handling all the driver personnel for Greyhound Lines east of Chicago and St. Louis, a territory which probably is more accident-prone than any other, due to traffic congestion.

Mr. Marcus Dow, Manager of the Greyhound Department of Safety and Personnel, inaugurated the present training program in 1930. Since that date the accident frequency has gradually improved year by year, with the result that today we are experiencing less than one-tenth of the number of accidents based on a mileage frequency basis as compared to the record in 1930. Improved vehicles, roads and general safety promotion among the drivers have been contributory causes for this improvement, but it is felt that undoubtedly the basic reason for the reduction in accident frequency is due to the emphasis placed on selecting and training drivers.

The seasonal nature of bus business, with maximum peak period during the summer months, makes it practical to employ new men only once a year, in the Spring. Applicants to be considered are selected by the

regional manager or supervisor at each regional point, but, before being allowed to work, they must go through a minimum of a week's training course at Cleveland and obtain the approval of the Department of Safety and Personnel. After satisfactorily completing this course, they are required to return to their regions and ride with regular drivers until they are thoroughly familiar with all routes operating out of the city to which they are to be assigned.

It is a standing rule that every new man, regardless of previous experience or apparent driving ability, is required to attend the training school. This is rigidly enforced and as a result it is just as important for any man driving a Greyhound bus in our territory to have gone through the training period and have been approved by the Safety and Personnel Department as it is for him to have the necessary state licenses. In this way we have full control of the selection of the men allowed to drive.

The Safety Department has established certain requirements each applicant must meet. For example, all applicants must have had at least one year's heavy vehicle driving experience and be at least 5 feet 8 inches tall, weighing in excess of 160 pounds and be between the ages of 24 and 30 years, although men up to 35 years of age are accepted if they have had considerable experience and a good safety record. These specifications have been arbitrarily set and it is not meant to imply that any man not coming within these specifications would not make a good driver. However, at least from a psychological standpoint, there are many bus passengers who have a greater feeling of security when a physically well proportioned and fairly good sized man is behind the wheel. The minimum age limit is set at 24 instead of 21, as it is felt that the slightly older man is possibly the steadier and capable of better judgment in an emergency.

We did experiment on a small scale in 1936 with hiring a few men without any previous heavy vehicle driving experience and put them through a special course which lasted several weeks instead of one. The majority of these men proved satisfactory and followed instructions, but the experiment was not attempted again this year due to the amount of time required to train such men.

Each applicant is required to submit to

medical examination by a doctor approved by the company. Frequently, unsatisfactory eyesight or physical defects which might affect his driving are revealed by these examinations and the applicant rejected if not corrected to the examining doctor's satisfaction. Similar medical examinations are required every six months after employment, so as to assure each driver being physically fit.

The applicants satisfactorily meeting these requirements are then given road tests at the regional points by specially selected drivers who are temporarily pulled off their runs for this work. Each man is required to drive the bus in which test is made in both city and country traffic to ascertain if his previous experience had developed the necessary qualifications to make him a good subject for our training school.

Frequently cases are found where the applicant has claimed on his application blank to have had considerably more experience than his road test driving will substantiate, and he is rejected before being sent to the Cleveland school. Also, many applicants can handle the vehicle but appear to be natural-born reckless drivers and chance-takers and are promptly rejected as it is felt that, despite any amount of training and instructions given such men, they will revert in time to their own way of driving when not being watched. The applicants are also given instruction on proper handling of gears on these regional road tests, so that when the student arrives in Cleveland the question of safe driving can be emphasized rather than having to devote too much time to the mechanical operation of the vehicle.

Through the qualification requirements imposed by the Safety Department and the road tests given in the regions, considerable weeding out is accomplished and only the most likely candidates are presented for training. It is essential to have the full cooperation of the regional superintendents who must select in the first place only those regular drivers to give these road tests to applicants who will take a sincere personal interest in the work. Otherwise, considerable efficiency will be lost in the training school due to instructors having to spend valuable time in weeding out undesirable candidates.

However, regardless of the efforts to have the preliminary work done thoroughly in the field, it has been necessary to reject

annually on an average five to 10 per cent of the applicants after they have been sent to Cleveland. These rejections have been due in part to shortage of time or lack of thoroughness in making tests at the regional points. This tends to emphasize the advisability for centralizing the control of final approval if a thorough job is to be done.

Confidential reference questionnaires for each applicant are sent to his last three employers. The replies are carefully checked as to the reason for leaving his last place, the length of employment and previous employers' estimate of his character and ability. Men who have been discharged for intoxication, dishonesty or unsatisfactory driving records are rejected.

While safety is the primary purpose of the school, all matters pertaining to the driver's duties are covered. Two to four hours are devoted each morning to classroom instruction and the balance of each day is spent in the student buses on the road, each student being required to drive under the supervision of the driving instructor.

Talks are given to the men in the classroom regarding handling of tickets, handling of baggage, claims and what to do in case of an accident, as well as the all-important subject of safety. It is essential the instruction be handled in a clear and convincing manner and consequently either the manager or assistant manager of each department concerned gives the instruction to the men.

Mechanical instructions are included in the course. It is not expected that a driver should be an expert mechanic but it is deemed advisable that he have a working knowledge of the mechanical features of his bus so that he will be able to make minor repairs and adjustments on the road, if necessary. This instruction is handled by a garage foreman or superintendent who is assigned to full time duty as mechanical instructor during the three months the school is in session each year, and the instructions cover the brake system and adjustments, the ignition and lighting systems, carburetion and fuel supply systems and other general mechanical instructions, including the changing of tires.

Generally just one subject regarding the mechanics of the vehicle is discussed each morning, so that the instructions can be absorbed. Actual units taken from the bus are mounted on display racks in the lecture

room for illustration purposes. This instruction is also supplemented by demonstrations on the coach. Various units are tampered with by the instructor so that they are out of adjustment or do not work and the students are required to find the trouble and make the repairs.

The daily safety talks and driving instructions are handled by members of the Safety Department and driving instructors. The men used as driving instructors are taken from the ranks of the drivers who have established outstanding safety records and who show special ability as teachers.

When we come down to the final analysis, the reason for the safety school is to teach men who already know how to drive and handle the vehicle to do it *safely* and to convince them of the wisdom and necessity of driving safely at all times. These men have all had driving experience and it is reasonable to assume that they know they are taking a chance when passing overtaken vehicles on curves and hills, or when they follow too closely behind a car or operate at a speed that does not permit them to have their vehicle under control, and indulge in similar unsafe practices. But the majority of drivers who have not had special training such as ours are not capable of valuing or determining the odds against them when they take such chances. They have not had an opportunity to study hundreds of accident reports and see the actual results of unsafe practices. They develop habits that need to be corrected to make them safe.

So, in training a new man it is not sufficient to give to him a long list of things he should and should not do and think the job is done. Instead the points of safe driving must be hammered home time and again in a practical and convincing manner until the man is actually sold on the necessity and wisdom of safe driving practices and until safe habits supplant the unsafe ones. He should be sold on the idea of driving in such a manner as to have his vehicle under control at all times. Like any sales job, a well planned program is essential. The ideal time to sell the man safety is before and not after he is actually employed. Prior to employment he is more susceptible to instructions as he is anxious for the position.

A safety atmosphere is created in the classroom through the use of appropriate safety posters and photographs. Pictures

of accidents are displayed and labeled with a description of how it occurred as well as what could have been done to prevent the accident.

Safety is discussed each morning in the classroom but not at too great length on any one day. The company's rules, as well as those of the I. C. C., regarding safety and the manner in which our vehicles are to be operated are thoroughly discussed and explained. The company's accident record is analyzed as to the types of accident which have the highest frequency or greatest claim cost. Each of the more prominent types of accidents are discussed as to causes and means of prevention.

Special emphasis is placed upon accidents occurring at intersections and when passing overtaken vehicles. The effect of speed on braking distance and the distance traveled between the time of seeing danger and actually applying brakes due to driver's reaction time, are gone into thoroughly. By means of diagrams the parts that reaction time and improper braking distance play in causing accidents are explained so as to drive home to the men the minimum precautions that must be taken if they are to have their vehicle under control at all times.

In order to further impress the men with the distance required to stop a vehicle at various speeds, actual road tests are made while they are behind the wheel. The student does not know he will be required to make an emergency test stop, as the first warning he has is when the driving instructor sitting behind him calls out, "Emergency stop!" In such tests the instructor secretly picks out a fixed object along the roadside and then gives the signal as the bus passes this landmark. After the coach is brought to a stop the student driver is required to get out of the coach and pace off the distance. It is found that practical tests of this nature have a very favorable reaction on the men and the distance required is often considerably in excess of what they had anticipated.

Another test that is given the men aside from routine driving is to place several standards in a zigzag line on a little used highway and require the students to weave in and out between these standards at various speeds so as to test their ability to handle the vehicle in an emergency and to judge distances.

A card record is kept on the student's driving each day while he is at the Cleveland school. These cards list the various common faults, such as following too closely, improper passing overtaken vehicles, faulty handling of gears, lack of precaution at intersections and excessive speed in congested areas.

The driving instructor, sitting directly behind the student, calls his attention to mistakes as made and checks them on the man's card. The cards are reviewed each night and the faults observed discussed by the instructor in the classroom the next morning. This card system furnishes a close check on each man's driving and is made a permanent part of his personnel record. If a man continues to make serious mistakes after the third day, he is generally rejected. Experience has indicated that if there is any question as to the student's ability to handle the vehicle properly or drive at all times in a safe manner, he should be immediately rejected. There have been times when such men have been allowed to remain an extra week in the school but in the majority of cases they invariably had to be released later.

The training coach is operated at a reduced speed at the start of the week until the instructor has an opportunity to determine the ability of the men. Towards the end of the week a route is mapped out and set to a time schedule similar to the regular inter-city routes requiring varying speeds, though never exceeding our maximum speed limit rule of 45 miles per hour, and the students are requested to maintain the schedule as closely as safety will permit so as to see how the students react under the pressure of a schedule. It is firmly impressed on their minds that safety comes ahead of schedule, and this is Rule No. 1 in the Driver's Manual of Rules.

At the conclusion of the week, written examinations are given on safety as well as mechanical instructions. The questions have all been thoroughly covered during the week so that any man that has applied himself should have no difficulty making a satisfactory grade. The purpose of these examinations is, of course, mainly to make sure the men have applied themselves diligently.

The program for the week is closed with a final forceful lecture outlining the common causes and preventive measures for

accidents, together with the importance of safety to the success of both the employee and the Company.

After obtaining the approval of the manager of the Safety and Personnel Department, the men are returned to their respective regions. Each new man is required to familiarize himself thoroughly with all the routes out of his regional point. In this way we endeavor to eliminate the possibility of an accident, especially at night, resulting from a driver suddenly coming upon a hazardous section of road without his vehicle under control, due to being unfamiliar with the road.

These break-in trips are made on regular schedules and the student driver having qualified in the school does the majority of the driving, although at all times the regular driver watches his work and occasionally relieves him. This affords still further training under the supervision of an experienced driver. A written report on a prescribed form is made by the regular driver to the superintendent on the performance of the student driver after each of such "break-in" trips. The length of time to break in a student driver varies with the number of routes to be learned and his previous knowledge of the territory, but on the average two weeks are required.

Even after the man has completed the training as outlined, we cannot consider him a finished, stable product. Our experience has been that at the start the new men are exceedingly careful and may have trouble maintaining schedules, as a result. But as time goes along and they gather confidence, a tendency develops to consider themselves a seasoned driver and as a result they sometimes become lax in their safety precautions in varying degrees. Consequently, after the school is closed the driving instructors are sent to the various regions to ride at least one trip with each man recently hired and a report on the trip made to the supervisor for whatever corrective action is deemed necessary.

Thus under our present plan a new man is in training for a period of three or four weeks before he is allowed to "pull" a regular run by himself. It might be felt that by requiring an experienced man to spend so much time in training and breaking in that only men unemployed with time on their hands would apply. However, this has not been our experience. For example,

190 men out of a total of 321 that went through our training school last Spring left other positions and did this without any definite assurance that they would be finally hired by Greyhound. Furthermore, the men are proud of their jobs after they get them and the turnover of personnel is very favorable.

Last Spring we hired and trained 304 men along these lines. A total of 321 men were sent to school, of which these 304 were finally approved. The school was operated for approximately twelve consecutive weeks.

Selection and training of drivers is naturally only a part of our safety program. Promotional work is continually being carried on through safety awards for no accident records, safety contests, safety meetings, corrective discipline where necessary, checking of running times of schedules, cooperation with the maintenance department where our equipment is maintained in safe mechanical condition and similar activities.

As previously pointed out, our safety record has been showing a steady yearly improvement. It is impossible to allocate the exact benefits derived from each part of our safety program. However, it is firmly felt that our selecting and training of drivers plays as important a role as any. It is the foundation upon which our whole safety program rests, so to speak. The method as outlined sets up a definite procedure which is rigidly enforced and grants to those responsible for safety a complete control over the type and character of men employed as drivers. The task of obtaining employment is not made easy and as a result the men value their positions and strive to follow the rules and regulations in order to remain in the employ of the Company. Through a constructive training program the men are sold on the idea of safety and are impressed with the importance of their positions and the responsibilities they must carry.

Each type of transportation, as well as each company within the same industry, has its own individual characteristics and problems, so that no one program for selecting and training of drivers can perhaps be applied to all. However, we feel that our own experience proves the wisdom and necessity of having a well organized selection and training program adapted to the needs of each individual company rather than to hire men at random.

TUESDAY AFTERNOON SESSION

October 12, 1937

Sustaining Educational Activities

By HAROLD L. HILTON

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It has become generally apparent that any substantial progress in alleviating the automobile accident situation must be achieved largely through a systematic process of education.

Our experience has clearly indicated, however, that such education or training is by no means complete, when vehicle operators are first qualified to drive, even though the procedure involved in their selection and preliminary instructions has been thorough. That this first important step is indispensable, we must agree.

It is certainly highly desirable to secure the best type of men available—men who are physically fit and otherwise suited to driving; likewise it is essential that their experience and ability be determined before they are entrusted with a valuable piece of equipment which possesses such tremendous destructive possibilities.

While this generally provides assurance that drivers possess the necessary physical qualifications and perhaps somewhat better than average driving ability, it still leaves much to be accomplished.

There are very few who ever acquire through practical experience alone, a sufficiently deep knowledge and understanding of motor vehicle operation, not to mention the proper regard for safety, itself, and these essentials cannot be thoroughly imparted in the time usually allotted to preliminary training. Considering the nature and scope of the present driving problem, it should not be expected. The kind of education necessary for continued progress in accident-prevention cannot be injected with one masterful application.

Getting the necessary information over to drivers, selling them on safety and keeping them sold is a task requiring constant, systematic efforts.

To secure and maintain the highest possible degree of safe performance in fleet

operation, it is invariably necessary to inaugurate a permanent follow-up program, which will provide adequate measures, designed not only to develop safety-consciousness and maintain interest, but steadily to advance the drivers' knowledge and understanding of safe operating technique.

In arranging such a program there are always three important matters to consider: First, the methods to be employed; second, the nature of the additional instruction to be given, and third, the mediums to be used in imparting it.

Although there are a number of suitable methods in common use, some more effective than others, it has been my experience that no single one can be depended upon to produce the desired results. The reason is quite evident. Thorough training involves more than telling an employee what to do, or even showing him what to do. It is also essential to find out if he thoroughly understands the instructions given, and if he applies them correctly.

Any safety educational program to be wholly effective must be organized with a view toward fulfilling these requirements, and it is my strong contention that this applies just as much to the education of drivers as it does to those engaged in other lines of employment. Each year it becomes more and more evident that taking too much for granted has been largely responsible for making the traffic accident problem what it is.

As the result of our experience in rendering accident-prevention service on many automobile fleets, we have found that the most satisfactory results are obtained through the following measures: group meetings of drivers at regular intervals, individual instruction by supervisors, members of the safety department, and others concerned, observation inspections, and periodic driving examinations by qualified

inspectors, an efficient tie-in with all department heads and supervisors to correlate activities and coordinate efforts through periodic safety-committee meetings or individual conferences held at intervals, and an accident-investigation committee or "court of inquiry."

These measures, together, constitute the framework for an effective program. Although they are probably well known to many in this audience, I believe their importance justifies some additional comments.

For uniformly advancing the education of all drivers, no better method has been found than that provided by regular drivers' meetings. These, in my opinion, play an important part in any program. Their effectiveness, however, depends entirely upon the nature of the subject matter. Instructions should deal primarily with accident-producing practices and conditions together with all underlying factors involved, in order to establish not only the rules or principles to be followed, but the reasons for them.

Where a series of meetings are contemplated, it has been found advantageous to break down the whole accident-prevention problem and deal individually with specific unsafe driving practices, hazardous road and traffic conditions, unsafe delivery methods, etc., so that each may be discussed with sufficient thoroughness.

In any case it is best not to try to cover too much at one meeting. In trying to cover all, we invariably cover little or nothing. The objective should be to send the drivers away with a clear understanding of some one phase of the problem firmly fixed in their minds. In determining whether instructions are going over, a simple questionnaire may be used to advantage.

In any group there are always some who, for various reasons, fail to properly assimilate the instructions given. These drivers should be reached through individual instruction. Some of this work may be handled by a member of the safety department, but it is largely the supervisor's job. In no case can it be assumed that group instruction is intended to supplant the counsel and guidance given by the drivers' immediate supervisors. Both are important and have their place in the educational scheme.

We have used observation inspections, and periodic driving examinations exten-

sively and found them almost indispensable in determining whether or not instructions are being followed. Trailing inspections have proven more effective than observations made from fixed points, but both are very useful in that they provide an opportunity of observing operating methods while the drivers are not under restraint. They also have a psychological effect which tends to make drivers more respectful of driving rules and regulations.

Some fleet operators look upon driving observations with disfavor, but I believe this is due to the fact that they do not fully appreciate their purpose. On the other hand, favorable observations reports form a basis for commendation.

Periodic driving examinations also have much to recommend them. We have found them particularly effective in dealing with "accident proneness." In this respect they are superior to observation inspections in that they make it possible to study driving traits and behaviorisms more closely, and take immediate steps to remedy any faults.

I should like to clarify my previous statement with regard to securing organized efforts in carrying on the various activities. It has become a recognized fact that no safety educational project can make real progress without active participation and intelligent application of effort and initiative by all those in supervisory capacities. Although the safety or personnel department in most organizations is largely responsible for the proposal, arrangement and direction of safety activities it is, nevertheless, necessary for all supervisors concerned to follow through closely to make sure all instructions are fully understood and properly carried out. But at this point the questions arise: Do they always do this? Have they always the knowledge and experience to do it?

Although these questions may seem rather far-fetched, a number of cases have come to my attention where those in supervisory positions not only failed to follow through, but were obviously unprepared to do so. In each of these cases results attained were far below average. Without doubt, these situations are most undesirable, yet the supervisors are not altogether to blame. In most instances, the main reason is failure to maintain a sufficiently close relationship between the safety promotion force and the supervisory staff.

The remedy lies in correlating all safety activities properly; in working with and through the supervisors, not around them. Each department head or supervisor should be kept fully informed regarding all steps taken in connection with the educational program. He should be fully acquainted with their nature and purpose, and he should be made to understand his position with regard to their proper execution.

I believe this can be best accomplished through regular central safety committees, or sub-committees if the territory is very large. These always provide the added advantage of allowing the supervisors to take a hand in planning the safety work. However, where the nature of operations make these impracticable, or where they are held infrequently it is always advisable to arrange periodic conferences between a safety representative and each of the various supervisors. In any case, those in charge of safety activities should consider it an important part of their job to make sure that all those acting in supervisory capacities are not only fully prepared to give full support but that this support is actually forthcoming.

We have recommended and assisted in forming "courts of inquiry" on a large number of fleets. They provide a useful means of gaining information since they enable the members to study the circumstances and conditions involved in each accident occurrence and to discuss proper means of prevention. As an educational measure their value may be further enhanced by arranging a rotating membership of eligible drivers or having a representative group in attendance. Their greatest value, however, is in connection with the investigation of accidents for the determination of cause and responsibility. They are essentially fact finding bodies. They do establish the sources of trouble upon which efforts must be centered but they have one disadvantage. They are post-accident in effect.

It is true that we learn primarily through experience but surely this process does not have to continue any longer. The intensive study of automobile accidents has already provided ample information regarding the causes and manner of occurrence. Although all drivers are more or less aware of the causes, it is evident that a large percentage still do not know how to exercise the nec-

essary means of prevention. The fact that accidents occur over and over again due to the same faulty driving practices, proves this point beyond doubt. Therefore, I believe that our further efforts should be directed toward providing more definite means of preventing accidents rather than simply go on determining the reasons for their occurrence.

Which brings us to the second issue: The question of providing additional education.

It has long been my belief that the education given to commercial drivers is in some respects entirely inadequate to meet the demands imposed upon them. There has been too much persuasion; too little constructive education. Too much dependence has been placed on the educational value of accident statistics, sensational propaganda and emotional appeal. These are useful in arousing interest and crystalizing action.

Yet it is obvious that simply pointing to the causes and effects of accidents and emphasizing why they must be prevented, does not help drivers to prevent them. There has been too much of a tendency to proceed on the premise that after preliminary instructions have been completed, drivers know how to operate their cars safely and therefore the remaining job is to get them to do it.

For many years there has been a general lack of understanding of many of the fundamental principles which influence the operation and control of motor vehicles, in some instances complete ignorance of them. I have found that this condition persists to a considerable extent.

The principal reason, as I see it, is that the instructions generally given to drivers do not thoroughly cover these important points, nor are they always comprehensive enough to enable them to understand how to apply the driving rules, which are given. Many of the accepted rules themselves are very general in nature and do not provide definite answers to driving problems. Some are evidently based more on opinion than actual scientific facts. Then, too, there are a number of time-worn admonitions in use which are practically worthless. I am thinking of two which are heard quite often—"Be more careful" and "Use good judgment." Frankly, I consider it the height of futility simply to caution drivers to be careful.

It is generally assumed that if a person

always uses good judgment in operating his car, he is a good driver. This can hardly be disputed, but the question is, "What is good judgment and how is it acquired?" Good judgment is a human faculty developed through study, introspection, observation and experience. Persons with normal intelligence usually develop it by applying themselves conscientiously, but asking a driver to use "good judgment" is a rather large order, particularly after he has just demonstrated the lack of it.

One driving rule which has been in use for several years: "Do not attempt to pass on a narrow street or highway, unless you have three hundred feet of clear road ahead." Anyone who thinks this rule is accurate enough for everyday use might try it under average traffic conditions, but I would advise getting plenty of accident insurance beforehand.

This is an example to illustrate my reasons for believing there is still opportunity for improving driving education. Considering the situation as a whole, there are many facts which should be better known and understood by drivers in order to raise them to the proper plane of operating efficiency.

Really to know how to operate a motor-vehicle safely, a driver should be educated to the point where he has a practical knowledge of all elementary physical laws and mechanical principles which influence or limit his control over the vehicle, as well as road rules and his own operating limitations.

I realize that all this cannot be accomplished overnight. But, surely those who are devoting time and effort to the education of their drivers should work toward this goal, rather than content themselves with any course which promises less favorable results.

Considering the question of progressive education from the viewpoint of the drivers themselves, makes it even more desirable. Commercial drivers, as a whole, resent receiving the same advice over and over again, and often come to regard safety rules as unimportant because they've heard them so often. Like everyone else, they want facts and definite information and unless these are forthcoming, do not have really deep interest in safety work. On the other hand, they are ready and eager to listen to any constructive information which will help them to improve their driving ability. All that is necessary is that the instruction be ac-

curate and to the point and be presented in an interesting and assimilable manner.

We have found it difficult if not impossible to educate drivers by oral method alone. As the result we have long used every available medium to assist in illustrating or demonstrating our points. First of all we used blackboard sketches and drawings, but as the work progressed, we found that certain problems required more accurate illustration and therefore resorted to carefully prepared charts, drawings and enlarged photographs. These have proven very satisfactory. We have also used the miniature cars, with which you are probably familiar.

Finally, when small projectors using film strips made their appearance, we decided to try this means of conveying our instructions. In making up film strips the necessary charts, etc., were imposed on the film and used with suitable photographs.

This last form of visual education has proven most effective, and we are now using them extensively.

Of course, all of the foregoing are used in connection with direct methods of instruction.

In a comprehensive educational program, it is also highly desirable to use other recognized mediums of safety education, such as posters, bulletins, dash-board slogans, illustrated pamphlets, etc. These do not take the place of direct methods, yet they provide a basis for individual instruction; keep driving rules constantly in the foreground and maintain safety-consciousness at a high level.

In substantiating previous contentions, particularly with regard to education, I should like to describe briefly our experience in developing and conducting such a program on one of our large fleets in the East. The safety director of this organization who was extremely open-minded and progressive, decided some years ago that the accident-prevention program was not producing proper results. He called us into conference to discuss means of better educating the driving personnel. This started in the Spring of 1932. At that time, all the usual methods in connection with driver education were already in use.

A "Court of Inquiry" was maintained for analyzing accidents and the methods of compiling statistics were more than satisfac-

tory. But we wanted to further improve the driving record and the question was how to accomplish this purpose. It was finally decided to attempt to raise driving to a higher plane through a progressive method of education. All of the proven steps were retained such as preliminary instruction, accident investigation committee, etc. and two new steps were added.

These involved a new method of group instruction and observation inspections. We decided to call the group method of instruction our "drivers safety school." We further arranged to limit the number in attendance at any class to twenty-five or less. It was evident that if we wished to cover the ground thoroughly, we would have to break down the whole subject of accident-prevention into specific problems, otherwise, we would have to resort to generalities which we wished to avoid.

Instructions, therefore, dealt with each specific driving fault and accident-producing condition together with all underlying factors. Since statistics showed that "traveling too fast for conditions" was the primary cause of many accidents and indirectly involved in others we decided to tackle this phase of the problem first. All physical laws which had any bearing on operation were carefully explained.

We later gave further instruction in connection with safe speeds which involved a study of various sizes and types of vehicles, road and weather conditions and their relation to various traffic situations.

We also thoroughly discussed the physical limitations of the driver which, of course, involved the study of reaction time. Having checked the results of a large number of tests and also having made some interviews, we explained the effect of reaction time upon control of the vehicle. Another phase of the problem was rear-end collisions which was one of the predominant types of accidents. The solution was not as difficult as might be expected since a careful study revealed that all accidents of this type involved the same circumstances. By considering the various factors involved we were able to establish a rule of road which was readily understood and could be followed with safety. This resulted in reducing accidents due to "following too closely" to the vanishing point.

It is impossible to describe here all the items covered by the program. They in-

cluded a study of the relation between speed and vision, traffic light control systems, judging time distance in making various maneuvers, the causes of pedestrian accidents, turning, backing, signaling, parking and a large number of other subjects dealing with recognized unsafe practices and conditions.

All of this work proved very interesting and some of the problems were unique. For example, we had been having a number of accidents due to making turns with some of the larger vehicles. Since it was obviously impossible to eliminate the hazard entirely, we decided to try to establish a rule which would under all ordinary circumstances reduce the danger of turning to a minimum. After some study this rule was determined and carefully outlined to the drivers with very favorable results.

Incidentally in carrying on this work, we used all of the mediums which I previously mentioned. At first we used charts and photographs to a large extent, but in recent years the instruction has been given entirely with the aid of still films. These are still in use and are eminently satisfactory.

One of the recent film strips was made up to deal with the skidding problem. The title of this film was "Keeping the Car under Control" and dealt with the skidding problem. In conducting this series of meetings, we emphasized these facts: that there are several distinct types of "skids," all of which are preventable; that skidding is not a cause of accidents, but rather the result of improper operating practices; that skidding is caused by failure to understand a simple principle of mechanics, which governs transmission of power or motion, or failure to work in harmony with natural laws under existing conditions; that skidding itself is an accident and the only safe procedure is to drive to avoid skids, rather than risk being unable to correct them, after they occur.

In carrying on the entire program whether dealing with a simple driving problem or one of a more difficult nature, every attempt was made to evolve rules of safe practices, which were simple to understand and practical to apply. Where the rules were already established our efforts were directed toward clarifying them and explaining the reasons for their existence. In every case we tried to leave nothing to doubt; to create complete uniformity of thought and action among all drivers.

At the close of each session of the "drivers safety school," a simple questionnaire containing ten questions based on the important points in the discussion were distributed. We also took this opportunity to pass out bulletins and suitable safety literature. The bulletin used in connection with the skidding film was entitled, "Are you an all weather driver?" and has since been widely used. It is interesting to note that most of the men received excellent marks on their questionnaires, although most of them were men with average education. It was never difficult to maintain their interest. They were all eager to learn and the majority had little difficulty in assimilating the instructions. The idea that the average driver cannot absorb knowledge is a fallacy.

Constant improvement has been realized year after year since starting this training procedure and the accident frequency is still dropping. Moreover, the severity of accidents, have shown an even greater reduction, particularly with regard to personal injuries to other drivers and pedestrians. During the entire period we have continued to follow up with trailing observations and driving examinations to make sure that instructions are being followed.

In the case of trailing observations, both favorable and unfavorable reports are turned in to the drivers' supervisors. When driving practices are found unsatisfactory, the driver involved is advised or disciplined if necessary. On the other hand, if his driving is entirely satisfactory, he is properly commended. This procedure is well received by the drivers.

Three other important points may be introduced here. First is the matter of courtesy and correct attitude. I realize full well that these are essential factors in driving safely. However, it is my opinion that the enlightened driver is much more likely to be courteous and considerate of others. He appreciates more fully his responsibilities as a vehicle operator. He takes more pride in his ability and tends to look with contempt upon those who use mean and lowly tactics.

The second item is in connection with the question of old and new drivers. Of course, new men always need more attention, not only as regards driving instructions but also the policy of the company. But on the other hand, I have never seen any drivers, regardless of how long they have been operating a vehicle, who were so proficient that they could not benefit materially from additional instructions.

The third is in connection with handling the drivers who are either extremely slow to learn or untractable. I shall not attempt to go into this matter, but I am sure you will all agree that it is either a question of further education or discipline. Try as we may, we cannot always make a good driver out of a poor one. Sometimes, the only safe course is to remove a driver from the vehicle permanently. I believe, however, that this should come only after thorough going efforts have been made to convert him, and not before. It has always been my belief that we should accept such cases as a challenge to our ability. Every convert becomes a conquest—every failure a defeat.

Disciplinary Programs—Awards and Penalties

By R. J. CROSBY

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There are two essentials to effective accident prevention in any industry or activity—a knowledge of the preventable causes of accidents, and corrective action based upon this knowledge.

The institution of a system of awards or penalties may be considered, therefore, as one means of getting people to do the things that you determine must be done if accidents are to be avoided.

It has been said that every employer has right to demand of paid employees that they perform their work in the right and safe way. However, it is often the case that neither employer nor employee actually regards the avoidance of an accident with the same respect as the avoidance of a mistake in the performance of duties.

Objections have been made to the adoption of any kind of an award or penalty

system, but many operators have found that such systems are important factors in maintaining interest in accident prevention.

Some companies have adopted a system of penalties alone, but have restricted it to a question of layoff and subsequent discharge for outstanding violations. Such systems operate on the basis of fear rather than a spirit of cooperation, and are not as desirable as the system which combines penalties and awards wherein the accumulated penalties lessen the award and may ultimately result in layoff or discharge.

A driver works alone for the most part. He does not have the same contact and supervision as a man working in a plant. He is more apt therefore to disregard instructions and take chances. Awards serve as an incentive to help him keep safety actively in his mind throughout the day.

There are two important parts to the program—the method of computing the accident records and the method of distribution of the awards.

Computing the Accident Record

The method of computing the accident record must be fair. It should be as simple as possible, easily understood by all drivers. If it is made too simple it may not be fair. Several factors must be given consideration in fairly rating accidents. For example, one concern charged the driver's record only with such accidents as cost them money. Such a system would permit certain chance-taking drivers guilty of contributory negligence, to keep their record clear. For example, such a driver may drive blindly into an intersection and be involved in a collision wherein the other driver was chiefly but certainly not wholly at fault.

A fair system of charging accidents should relieve the driver of responsibilities that rightfully belong to the company itself. He should be provided with safe equipment. His car should be provided with approved safety fixtures such as effective windshield wipers, both for rainy and freezing weather, directional signals, rear vision mirrors of ample size and properly set, regardless of whether or not such items are required by law. There should be an established system of vehicle inspection and maintenance so that necessary repairs and adjustments are made when reported and the driver is not required to take out a truck with poor brakes, faulty clutch or smooth tires.

There should be a regulated procedure for allowing sufficient rest periods for drivers engaged in long hauls. In an attempt to please an employer men have offered to take extra runs and have become involved in accidents which could be attributed only to lack of attention resulting from drowsiness. There should be a "check out" of the load to see that it is properly distributed. Accidents have occurred which indicate that the steering of the truck was greatly interfered with because of the load distribution. Such action on the part of the company will show good faith and sincerity in their efforts to prevent accidents.

A fair system of charging accidents should have an established list of definite unsafe driving practices. Charges in each case should be based upon the fact that thorough investigation proves that the accident was due to one of these unsafe practices on the part of the driver. The degree of penalty or number of demerits or other measure of disciplinary action should be governed by the probability of serious damage or injury that might result from such a practice regardless of the actual outcome of the particular case under discussion.

For example, we know that fatalities have resulted from every type of automobile accident, yet the probability of serious results from backing without having a clear view of the space in the rear is by no means as great as from attempting to pass a car without having a clear view of a sufficient length of open road ahead.

The causes of automobile accidents have been fairly well established; a recent review of 1,400 reported accidents for the first six months of the year in one company shows that the outstanding types and causes are practically the same as for previous years. Collisions at an intersection, for example, represented 23 per cent of the total number and approximately 40 per cent of the incurred loss. The outstanding cause of these collisions was failure to grant the right of way at an intersection especially to the car approaching from the right. Other outstanding causes for the same type of accident were:

1. Driving into an intersection without having a clear view of the cross traffic.
2. Driving through an intersection at a high rate of speed.
3. Traveling too fast on a slippery highway.

4. Failing to observe the traffic in both directions before making a left hand turn.

Definite causes can be named for other types of accidents. For example, rear end collisions are the result of driving close to the rear of other vehicles and failing to watch the movement of the traffic ahead. Runaway trucks are the result of failing to follow a definite procedure for parking on an incline.

A list of such causes which represents the ones which will probably result in serious loss can be prepared and specific charges made for each cause. All other causes not specifically named would naturally fall into a group and have a fixed minimum charge.

These causes when so named are easy to understand. They represent in simple language only what safe driving demands. They permit of discussion with the drivers as they are not technical. They can be published in memorandum form as a frequent reminder to the driver that if an accident should occur to him and investigation should show that it was the result of one of these causes, he will be charged accordingly.

Most automobile accidents do involve a divided responsibility. Regardless of how the responsibility is divided however in a single case, the charge for the accident should be based on the violation of safe driving performance as indicated by the commission of a definite unsafe act.

Such a procedure eliminates a consideration of territory when branches or subsidiaries may be in competition. Such items as density of population, contour of the country, weather conditions and daily mileage need have no bearing on the accident charge, if the charge is based upon accountability for an accident because of disregard of safe driving practices.

A fair system of charging should provide for a thorough investigation of all accidents. An accident investigation should take into consideration all of the circumstances leading up to the accident occurrence. In too many cases where the other driver is found to be chiefly at fault the investigation is not carried to completion. No attempt is made to determine whether the driver was guilty of any specific unsafe act and the advantage of the investigation is lost.

A jury award of \$80,000 was recently made because the driver on questioning, admitted that he failed to look back or into

his rear vision mirror before attempting to make a left hand turn and therefore, made a turn when he did not know that the other driver was trying to pass him. Truly, the other driver was chiefly at fault. In fact, he was over the center line of the road, speeding, and trying to pass in an intersection. There was no contact between the cars but in attempting to avoid the collision the second driver hit the curb and turned over. Passengers in the car were seriously injured and the first driver was held negligible in that he had failed to look back before starting to make the turn.

A fair system of charging accidents should include some provision for penalizing a driver who has been guilty of unsafe driving practices but who has been lucky enough to avoid an accident. This involves the establishment of planned observation of vehicle operations. There has been some objection to trailing on the assumption that it is considered "spying." The attitude created by such work all depends upon the manner in which the work is done. Again in the interest of fairness, the man who is honestly trying and does observe safe driving rules should be protected from the chance taker who, unknown to his fellow men, may be jeopardizing their opportunity of participating in the distribution of awards.

The Distribution of Awards

It is not to be expected that the award represents the saving that has been effected for the company. It is difficult even to estimate the amount of such a saving. This is not unfair, for after all the company is not asking the driver to do any more than is rightfully expected of him. He is asked to drive safely, to avoid taking chances, to obey traffic regulations and to adhere to definitely stated driving practices.

If he does these things he will not become involved in an accident which investigation will show was due to his negligence. For such cooperation the company is "willing to show its appreciation in the form of an award.

If we were to judge from the type of awards that have been distributed, it would be difficult indeed to select one which might be considered most suitable for any one case. A Southern concern employing negro drivers awards multi-colored combs, pencils, finger nail cleaners, elaborately inscribed

certificates and finally for a prolonged good record the driver gets a knife and a gold seal certificate.

Other concerns have paid a definite amount per month for a no-accident record and still others allow each man a certain number of credits which have a designated cash value at the end of a three or six month period. If a driver is involved in an accident during the period credits are withdrawn in an amount representing the penalty imposed for the accident.

Whatever the method of awarding may be, however, there are certain features that should be considered to make a system most effective.

Awards should be made at frequent intervals. If a man can see a goal in the immediate future, he is more inclined to exert himself to attain it. If he must wait a year for recognition, he may delay his efforts until the last few months. Most people like to be given another chance, and if there is the opportunity to "try again" without waiting too long a time, there is bound to be built up a spirit of determination to win.

Awards should be made to groups of drivers as well as to individuals. Such a method introduces an element of competition and rivalry; it builds up cooperation in the separate groups; it lends a moral support to the individual driver, for if he is of a desirable type, he will not expose him-

self to the criticism of his fellow men by lessening their opportunity to participate in an award, due to his negligence. It is true that awarding a group may mean that some drivers will share in the honor who have an unsatisfactory record. This can be partially offset by recognizing the accomplishment of the men with good records by some additional award.

Some accidents may be caused by improper maintenance. The group system of awarding permits of including garage service men particularly where the company maintains widely separated units. The type of award for groups depends upon the characteristics of the group. A President's Cup presented at a dinner and inscribed with the name of the winning group, a banquet to which wives and friend are invited, a picnic or attendance at some current event has been used successfully. It frequently happens that it is not so much a question as to the type of award as it is the manner and importance attached to the actual presentation.

Awards should be made with ceremony. The executives of the company should participate and thereby show their continued interest in accident prevention. Being present at such a ceremony gives management an opportunity to emphasize that the awards are not necessarily a measure of any saving to the company, but rather a manifestation of appreciation on the part of the company for the cooperation of its employees.

WEDNESDAY LUNCHEON SESSION

October 13, 1937

Election of officers for the section was the main order of business at the luncheon meeting, at which General Chairman Haven

presided. A list of the officers of the Section will be found on page 137 of this volume.

National Fleet Safety Contest

Twenty-three plaques and 30 certificates were awarded in the National Fleet Safety Contest.

A total of 724 fleets, operating nearly

52,000 vehicles, traveled nearly 900 million miles during the contest period.

Participants averaged 2.32 accidents per 100,000 miles.

Passenger car drivers had the lowest rates, averaging 1.63 accidents per 100,000 miles. Bus drivers were next with a rate of 2.37, and truck drivers had the worst experience, with an average of 2.78.

Awards were presented to the winning units by R. I. Catlin, Assistant Vice-President, Aetna Casualty and Surety Company, Hartford, Conn., and member of the Executive Committee, National Safety Council. Winners of plaques were as follows:

Passenger Car Division, Group 1—Shell Petroleum Corp., Mid-Continent area.

Passenger Car Division, Group 2—Texas Pacific Coal and Oil Co., Fort Worth, Texas.

Passenger Car Division, Group 3—Pamhandle Refining Co., Central Texas Division.

Passenger Car Division, Group 4—Atlanta Gas Light Co., Atlanta, Ga.

Inter-City Bus Division—Large Fleets—Pacific Greyhound Lines, Inc., Los Angeles, Calif.

Inter-City Bus Division—Small Fleets—Pacific Greyhound Lines, Inc., El Paso, Texas.

City Bus Division—Reading Coach Co., Lebanon, Pa.

Inter-City Trucking Division—Large Fleets—Hugh Breeding Transport Co., Oklahoma City, Okla.

Inter-City Trucking Division—Small Fleets—Ameen Transfer Lines, Ishpeming, Mich.

Bakeries Division—National Biscuit Co., Niagara Falls, N. Y.

Coal and Ice Division—The Union Ice Co., Oxnard, Calif.

Miscellaneous Manufacturing Plants Division—American Bemberg Corporation, North American Rayon Corporation, Elizabethton, Tenn.

Public Utilities Division—Large Fleets—Shell Pipe Line Corp., Telephone and Telegraph Division.

Public Utilities Division—Small Fleets—Lone Star Gas Co., Dallas, Texas.

Petroleum Division—Large Fleets—Pamhandle Refining Co., Central Texas Division.

Petroleum Division—Large Fleets—Pamhandle Refining Co., Oklahoma Division.

Dairies Division—Sweetzer Creamery Co., Detroit, Mich.

Newspaper Division—Canton Repository Co., Canton, Ohio.

City Trucking Division—Large Fleets—City and County Garbage Department, Honolulu, Hawaii.

City Trucking Division—Small Fleets—J. E. Bejin Cartage Co., Inc., Detroit, Mich.

Department Stores Division—Large Fleets—United Parcel Service, Paterson, N. J.

Department Stores Division—Small Fleets—General Cigar Co., Inc., Des Moines, Iowa.

Laundries Division—Oregon Dye House, New Bedford, Mass.

WEDNESDAY AFTERNOON SESSION

October 13, 1937

JOINT SESSION WITH TRANSIT SECTION

A. E. Parker, Winnipeg Electric Co., Winnipeg, Manitoba, and General Chairman of the Transit Section, National Safety Council, presided at the session. The ad-

dress prepared by O. M. Brede was presented by John D. Riggs, Service Engineer, General Motors Truck and Coach Division, Pontiac, Mich.

Preventive Maintenance for Motor Vehicles

By O. M. BREDE

Director of Service, General Motors Truck & Coach Division, Yellow Truck & Coach Manufacturing Co., Pontiac, Mich.

Thirty years ago, the loss of a vehicle wheel or failure of an axle shaft meant little more than being dumped out in the mud. Today, such a failure may result in a head-on collision or crashing over an embankment with every possibility of death. Faster vehicles and increased tonnage have caused manufacturers to develop sturdier axles and spindles and efficient wheel bearings—the old wagon wheel construction will no longer suffice.

How many of you recall stopping your car at sundown to light up the kerosene wick lamps? They seem ridiculous now, but they did a fairly good job at 15 or 20 miles per hour.

Imagine stopping your car, traveling 60 miles per hour, with a pair of block brakes that scrape on the tire. It would be impossible, of course, yet that is the means by which some of the first automobiles were stopped. Then came the various types of brake bands, exposed to the weather, utterly useless in the rain. Today we have fully inclosed brakes—hydraulic, air and booster actuated—capable of stopping thirty ton loads within distance unheard of, even among the lighter vehicles a few years ago.

Today we feel that we are approaching the peak of highway transportation. Naturally improvements will go on as before, but nevertheless we must recognize the fact that manufacturers are producing motor vehicles capable of rendering thousands of miles of efficient, economical service *providing* they receive the proper maintenance. Unfortunately we have not yet reached the age of materials that will not wear. It is still necessary to clean, adjust or repair various parts of a vehicle to retain that degree of efficiency that existed at the time it was delivered by the producer.

Looking back over the rapid evolution of transportation we observe that *maintenance methods have not kept pace*. With all due credit to fleet operators who have recognized this science of operation, we can still safely state that the large majority of motor vehicles in the United States are repaired only when they fail to operate or when the need for repairs is so obvious that the owner's

conscience demands them. No systematic plan of maintenance is observed universally.

There is nothing problematic about this matter of maintenance. It consists of work which becomes necessary sometime during the vehicle life, and it must be done in the form of either maintenance or repair.

The word "maintenance" has become more generally used in the past few years—it is gradually supplanting the word "repair." We have maintenance departments, maintenance superintendents and the cost of the work performed on vehicles is recorded on the operating statement of most firms, as "Maintenance."

This is a step in the right direction, as we should have Maintenance Departments, Maintenance Superintendents, and we should practice maintenance—BUT—observation and investigation of maintenance practices conducted in fleet operations large and small—scattered and concentrated—lead us to believe that while operators, apparently, are gradually becoming aware of the importance of maintenance, too many are still operating a repair department, masquerading under the title "Maintenance Department."

Mr. Webster's definition of the word "repair" certainly applies to many operators who have for many years "restored the vehicle after decay." This decay with its attendant road failures, accidents, and out-of-service time cause operating costs to reach staggering heights that frequently spell ruin for the operator. Vehicles end their economical usefulness long before their normal mileage life has been absorbed.

The scientific, as well as the mechanical, phase of maintenance must be recognized. Replacements must be made by fact rather than by guess and the question why this failure must take precedence over just repairing—if customer service is to be maintained—operating costs kept at a minimum, and a profit on the capital invested, realized.

In other words, maintenance must be performed on a systematic basis and the aim and objective of maintenance should be primarily to prevent repairs—and thus we find a phrase which is slowly but surely being

heard throughout the industry—namely: Preventive Maintenance.

The points of a vehicle most frequently responsible for accidents are brakes, steering, lighting equipment and running gear. Preventive Maintenance covers all of these to some degree each 1,000 miles with major overhaul where wearing parts are involved at the more advanced mileages. Every precaution is taken to retain perfect working order at all times. In addition to correcting these items whose failure may be directly responsible for an accident, Preventive Maintenance practically eliminates the mechanical failures which cause a truck or trailer to be parked on or near the highway unable to move until a service car arrives. Some of our worst disasters are caused by parked vehicles.

Another function, although not exactly maintenance, is worth mentioning because it is the responsibility of all maintenance men. That is safety devices such as flags, flares, tire chains, fire extinguishers, special lighting equipment, turn signals, etc. Many of these articles are required by law, hence the equipment should be checked each time a vehicle visits the shop.

We have for many years cooperated with fleet owners in the development and improvement of truck maintenance methods and to those operators who practice Preventive Maintenance only partially or not at all, we offer this Preventive Maintenance System. It is not cumbersome nor intricate, but, on the contrary, simple—easy to operate and one that records maintenance facts.

There are two distinct phases of Preventive Maintenance. The first is "A scientific method of anticipating and performing required maintenance operations."

Years of research have established the mileages at which certain truck parts should be inspected, adjusted, or replaced.

Let us understand, first, that maintenance is an ever reoccurring cycle of events in which there are certain distinct phases, and each phase contingent upon every one of the other phases, if the cycle is to be kept intact.

To carry out this cycle, we have a series of five work sheets which prescribe the mechanical operations to be performed at various mileages, throughout the vehicle life.

The first of these is the "A" Service, rendered every 1,000 miles throughout the

life of the vehicle, or, on low mileage vehicles, every 30 days. It includes the adjustment of units affecting operating economy and, of course, a thorough lubrication and general inspection. Timing is checked, carburetor adjusted, spark plugs cleaned and spaced, valves adjusted, etc.

Second, is the "B" Service—suggested at 5,000 mile intervals. All "A" Service items are included, plus many others requiring attention at this mileage. For example, wheel alignment is checked, grease retainers and bearings checked, brakes inspected and adjusted, the crankcase ventilator is cleaned and the generator checked and charging rate adjusted.

Third, is the "C" Service—suggested every 15,000 miles. It includes all "A" and "B" items and involves arbitrary replacement of inexpensive minor parts which have served their economic usefulness. Certain concealed units are opened up, examined and adjusted to prevent abnormal wear and costly failure. The cooling system is thoroughly cleaned, valves are ground and springs replaced and the fuel pump overhauled or exchanged. Distributor points, rotor, condenser, and high tension wires are arbitrarily replaced.

The "D" Service is suggested at 30,000 miles. This service includes "A," "B" and "C" items, together with an exacting examination of all major units. The thoroughness of this service insures continued satisfactory performance and reliability at a mileage which normally introduces an era of uncertainty. The transmission and differential are removed, cleaned, inspected and adjusted; spindle bolts, bushings and tie rod ends are replaced; the clutch is disassembled and discs, linings, etc., replaced. Universal joints and center bearings are overhauled; wheel bearings washed, inspected and repacked; brakes refined and brake mechanism overhauled; a general check and reconditioning of the engine takes place—pistons and rods are removed, bearings and cylinder walls checked, valves ground and parts replaced where necessary.

Fifth is the "E" Service at approximately double the "D" mileage. The "E" Service specifies the installation of a factory remanufactured engine or a complete engine overhaul for those vehicles whose manufacturers do not offer an exchange engine service. A thorough reconditioning of all major units is contained in the "E" Service. Through its application, the life which 60-

1000 or more miles of service has consumed, is replaced and the art of maintenance, which is keeping, or maintaining a vehicle in as close to the original state as possible, is practiced.

With this plan of maintenance in effect, you will find the small chronic troubles that previously taxed the mechanical personnel almost entirely eliminated. The constant lost motion jumping from one vehicle to another to keep them in operation will be over. The only remaining interruptions, beyond the scope of Preventive Maintenance, are accident work body reconditioning and tire repairs.

Basically, these services are correct and will apply—generally speaking—to any commercial vehicle, but because of variation in operations, whether geographical, or vocational, it is mandatory that the system be flexible, and sufficiently flexible, so that it may be applied to any vehicle or any fleet.

To circumvent the possibility of failure because of one or more factors, it is imperative that maintenance facts be recorded and used by management in appraising the efficiency of an operation.

Records carefully prepared and filed away in a cabinet drawer are useless—but records carefully prepared and used as they were intended, may mean the difference between profit and loss.

Thus the second phase of Preventive Maintenance is "A systematic method of accumulating and interpreting operating and maintenance data."

Only two records are necessary: First, the Fleet Maintenance Record, on which the maintenance facts of each vehicle are recorded: date, mileage, frequency of visits to shop, work performed, mechanic assigned and work order reference. The work performed is recorded in code, which, to the practiced eye, soon becomes an open book.

With this record, the complete shop activity is readily interpreted by the practiced eye. Frequency of service . . . inefficient repairs . . . road failures, etc., come to the attention of those in charge, daily. Chronic ailments stand out vividly and corrections based on fact can be applied to vehicle or personnel.

And now, just as insurance statistics average out the length of human life, the second, and final record in the G.M.C. Preventive Maintenance System is "The fleet

history record" which records the history and dictates the replacement period of those units which experience proves should be treated individually rather than under the broad scope of the five scheduled preventive maintenance services.

The information recorded on this form, when used in conjunction with the previous forms, constitutes the preventive, or "Repair-before-failure" type of maintenance system. Forty-three items of repair are arranged on the left-hand side of the form. They are numbered to correspond with the same code that is used throughout the system. This form is flexible, since items may be changed or added to as found necessary in a particular fleet. Opposite the repair operations are 52 heavy-columns, each representing 1,000 miles of operation, thus providing a 52,000 mile history.

Previously, I associated the B, C and D Preventive Maintenance Services with definite advanced mileages for purposes of illustration, but I said that the items contained in these various services did not necessarily apply literally to all makes of vehicles and all types of operations. If they did, there would be no necessity for a history record such as this.

Assuming, however, that Services A, B, C and D, are in effect at the mileage periods we previously used—namely: 1,000, 5,000, 15,000 and 30,000 miles—deviations from these definite mileage periods may be recorded to suit variable operating conditions. It will be recalled that the D, or 30,000 mile service, included a complete brake relining; however, if because of very severe service, brakes last only 15,000 miles, brake relining—front and rear—is then blocked out on this chart at 15,000 mile intervals.

In another example, let us assume that new spark plugs at 10,000 mile intervals improve performance and economy. The chart is blocked out at 10,000 mile periods to care for this.

The C, or 15,000 mile, service includes valve reconditioning; but assuming that experience has proven that 20,000 miles is correct, this item is removed from the C Service and moved up to 20,000 mile periods.

The cleaning and repacking of wheel bearings and the replacing of grease retainers are included in the C, or 15,000 mile, service; but, using a low mileage factor, let us assume that experience indicates that

this should be done a little more frequently. It is then moved down to 12,000 mile periods.

These items are then removed from the C and D Service and treated individually each 12,000 miles. These are a few examples of how fleet history may be recorded on this chart. The chart is referred to each time the vehicle is brought into the shop for service.

Specific analysis of a fleet, as mentioned previously, might also change the periods at which the B, C and D Services should be performed; either moving them up or moving them down the mileage range, and, if this is done, the chart, of course, should reflect the changes. It may be used either for a single vehicle or a group of vehicles

identical in make, model and type of operation. For instance, assume a fleet in which there are ten vehicles engaged in practically the same type of work, let us say package delivery, accumulating approximately the same mileage and operating of course, under comparable conditions. Generally speaking, one history record will serve such a group. In the same fleet there may be 10 or 15 vehicles engaged in similar service but whose routes extend into outlying districts of a city. Mileage, therefore, being greater, these vehicles probably would constitute a second group, etc. Make, model and type of service must be collectively analyzed before grouping vehicles is attempted.

Preventive Maintenance offers advantages in every angle of motor vehicle operation.

Are Driver Tests Worthwhile?

By A. R. LAUER

Associate Professor of Psychology, Iowa State College, Ames, Ia.

There is some very foggy thinking on the fundamental principles of driver testing. Some seem to think any device which may be set up that resembles any phase of automobile driving is a test and that all such devices are equivalent. Therefore we must make a clear distinction between tests set up for exhibition and advertising purposes and those which have undergone long scientific study. We may say at the outset that the tests gotten together to interest people in some product, or as a merchandising scheme, are most likely to be valueless. To interest a large number of people it is necessary to get them through in a hurry. With speed as the objective there is likely to be other quite essential qualities lacking.

Some of the important considerations in the development of a scientific test are:

1. Reliability, or the consistency of measure from one time to the next.
2. Validity, or whether the test measures what it is supposed to measure.
3. The test should further challenge the driver to do his best. If it does not resemble the function it is testing there is danger that the subject may not do his best. This means that such factors of driving as the pressure on the steering wheel used in turning and

other operations to be performed, are in general harmony with the function supposed to be measured.

4. In general a test must actually tax the ability of the operator. One could hardly expect to ascertain the strength of a man by having him pick up 25 lb. bars at spaced intervals of time. There must be weight added until he can hear no more before his strength may be compared with another's, or his capabilities established.

Why Is a Superior Test Not 100 Per Cent Effective?

The definition of effective is slightly equivocal. It depends upon what we use as a criterion. Many superior performers have accidents because they take too many risks. Many inferior drivers have no accidents because they are extremely careful. One may set up two general criteria of good driving. In either case a number of defects in the criterion may be readily recognized. The two criteria are given below. Their limitations will be discussed later.

1. Good performance at the wheel.
2. Freedom from accidents over a period of time.

Experimentally we have found a very low correlation between these two variables. In the first instance the degree of superiority in driving must be established by some observer's judgment. This has been found to be very unreliable. Again it assumes carefulness all the time. This is a fallacy. A watched driver becomes a careful driver. Other things such as revenue brought in, personal characteristics and general impressions are substituted for actual knowledge of the driver on the road.

Freedom from accidents is a variable criterion. It depends entirely upon the definition given. Many accidents are not reported and many reported accidents are not strictly traffic accidents. This is particularly true of public carriers.

Another weakness of the frequency of accidents as a criterion of good driving is that often no account is taken of the risk which must be met by the driver. Different types of driving are not comparable. Again other factors, such as the ability of the driver to compensate for his weaknesses, his inability to do his best, and the numerous causes which may lead to a given accident, complicate the problem immensely. It is easy to see that unless an accurate account of the driver, his habits and driving experience, the conditions of the accident and numerous other influences are described that it would be hard to ascertain the degree of blame which may be attached to any single accident or to an accident record.

Primary Functions of a Test

It is obvious that a test itself can have no intrinsic value as such. A medical examination will have no intrinsic value unless it is preliminary to a therapeutic procedure which is aimed to help the patient. The function of a driver test should be for one or more of the following purposes:

1. To apprise him of possible weaknesses in order that he may avoid danger.
2. To apprise him of possible weaknesses of the other driver in order that he may avoid danger by keeping out of the way of the other car, regardless of who is legally right.
3. Together these should lead to a systematic attempt on the part of the driver to avoid dangerous traffic situations by being constantly alert while driving.
4. Another use of the driver examination is to obtain data for use as a basis of education. To demonstrate objectively what a driver should do to increase his safety factor

is not the least function of the driver examination, yet it may serve as a basis for a training program.

5. There is also a purely psychological effect. Those employed by a company which makes frequent check-ups of its employees are quite certain to stretch a point in keeping themselves out of trouble. Their jobs may depend upon it. This is quite likely to reduce accidents.

Limitations of Drivers' Tests

A driving examination is subject to all the weaknesses of other scientific and practical phases of the application of measurements. They are not 100 per cent efficient. Mistakes are made as in medicine or other applied fields.

Perhaps one weakness of the entire testing movement is that it is often not made an integral part of a general remedial program. There are several steps which must be taken to make it effective both in organization and application. To make such techniques worth while their application must be accompanied by:

1. Full cooperation of the superintendents and higher administrators.
2. The men must feel that it is a special service being given them and not a penalizing plan for "kicking" some out of their jobs.
3. It should be preceded by a careful analysis of accident records, accident locations, service and personal accident records of employees, etc. In fact there should be first hand and carefully tabulated data on the conditions under which the operators are working.
4. Drivers should be classified according to the conditions under which they can drive best. Those night-blind should be kept off the road after night if possible. They may be perfectly safe as day service men.
5. Special training squads should be organized and careful instruction given those who have defects or who have bad records.
6. Some alert supervisor must be given full charge of the accident prevention program. In other words it must be made to "click" from the beginning. The supervisor should have thorough training in traffic engineering, psychology, statistical methods, personnel management and traffic survey work. *He must be trained in the use of these methods.*
7. Each accident should be very carefully studied to ascertain the real cause; i.e., the proximate cause. The testing of the driver's

capacities should be correlated with the nature of the accident. A few months of such studies would put the science of accident prevention on a much higher plane than it has formerly enjoyed.

Feasibility of Program

There is nothing new in the principle involved in accident prevention: It is a continuous job of applying known principles to the situation in hand. There is no more a once-and-for-all solution for accidents than there is a formula for making a business pay. Trained personnel is the first prerequisite. The second is application of up-to-date methods in whatever form they may be most applicable.

Keeping a group of drivers out of accidents; i.e., keeping them all fit—is somewhat like maintaining health. Prevention is half the battle. When one does have an accident after methods of prevention have failed, he should have special and individual attention. At such time the use of precision instruments and methods of diagnosing the trouble may be the most important item in accident prevention.

Would Such a Program Pay?

This depends more or less on the point of view of the operator. He stands to lose from

accidents and inefficient drivers, through various avenues. Some of these are:

1. Higher insurance rates.
2. Loss in damage to equipment.
3. Loss in time of the driver and equipment.
4. Loss in time of administrators and adjusters.
5. Loss in business through inefficiency in distribution, etc.
6. Losses in legal services and damage suits.

Loss in Good Will of the Public

There are other ways losses may be incurred by accidents. Does it pay a business man to modernize his store? Does it pay a farmer to harvest his crop? The answers are quite obvious. Over a short period of time, no. Over a long period of time, yes. The necessary steps to promote safety in a plant perhaps come under the same general category. The use of bona fide scientific methods to reduce accidents should be worthwhile. In the meantime it must be remembered that there are many substitutes. The latter may appear as good as the real thing—they may be even more spectacular. Our answer to the original question is "drivers' tests are worth while if properly given, interpreted and used." The most difficult part is to find those who know enough about the problem to give and apply the test in an effective manner.

Psychological Testing at the Capital Transit Company

By J. V. WAITS

Personnel Psychologist, Capital Transit Company, Washington, D. C.

Psychological testing is in an early experimental stage at the Capital Transit Company. At present we are using an intelligence test and a small battery of physical and motor skill tests. This battery consists of: A Snellen vision test, a test of peripheral vision, Ishihara color vision test, a color vision test on standard traffic signals, a test of depth perception, a multiple choice reaction time test, and a test of tapping or speed of muscular movement.

The term "psychological testing," as used in this paper, denotes those examinations administered to determine aptitude for bus or street car operation. While numerous

elements are involved in the ability to operate a bus or street car, it can hardly be questioned that motor skills play an important, if not the most important, role. Psychological testing for bus and street car operators has been predicted on the assumption that tests which indicate general motor skill in an individual should give some clue to his subsequent driving ability.

Attention should be directed to the fact that most of the tests of motor skill now in use are of a general nature. Their use as indicators of motor skill has met with small success in the past. Investigators have found there is a fairly low degree of re-

relationship between them. Thus we find individuals who have a fast reaction time and who are slow in speed of muscular movement.

Furthermore, when these motor skill tests have been applied to such problems as the prediction of typewriting speed, we find they do not give very reliable predictions. These facts have led some investigators to the conclusion that motor skill is a specific and not a general ability. If such is the case, an individual might become very skillful at one motor task and still lack the ability to become skillful at another, so it would not appear tenable to expect general tests to give accurate prediction of later driving.

The problem would thus resolve itself into one of finding certain specific motor skill tests which would give a high relationship with subsequent success or failure. Even if we were to admit that none of the present psychological tests will predict driving ability, we should still contend the prospect is far from hopeless.

While adequate data to draw reliable conclusions is not yet available, certain observations are indicated in the results obtained during the past 15 months at the Capital Transit Company. There are definite indications that "on the average" those who make good scores on the psychological tests tend to be successful drivers. But there are a number of exceptions in both directions. Some individuals were poor or below average on the tests and have made good operators; some did well on the tests and have been failures. Yet "on the average" we have secured a somewhat better group of drivers.

What the personnel director wants is not a series of tests which will deal in average results, but one which give him individual prediction. He must answer the question, "Should I employ this specific individual? Will he later become a liability or will he

be an asset?" If psychological testing is to become a permanent necessity of the transit industry we must be able to answer those questions with a reasonable degree of accuracy.

The writer believes we will eventually be able to do so, but that before we reach that goal we must solve two problems.

First, we must find those tests which give specific prognosis of driving aptitude. When we find them, they will probably be those which indicate that an individual possesses specific motor coordinations, and not that he is able to make a good score on certain more or less general motor tests.

Second, we must develop some numerical measure of driving efficiency against which to relate our testing results. At present there is no such criterion. We rate efficiency in terms of the number of accidents the individual has; the number of accidents per 1,000 miles or per 1,000 hours; the number of preventable or chargeable accidents; the number of times a man is up for discipline; the number of dangerous practices charged against the individual; the number of "misses" he has; or the reports of the division superintendent, inspectors or instructors. In most cases we would admit none of these is an adequate measure of the man's efficiency as a bus or street car operator. Yet one of these or some combination of them plus our own personal opinion is being widely used.

To the writer it seems we have placed the cart before the horse. We are attempting to find tests that will give a reliable prediction of driving ability before we have any method of measuring that ability, when and if we get it. The development of an adequate criterion which can be stated in numerical terms, and which has a known reliability, is an urgent necessity before we can expect much success in psychological testing.

The Effect of Parking on Boarding and Alighting Accidents

By HAWLEY S. SIMPSON

Research Engineer, American Transit Association, New York City

When the subject of the effect of parking upon boarding and alighting accidents was assigned to me, I made inquiries within the transit industry for pertinent information and

soon found that there was nothing to show any direct relationship between parking, in general, and boarding and alighting accidents on cars or buses.

I did discover, however, that there seemed to be a relationship between boarding and alighting accidents involving buses and the parking regulations immediately adjacent to the intersection, particularly with respect to the size of the zone set aside for the bus stop and the location of the stop at the intersection; that is, whether the stop is on the near or far side.

When I had gotten to this point, I learned that E. J. Kreh, Manager of Accident Prevention, Philadelphia Company, Pittsburgh, was preparing a paper on this subject. I have read this paper for presentation at this Congress and it covers the field much more fully and better than I could have done.

The members of the American Transit Association have recently approved a program for accident prevention work within the transit industry and the establishment of an accident prevention department at Association headquarters. At the time the plan was approved, a substantial sum of money was pledged to the support of the undertaking, sufficient to assure its operation for at least three years.

So that you may know something more of the importance of the accident problem to the transit industry; so that you may know that we are sincerely interested in reducing accidents for financial reasons as well as from humanitarian considerations, I should like to read two brief paragraphs from the report presented by T. Fitzgerald, Chairman of the Association's Committee on Accident Prevention, which led to the adoption of the program I have just mentioned. The report says:

"Accidents are costing the transit industry between \$25,000,000 and \$30,000,000 annually. This sum is equivalent to at least four per cent of the total operating revenue and more than five per cent of operating expense, and runs much higher on individual properties.

"In electric railway operation, accidents cost approximately one-half as much as the expenses charged to way and structures; one-half as much as all equipment expenses; and one-third as much as power. In bus operation, accidents cost nearly one-half as much as does the maintenance of bus bodies and chassis, and more than half as much as all gasoline and lubricants. Furthermore, in either railway or bus operation, for every dollar set aside in the depreciation account, 50 cents is paid out for accidents; and for every dollar in operators' wages, approximately 20 cents

must be paid out to compensate persons involved in accidents."

Before concluding, there is just one other thing which I should like to say to you.

The chief traffic engineer of the National Safety Council, Earl J. Reeder, has at numerous times* within the past several years, made recommendations which have conveyed the impression that far-side stops are more advantageous than near-side stops. As you all know, transit companies are among the largest supporters of organized safety activities in their communities. This is because we have a real and sincere interest in reducing street accidents. It seems to me, because of the concern which we have in this problem, and because of the interest expressed by us in our financial support of organized safety work, that we should at least be given the courtesy of presenting our viewpoint to the staff members of the National Safety Council before any report is issued containing recommendations which concern in such a vital way the operation of a city transportation system and which may have an appreciable effect upon our accident record.

To illustrate what I mean, I want to read some brief excerpts from the report of the Honolulu traffic survey made by Mr. Reeder in February and March of this year. It is what I have read in this report which is largely responsible for my making this statement at the present time:

"Except at a point where a right turn is to be made, it is always easier for a bus to enter a bus stop from the far side of an intersection than on the near side because in the latter case it is difficult to bring the rear end of the bus to the curb unless the zone is very long. It is easier to swing the bus out of a far-side zone than it is to enter one on the near-side."

Here it is implied that the far-side stop is more advantageous than the near-side stop except where the bus is about to make a right turn. This is exactly the reverse of general practice. Operating companies have found that it is more advantageous to make far-side stops at intersections where the bus makes a right hand turn, stopping after having made the turn. At other points, generally, the near-side stop has been found to be superior.

Then, the report goes on to say:

*Editor's note: Recommendations for far side bus stops in limited areas have been made by Mr. Reeder in two traffic surveys.

"When buses are stopped on the near side to receive or discharge passengers, right turns by other traffic are seriously interrupted and must be made, if at all, on the portion of the street beyond the bus. Then, if the bus starts when such a right turn is being made, collisions are likely to occur."

Here is illustrated a fundamental difference between the thinking of the transit operators and the safety experts of the National Safety Council. In the paragraph I have just read alarm is expressed at the fact that right turning automobiles may be "seriously interrupted" when buses make near-side stops. Public transportation, handling 60 to 80 per cent of all the passengers on heavy traffic thoroughfares, should be inconvenienced, the report recommends, to add to the convenience of private automobile passengers. Buses, carrying perhaps 30 or 40 passengers each must, then, find a place to stop where they will not inconvenience passenger automobiles using approximately the same space and carrying only 1.75 passengers per vehicle.

Furthermore, right turns in traffic on an average street will not amount to more than about 10 per cent of the total and, on a heavy traffic bus thoroughfare private vehicles making right turns will carry probably not to exceed 3 or 4 per cent of the passengers using the street. The suggestion that buses, carrying the great bulk of the load, composed of people who are unable to afford the luxury of personalized transportation, should be inconvenienced for the advantage of such a relatively negligible number of automobile owners, exemplifies what I mean when I say that there is a fundamental difference between our point of view and that of the safety experts of the National Safety Council. The latter think of traffic in terms of vehicles; we think of it in terms of passengers. Those of you who heard Ross Schram deliver his excellent address on "The Approaching Revolution by the Riders of Public Carrier Vehicles on City Streets" will know exactly what I mean.

The report then says:

"The choice between near-side and far-side bus stops is not to be made arbitrarily for all locations; but must depend upon local conditions. Wherever there is much right turning traffic and considerable parking adjacent to an intersection, far-side bus stops are advantageous. At other points, where traffic is less

complicated, little parking exists and right turns are few, near-side bus stops may be equally advantageous."

Following this line of reasoning to its conclusion, bus stops on all heavy traffic streets would be located on the far side of the intersection. On these streets there is almost invariably considerable parking adjacent to the intersection, and also a fair volume of right turning traffic and so bus stops should be transferred to a location which we know will considerably slow down schedules and which, on the basis of the little information available on the subject, we believe will increase the accident hazard at intersections.

I shall quote next from the succeeding paragraph of the report which, though not directly on this subject, is still further indicative of the difference in point of view which I have just mentioned:

"Waiting for scheduled departures in bus zones in a busy business district is conducive to traffic congestion. It should be discontinued. Such waiting for schedules should be done outside of business districts where interference with other traffic will not be a problem."

Here again is a direct statement to the effect that buses standing at the curb inconvenience "other traffic." It is difficult for me to conceive of a situation in any city in which sufficient space cannot be allotted at terminal points in business districts to allow buses to await scheduled departures within reasonable time limits and, by that, I mean a matter of a few minutes.

A bus, standing at the curb awaiting passengers at its terminal point certainly causes no more congestion than a parked vehicle, yet it is in the act of serving a large number of people, while the parked vehicle, occupying practically the same space, is serving nothing except the wishes of its owner who uses the street for terminal purposes over a relatively long period of time.

To my mind this report gives undue weight to promoting the convenience of the private vehicle owner, with very casual and wholly inadequate consideration of the needs of public transportation vehicles which perform a much more vital service through serving the greater proportion of the citizens with a minimum usage of street space, both while moving and at the curb.

At the conclusion of this statement, Mr. D. L. Fennell, General Superintendent of Transportation, Kansas City Public Service Company, moved that this matter should be called to the attention of the officers of the National Safety Council and that the Transit Section request that, whenever reports are made by staff members in which recommendations with respect to the operation of public transportation systems are

included, such recommendations should be submitted first to a conference with the operators of the local public transportation system or systems so that their viewpoints could be placed before the Safety Council's employees. The motion was seconded by E. E. Grover, Manager of Claims, Columbus and Southern Ohio Electric Company. It was unanimously adopted by the delegates.

Boarding, Alighting and Falls Inside of Cars and Buses

By JOHN M. ORTS

Director of Safety Education, Public Service Corporation of New Jersey, Newark

Uppermost in the minds of all operating men engaged in the operation of common carriers is the cost of accidents. This constant gnawing has eaten into the vital organs of many companies to the extent of entirely destroying their growth. Outstanding in the classification of these accidents is the tantalizing fall. They are tantalizing to the claim man, to the operating man and to the operator. As we often view them it seems almost unbelievable that the average human being can be so careless in conducting himself when traveling.

But all one has to do is to review "Accident Facts" of the National Safety Council and note the number of people who lost their lives through falls in the home. What can we expect when they become passengers upon our common carriers? I often wonder that we do not have more of this type accident than we do.

The parking problem, as we have it today, beyond a question of doubt has increased this type of accident. Operators of street cars and buses are compelled to stop at uncertain points, suddenly, and in a position creating a hazardous condition in the discharge or receiving of passengers.

I dare say that you all have tried every conceivable idea that may have come to your attention, such as the best of non-skid materials for the steps, aisles, and platforms, the proper height of the step and a constant supervision of your operating conditions, etc. Still we are having falls.

Some time ago I made a check to find out who was falling; their vocation in life; young, old or middle-aged; male or female. While this check seemed to be scattered out over the

entire range, it brought out one peculiar characteristic—that when a person is traveling alone, he seldom falls.

Training of Men

Our accident records show that in 1936 over 1935 there was an increase of 290 in this type of accident. Under the supervision of Robert A. McArthur, who is in charge of our training schools, a highway was constructed on our property to teach the bus salesman how skidding can be avoided, also in the making of smooth stops and starts.

This highway is constructed of the various types of pavements used in the streets and highways in the State of New Jersey, consisting of concrete, asphalt, brick, stone, block, macadam, wooden block and even wooden planking. Any section of the test course can be quickly flooded with water or greased to produce a slippery effect. In winter the road will be kept slippery with snow and ice. Sharp curves also add to the driving hazard. Each driver must demonstrate his ability to handle his bus, starting, stopping, and turning on each type of pavement under adverse conditions.

Transportation engineers developed this test course which is believed to be the only one of its kind in this country. This course is also used for giving instructions to regular drivers.

Committee Meetings

Committees are organized in every carhouse and garage, consisting of one to three drivers from each line, both day and night men, selecting their chairman from the rank and

file. These committeemen review the accidents each day and talk with the salesmen of their line who have been involved, going over in detail, how the accident could have been avoided if proper consideration had been given the existing conditions. These meetings are held monthly and bi-monthly in some of the larger garages. Each salesman is given the opportunity to make any suggestions in which improvement can be made to avoid accidents. All of these suggestions go to the general manager. Through these committees, conducted as they are, we are getting information which has improved conditions.

Public Education

A constant campaign in safety, educating the public, is conducted by the Department of Safety Education. This is accomplished through lectures and safety educational mo-

tion pictures made by ourselves and selected to fit the particular group. This branch of safety educational work is reaching the average of 100,000 to 125,000 persons per year.

All-Service Vehicles

The substitution of all-service vehicles for trolley cars, undoubtedly has been a factor in the reduction of this type of accident on our property. Of course, they are new, people are all attention when boarding and alighting; that, of course, may wear away as time goes on and they become to the public just one more operating unit. However, putting into effect these four courses of education, we have reduced this type of accident on our property for the first seven months of 1937 over 1936, by 202 accidents. Whether we are off on the right foot, only time will tell. However, this reduction is very satisfactory.

Effect of Parking Conditions and Practices on Frequency of Street Car and Vehicle Collisions

By H. V. SCHREIBER

Safety Engineer, Capital Transit Company, Washington, D. C.

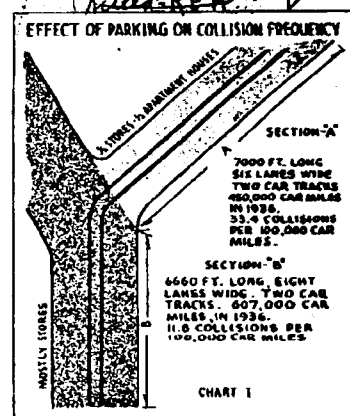
Better control of the parking hazard seems possible by improved training of car operators to foresee and prevent the hazards and by better enforcement of parking regulations.

In reaching these conclusions we first listed a number of parking accidents all over our system. Then we listed the location, time, direction and class of collision on two quite different sections of one of our lines, each about 7,000 feet long, on which we are having more than the average number of accidents.

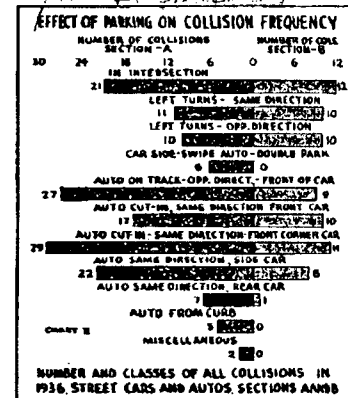
The general characteristics of these two sections are shown on Chart I and are more fully described as follows:

Section A starts at the outer end of the line and about half its length is used for business—principally chain food stores and service stores. The rest of the length is occupied by apartments 3 to 6 stories high. The street is six lanes wide and cars operate in both directions. Parking is permitted and in front of the stores. Much double parking occurs during the morning rush hours. The number of cross streets is about the

same, traffic control signals are fewer than on the other section. Free wheel traffic is



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largely of local origin and does not follow the car tracks very far. There is too much single and double parking to make this section attractive to through traffic, compared to wider streets leading toward the congested area without car lines and where rush hour parking is forbidden on heavy flow side of street. Because of the lack of adequate parking control this section has only one lane for free wheel traffic along the car track in each direction. Double parking of course eliminates this. Except for one short section there is no rush hour parking control. During 1936 this section had some 450,000 car miles of street car movement and 160 collisions with automobiles occurred, or 33.4 collisions per 100,000 car miles.

Section B follows along the same car line, is 8 lanes wide and has a cross over switch which permits turn backs and carried in 1936 a total car movement of 607,000 car miles over 6,660 ft. of street. There were 72 collisions on this section giving a rate of 11.8 per 100,000 car miles. More stores and hotels are located on this section, much through traffic is cared for and cross street traffic with signal control is often heavy. Because of the extra free wheel traffic lane double parking does endanger street cars not so greatly as on Section A. Also, rush hour parking is eliminated on the heavy flow side and the heavy traffic is not the menace it otherwise would be.

A classification of collisions and segregation by sections (Chart II) indicates there is a marked difference in frequency of those types of collisions to which parking and double parking contribute. This tabulation and chart show why the total along Section A is so much greater than Section B. The classifications used are as shown below, and those which indicate undue parking hazards are prefixed with an asterisk.

These figures indicate how watchful the street car operator must be for autos that pull out or back into the curb without warning, how careful he must be to keep an eye on traffic on the opposite track because it may suddenly be forced over on to his track. Most of all he must be quick to slow down for the motorist who is trying to pass him. He may misjudge his clearance from the moving street car or he may be forced over on track by autos pulling from curb too closely in front of him. So many motorists pull out a foot or two before they look back,

Classifications for Collisions of Street Cars with Automobiles

	Sect. A.	Sect. B.
Collisions in intersections	21	12
Collisions with autos making left turns from same direction	11	10
Collision with autos making left turns from opposite direction	10	10
*Cars sideswipe double parked autos	6	—
*Collisions with autos passing in opposite direction	27	9
*Collision with autos stopped on track in same direction	17	10
*Collision with autos in same direction, cutting in on track striking near front of car	29	11
*Collision with autos in same direction near center of car	22	8
*Autos colliding with rear of car	7	1
*Collisions with autos pulling from the curb	5	0
Miscellaneous vehicle collisions	2	0

*Undue Parking Hazards.

R.E.H. ✓

they scare the approaching motorist who then collides with the street car.

Chart III classifying collisions according to time of day when they occurred and plotting this time frequency for the two sections on opposite sides of a center vertical base line gives us a different kind of picture when and why one section has more collisions than the other. Still further light is thrown on the subject by superimposing on this chart for each section a curve indicating the frequency of car movements each hour. This reveals clearly when we have most collisions and their frequency in proportion to the number of cars moving each hour. Not only do we find on Section A that collisions are most frequent during the 8 a.m. rush hour but that during the 11 a.m. shoppers rush the relative frequency is 9% greater per car. Also we find that with 60% more cars on Section B we have nearly 60% less collisions, or Section A has 3.8 times as many collisions per car at 8 a.m. as Section B.

It is of interest to note that on Section B the same number of collisions have occurred at 11 o'clock as at 8 with much lighter car movement, in other words the rate per car at 11 is about 2.2 times that at 8 compared to 1.09 for Section A. The highest rate per car is about 9 p.m. when it is about 2.6 times that at 8.

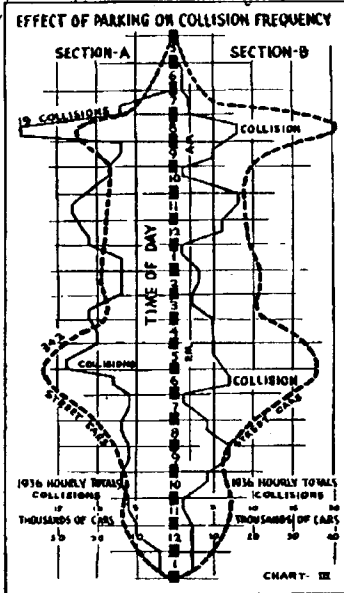
Summarizing the above we see why and when the collision rates on Section A are so high and why they are 2.83 times those of Section B per 100,000 miles. A comparison for a longer period would give a larger number of collisions for analysis and permit more positive conclusions. But the indications of sufficient importance to justify further study and an attempt to control the hazards and reduce frequencies at times and points where they are shown to be greatest.

In further detail, the practical suggestions which evolve from this study:

Further observation of a.m. parking practice Section A, to determine cause for peaks:

- Count of overtime parking;
- Count of double parking;
- Count of free wheel traffic movement along car line and on cross street;

Check of police record of accident, location, frequency and time of occurrence;



Prepare similar charts for free wheel traffic movement and collisions;

Chart present parking control and control called for by regulations;

Determine from this complete data point by point along Section A where and what changes in parking control is needed and where free movement control along car lines and on cross streets will reduce hazards.

Lay these before proper authorities and get correction.

Study conditions which may affect future free wheel traffic flow and present hazards.

Develop if possible some rough formula which will be an indication of street car collision frequency to be expected with 6 and 8 lane streets with business streets and residential streets.

Get a complete picture of the conditions and use it to get the corrections needed.

THURSDAY MORNING SESSION

October 14, 1937

COMMERCIAL VEHICLE REGULATIONS

The session was called to order by Division, American Trucking Associations, Charles G. Morgan, Jr., manager, Safety Inc., Washington, D. C.

Safe Transportation of Liquid Fuels by Motor Carrier

By G. O. LOCKWOOD

Director of Safety, Cities Service Oil Co., Bartlesville, Okla.

I—Reports of Inspections

The Kansas Corporation Commission, Department of Inspection and Registration, and the Highway Patrol, each is charged with the responsibility of inspecting transport trucks to see that the rules, as formed by each agency, are being complied with.

Some interesting occurrences and findings in connection with the inspection of 12 loaded trucks on the highway, not included in the official report, follow:

Many of the lights were so covered with dried mud that they could not be seen.

Only one truck passed the brake requirements. The stopping distance of the others varied from 34 to 85 feet.

A chauffeur employed by a common carrier made the remark, "You couldn't hire me to drive one of these trucks; it is too dangerous." This young man was, at that time, on compensation because he had dropped part of the cargo he was delivering upon his foot.

Two or three other trucks had slight leaks, consisting of an occasional drip from a faucet or union. Since leaking transport tanks had been discussed as one of the reasons for the importance of the transport problem, I called the attention of the inspectors and two other patrolmen, who were assisting, to these leaks. They agreed that there was little, if any danger from such a slight condition, but that when people saw this drip of gasoline they immediately were aroused to a danger of a tremendous fire. While we were looking at other trucks which had been lined up for

having leaks, all three of these patrolmen lit cigarettes. My comment on this was that it was just as safe to smoke in most places in our refineries as it was around the rear of a gasoline truck, but that if we caught one of our employees smoking in a refinery it would be grounds for a dismissal.

On one truck, back of the regular cab and in front of the gasoline tank, a sleeping compartment had been built out of wall board. This compartment was ventilated through an opening to the driver's cab and an open window in the back. This window was immediately above the end of the exhaust pipe.

Another driver, whose brakes did not pass tests, called his boss who ordered him to pay no attention to the inspector but to come on in. This truck was held up at the Port of Entry when it appeared there for clearance to leave the state.

The director of the Department of Inspection and Registration, and the State Fire Marshall, have formed the plan of training the state agents at the 20 refineries and 68 ports of entry in the procedure of inspecting all transport trucks either loaded at a refinery or passed through a port. The writer went to a refinery at El Dorado, Kan., and there not only watched, but also discussed the whole procedure with the two inspectors, who are inspecting trucks and training the state agents.

Of 86 trucks, eight were issued licenses to operate after the first inspection. In most of the trucks disapproved because of lighting

the operators had not complied with the regulations as to the location of clearance lights and the other lights required in addition to the headlights, etc.

In the inspection of fire extinguishers it was found that four trucks had none; one was equipped with a make not approved by the Board of Underwriters and 18 were equipped with extinguishers, one or more of which were inoperative due to lack of maintenance.

Most of the trucks not approved because of vents were not equipped with a two inch emergency vent. Some of the trucks were being passed without this equipment where the fill cap was fitted with a spring loaded vent which in the judgment of the inspector would meet with the safety requirements.

In inspecting the drag chains, it was found that 15 were equipped with chains which did not reach the ground, with three being disapproved for reasons not stated.

In inspecting exhaust systems, it was found on four trucks that the muffler had been lost, on 11 the exhaust line was too short and on five the exhaust system was in bad repair. Eight of the trucks inspected were found to be in good condition on the first inspection.

II—Discussion of Accident Reports

One of the duties of the State Corporation Commission is to make a complete investigation and report of each accident which occurs to a truck with a Commission permit where, in its judgment, such an investigation is necessary. The reports of these investigations were made a part of the material to be studied, with the understanding that since they were of a confidential nature the Commission would have to approve any reference made to such reports. Some of these accidents have definite bearing on the subject and so are included in this report.

In connection with the first accident I quote a paper delivered by J. F. Winchester at the mid-year meeting of the American Petroleum Institute. The pamphlet referred to was published by the National Fire Protective Association.

"I have never been able to understand the analysis which was given to the accidents listed in the above-mentioned pamphlet, nor can I quite comprehend some of the general deductions that are drawn about accidents of the type which are illustrated in this pamphlet:

"On July 26 a gasoline transport tank truck overturned in the street of a residential section of Ottawa, Kansas. The spectacular fire which followed the spilling and igniting of the 2,163 gal. of gasoline destroyed the truck and burned to death the driver and his woman companion who was riding with him in the cab'.

"Other facts connected with this accident indicate that the truck was running at high speed, but there is nothing in the pamphlet which brought out that a careful examination had been made of the unit to determine whether it had been constructed to the standard specifications of the NFPA, if it was equipped with internal valves; was a single- or multiple-compartment tank and, if it was so equipped, just where it failed. The fact stands out that the opportunity was neglected to check construction against actual happenings, and that two outstanding safety regulations were broken; one, the carrying of a woman companion on the seat of the cab which might under many circumstances distract the driver's attention from his duties; and, two, the vehicle was being operated at an excessive speed."

I did not read the article to which Mr. Winchester refers; however, if his statement is true that the accident was supposedly caused by high speed, this assumption is not based on the facts as revealed in the accident report. One of the witnesses made this statement: "The truck was travelling about the same speed as other traffic."

What did cause the accident?

A car was seen to come out of a side street directly in the path of the truck. In a heroic attempt to evade this car, the driver risked the loss of his life when his truck hit the curb at the side of the street and a lamp post.

In other words, the conclusion that the truck driver was directly responsible is false. The primary responsibility must rest on the driver of the car who had violated a city ordinance by crossing the main traffic artery without having brought his car to a stop.

While the driver of the truck was apparently violating a safety order of his company by carrying another person as a passenger, the assumption that this violation had anything to do with the disastrous occurrence seems far-fetched.

As a result of this accident, gasoline trucks of this size have been barred from the use

of the streets of Ottawa and some other cities in Kansas. Needless to say that any municipality, at least in Kansas, has this legal authority.

Approximately 8½ per cent of all trucks registered are petroleum carriers, and these petroleum carrying trucks reported approximately 21 per cent of all the accidents. A comment was made that this showed that the accident rate for transport trucks was higher than for other carriers. The frequencies as revealed in this report are as follows:

Live Stock Carriers—5.21 accidents for each 100,000 miles traveled.

Merchandise Carriers—1.17 accidents for each 100,000 miles traveled.

Petroleum Carriers—92 accidents for each 100,000 miles traveled.

All licensed Carriers—1.35 accidents for each 100,000 miles traveled.

The Corporation Commission at the time of making this report did not have the mileage on any trucks not involved in accidents, nor did they have all of the minor accidents

which might have been reported. However, if these figures can be taken as comparable, a frequency of .92 for transport trucks is not only lower than for the other two classifications, but is also lower than any figure compiled by the National Safety Council or the American Petroleum Institute covering a large scale of operations.

Another interesting fact is that of a total of 123 accidents reported to transport trucks, 15 resulted in a fire. More than a million miles were traveled by these trucks that reported accidents per fire. The frequency of fires per 100,000 miles traveled was .0091. This is not a true figure, as the total mileage traveled by all transport trucks was not included. It is estimated that the miles traveled per fire would be more than twice as great and that the frequency would be less than half of the frequency just given. Of the 123 accidents, 119 caused property damage of less than \$500.

Since speed was mentioned as one of the causes of the Ottawa accident, as it is in many cases, it is interesting to consider the time and mileage of eight trucks clearing through Belleville port of entry.

	Left	Arrived at Belleville	Mileage	Average
McPherson	5:30 P.M.	10:05 P.M.	110 Miles	24 mph
McPherson	4:00 P.M.	8:30 P.M.	110 Miles	24 "
McPherson	6:30 P.M.	11:00 P.M.	110 Miles	24 "
McPherson	4:20 P.M.	9:00 P.M.	110 Miles	23 "
Augusta	1:45 P.M.	9:10 P.M.	187 Miles	25 "
McPherson	4:00 P.M.	9:15 P.M.	110 Miles	20 "
Arkansas City	11:45 A.M.	8:55 P.M.	233 Miles	25 "
Wichita	8:15 A.M.	4:45 P.M.	171 Miles	20 "

The average speed given in this tabulation does not indicate that these trucks were necessarily driven at a high rate of speed.

In another accident the investigation indicated that the driver was "hitting it up" on a down grade to develop sufficient momentum to make the next grade. Due to road conditions, speed, and one or two other conditions, the truck piled up. Occurrences such as this lead to a study of the power to load ratio as a factor of safety. Obviously, there are two hazards which accompany the use of an underpowered truck. The first is exemplified by such accidents as this, relatively few in number; the second is the jamming of a number of cars behind a loaded truck which is slowly making a grade. No one

cares to be slowed down. As soon as the cause of the reduction in speed has passed, each driver immediately steps on the gas and some accidents and many narrow escapes result.

In connection with this part of the study, T. Thompson, Highway Research Specialist of the U. S. Department of Agriculture, was asked for a statement concerning an investigation he is conducting. His reply follows:

"It cannot be said that anyone has as yet worked out any logical reason for any of the various grade-minimum speed stipulations that have been suggested for proposed motor vehicle regulations. There is a general

feeling that 20 mph is about right so far as the speed is concerned, but the rate of grade to be involved with the speed is still very, very much undecided. The speed of 20 mph is selected for preliminary thinking merely because it is believed to be sufficiently above the passenger car low gear to avoid the necessity for shifting on the part of passenger car operators and sufficiently low to be reasonable requirement for trucks. I have observed that if passenger car operators are permitted to move at 20 mph there is little evidence of impatience and the resulting temptation to take undue chances in passing.

"I am at present conducting some hill climbing tests which will perhaps throw light upon the subject generally. However, the Bureau is just inaugurating this work and it will be some time before we can get the apparatus developed and procedure worked out so that a large amount of data will be available."

Chapter 283, Section 120, Laws of 1937 (Uniform Traffic Laws) passed by the State Legislature states:

"Every motor vehicle to be operated outside of business and residence districts shall have motive power adequate to propel at a reasonable speed such vehicle and any load thereon or to be drawn thereby;—and if it is a motor vehicle to be used for propelling other vehicles he shall separately insert the total permissible gross weight of such motor vehicle and other vehicles to be propelled by it."

A letter from the Motor Vehicle Commissioner's office explains the basis for such determinations.

"This department has recently made several tests of various motor vehicles to determine as far as possible gross loads that may be safely operated upon the highways. The rated carrying capacity as given by the manufacturers is only used for license purposes. In determining the maximum gross weight, we take into consideration brake horsepower, torque, age of vehicle, size of tires, whether high pressure, low pressure, solid, whether or not the vehicle has overloaded springs, kind of brakes, and condition of motor.

"As far as I can determine, Kansas is pioneering, and I have definitely made up my mind that we are proceeding in the right direction to make our highways safer. So far truck owners seem to be pleased with this method of procedure, but the law has

not been in force long enough to affect many operators."

An executive in charge of a large fleet of trucks commented on this:

"We are also considerably concerned regarding the proposed ability factors which are now receiving an increasing amount of attention. By and large, we are in favor of such a move, but in making this statement, we want to qualify it by saying that any such requirement should be accompanied with a number of other changes in the present laws. Regardless of how the ability is arrived at, that is, by simply applying a minimum speed limit on a given grade, determining this ability by traffic patrolmen, or whether it would be determined by calculation prior to issuing the usual license, it will be necessary in general to use equipment with larger engines in relation to the gross load than is the practice at the present time. We believe it would follow more nearly present bus practice, although the requirement of 20 mph minimum on a 4 per cent grade would be far less than the average bus is capable of doing."

In the September 1937 issue of "Commercial Car Journal," George I. Hook, Editor, summarizes the opinions of 89 truck operators on the question of ability factors. The nine questions asked of each are summarized as follows:

1. 78 considered a slow-moving vehicle a safety hazard on hills; 10 said they did not, and one said trucks were not, but tractor-trailer trains were.

2. 79 favored the adoption of an ability factor to make trucks move faster on hills; 6 did not; one said it was not practical, and three gave no opinion.

3. 41 said they favored an ability factor of 4 per cent grade at 20 mph; 8 favored a factor higher than 4 per cent at 20; 3 favored between a factor of $\frac{3}{4}$ and $3\frac{1}{4}$ at 20; 2 favored 4 at 20 for truck and 2 and 3 per cent at 20 for trains and six-wheelers; 10 definitely favored factors lower than 4 at 20; 15 gave no answer; 8 gave incomplete replies; one did not favor a factor and another thought it impractical.

4. 53 said 75 to 100 per cent, inclusive, of their present trucks could meet the factor they favored; 20 gave replies under 75 per cent and 16 did not answer.

5. 23 asked no time extension to meet the factor they favored; 34 asked 1 to 3 years;

17 asked 3 to 5 years; 3 asked 5 to 10 years, and 12 did not answer.

6. 12 said they now specify an ability factor of 4 per cent at 20 or better; 12 definitely specified a factor under 4 at 20; 41 said they did not specify a factor; 6 gave incomplete answers; 17 gave no answer, and one gave a variable.

7. 60 said from 75 to 100 per cent, inclusive of their present equipment would meet a safety factor of 4 per cent grade at 20 mph. 20 said less than 75 per cent would meet it, and 9 did not answer.

8. 34 said their maintenance costs would not be affected by the imposition of a 4 at 20 factor; 15 said they would be lower; 6 said the effect would be "very slight," "very little," "not much"; one said they had already accomplished a reduction by means of the factor; 13 said maintenance costs would be increased; one said the effect would be "not good"; 18 gave no answers, and one said the effect would be to eliminate old equipment. Seventeen said total operating costs would not be affected; 15 said they would be lowered; 5 said the effect would be "very little," "not much," "problematical," and "little difference"; 17 said total costs would be increased, a number of them explaining that unit or per mile costs would be reduced as the result of a greater mileage; one said he had accomplished a reduction by means of the factor; 34 did not answer the question.

9. 61 said speeding up of trucks was economically imperative; 14 said it was not; 14 gave no answer.

These opinions all point to the importance of ability factor. A definite formula must be formed. A purchaser of a truck, knowing the load he wishes to haul, should know all the requirements and conditions considered under the factors of brake horsepower, torque, age of vehicle, size of tires, etc.

The opinion that "unless the industry regulates its minimum speed to a reasonable pace we believe authorities will do it for them" should not excite fear in the minds of operators unless they believe that "authorities" may act before sufficient information is developed or will otherwise act unfairly. The writer cannot agree that this is altogether a problem of the industry. Would it not be better to state that authorities and the industry should work out a satisfactory ability factor than to line up the authorities against the industry?

In several other cases it was established that the trucks involved were not following the rules and regulations formed by the state bodies given this authority. Of course, as stated in the rules, it is the duty of the owner to inform his driver of the rules and see that all requirements are met. But there are sometimes conflicts between the rules of the several departments.

Here is part of a letter relative to such a conflict:

"A state law gives us the right to carry reflectors. A rule put out by the State Fire Marshal merely requires flares. And a regulation put out by the Corporation Commission under the Motor Carrier Rules and Regulations requires electric lanterns."

If the state authorities would publish all rules in one volume and eliminate any conflicts which may exist, they could more logically insist on a complete understanding of their rules. And then, to go a step further, if the enforcing of all rules could be done by one agency, there should be fewer disagreements on interpretations.

Several other accidents were reported as caused by sleepy drivers. In one of these a total of 8,142 miles was driven in 27 days by two men in a sleeper cab. This is an average of 301.5 miles per day. No indication is made in the information as to how long these men were off duty, how long they spent loading and unloading, etc. However, in this one case these men had been on duty too long. In fact, they went to sleep.

It might be enlightening to quote from a statement from this report.

"Most owners do not instruct their drivers as to the specific number of hours to drive and hours to rest. Their instructions usually are that if they get sleepy to pull to the side of the road and sleep until they are ready to go again."

Many studies have been conducted of this because of sleepy drivers. The National Safety Council in its pamphlet, "How Long on the Highway" says:

"The large proportion of truck drivers who have their sleep accidents only a few hours after they have rested speaks eloquently as to the quality and extent of that rest; it indicates that many have no normal rest for some time—after a complete report of a study conducted by this organization, the following general recommendations are made.

"(1) The element of fatigue should be given a more important place on accident report forms used by fleet owners, insurance companies, states and cities. In addition to or in place of the usual items concerning the driver, 'asleep' and 'fatigued,' spaces should be provided for recording the number of hours during which the driver had been on the way prior to the accident and the amount and place of sleep during the preceding 24 hours.

"(2) There is urgent need for scientific research to determine what effect continuous driving, long hours without sleep, and various mechanical aspects of vehicles have on fatigue and to ascertain the recuperative value of various rest periods. Such research should also bring out, if possible, what degree of fatigue is dangerous and how different individuals vary in susceptibility.

"(3) Companies operating vehicle fleets, and individual truck owners, should voluntarily organize their business to avoid excessively long hours of duty for drivers and thus to minimize the number and cost of accidents which inevitably result from driving while excessively tired. Drivers of private passenger cars should also be brought to realize the danger of driving when very tired or sleepy.

"(4) Every state should limit the hours of duty of all drivers except those of private passenger cars. Such limitation should cover total working and waiting time and not merely the time spent at the wheel or on the road. These laws should specify also the amount and conditions of rest required to interrupt such a period of duty.

"(5) There is need for agreement among the states as to what constitutes time on duty and the conditions under which rest may be obtained.

"(6) Definite procedures for the enforcement of hours-of-duty regulations must be undertaken if they are to be effective. The authorities responsible, the methods to be used and the source of funds for such enforcement should be fully considered. It is especially important that violations be detected and prosecuted when they occur in connection with accidents.

"(7) Trip records carried on the trucks and systematically inspected should be adopted as the most practical means of securing compliance. To avoid hopeless confusion in interstate trucking, all states should

cooperate fully with the Federal government in this matter."

Charles G. Morgan, Jr., in his booklet "Hours and Truck Accidents," published by the American Trucking Association, has a different slant on the reason for these accidents which occur in the first few hours of service after a period off duty.

"While these studies may be of insufficient scope to be used as the basis for final conclusions, nevertheless, we believe they cover enough ground to indicate tendencies and inferences which cannot be denied without more inclusive study.

"The first of these inferences is that hours of duty have no relation to accidents, at least up to 16 duty hours. There may be a period when the hours on duty will bring on sufficient fatigue to make a driver unsafe, but what the period is cannot be determined from this study which includes almost no material on driving accidents occurring after 16 hours' driving.

"During the recent hearings, many of the driver witnesses placed on the stand by representatives of labor, seeking a short working day, testified that throughout their extended experience as drivers working long hours, they had not had an accident.

"In the few instances when witnesses were placed on the stand with bad accident records, testimony revealed that these drivers worked as much as 20 hours a day (sometimes more) week in and week out, sometimes without even a Sunday off in which to obtain rest and recreation, and usually getting what sleep they could on the seat of the cab between trips. Naturally, the organized trucking industry, like all other humane and safety-minded agencies, would never condone or approve any such requirement of working hours, and such testimony is weak because of the extremes represented, which are the exception rather than the rules.

"J. S. Baker, of the National Safety Council, author of 'Too Long at the Wheel' and 'How Long on the Highway?', publications which have aroused a great amount of animosity against the trucking industry, testified on the witness stand at the above mentioned hearing that in his opinion a driver, having adequate rest before going on duty, would be a safe driver for as much as 15 hours of consecutive duty. This statement bears out the evidence set forth by Studies 1 to 5 herein.

"A second inference to be drawn from the material here presented is that hours of rest before any period of duty have no effect on the frequency of accidents after going on duty.

"A further inference to be obtained from this material is that the time and duration of stops have no effect to slow up accident frequency.

"A final inference is that perhaps one of the contributory causes in highway accidents is being 'too fresh,' or too well rested. The general trend of all of these studies is to show that accidents happen in the early hours of duty or the early time after a stop. It may be deduced, therefore, that these drivers of motor trucks become safer the longer they remain at the wheel within reasonable limits. This can lead to but one conclusion and that is that drivers when first behind the wheel are so refreshed and rested that the duties of driving do not take all of their energy, either physical or mental. They find driving requires so little of themselves that they are inattentive or rather attentive to other things than driving, with resultant accident. As the tour of duty progresses and they begin to tire, they gradually concentrate more on their driving and have fewer accidents as the hours of driving increase.

"While this is but an inference, it is our hope that it and this material will not be put aside lightly, but that it will inspire other agencies to pursue the subject, making inquiries of a similar nature not only in truck and bus operation, but also in regard to pleasure car drivers and accidents."

III—Can Gasoline Be Transported Safely?

This question can be answered only in the affirmative. It not only can be, but it is transported safely every day. In this connection a statement from C. W. Kelley of the Transport Company bearing his name is included.

Mr. Kelley's letter follows:

"We are outlining below our set up in regard to safety, etc.:

"Before a driver is employed his past record is checked carefully to see that he has had at least one year's experience driving a semitrailer outfit, and to see that his record as a safe, careful driver is good. He is also required to pass a physical examination

before a licensed physician in compliance with the rules of the Kansas Corporation Commission. He is also required to make at least one student trip with an old experienced driver and get an OK from that driver. He must meet all of the requirements set out above before he is put on the payroll or sent out with a truck alone.

"Two drivers are assigned to each truck and the runs are so arranged that the drivers can be changed either at Hutchinson, Midway, Newton or McPherson within eight to fourteen hours after going on duty in the large majority of instances. We have one sleeper cab truck which takes most of the longer trips that cannot be made in 16 hours driving time and, of course, there are two drivers on the sleeper. On the few other long trips one driver takes the truck on the long end of the trip and stops for rest enough that he is never on duty more than 16 hours in any 24 hour period.

"All but three of the trucks operate out of Hutchinson and at the end of 90 per cent of the trips they come into Hutchinson and are put into our shop for inspection and repaired. The driver must turn in a "Shop Ticket" with a record of his trip and a record of his observation as to the condition of the truck, and then the mechanics inspect the trucks for other defects, etc., and all necessary repairs are made, oil and tires checked, etc., before another trip is started.

"The other three trucks work out of Augusta and the foreman there inspects each truck at the end of every trip and drives each truck about one trip out of eight, and he sees that all necessary repairs are made and that the trucks are kept in A-1 shape. These trucks get into Hutchinson about once a week and at that time they are inspected in our shop in the same manner as the Hutchinson trucks.

"From January 1, 1937 to July 31, 1937, our trucks operated 803,381 miles in Kansas and a total of 856,118 highway miles in Kansas, Oklahoma and Colorado. During this period our trucks were involved in five (5) minor highway accidents.

"This averages approximately one minor accident in a highway distance traveled equal to seven times around the earth at the equator."

It will be noted that this company has operated with a frequency of .62 accidents for each 100,000 miles driven. Does this figure mean that all of the publicity concern-

ing accidents and the danger of the transport business, and the feeling of the public against the transport business is wrong? The answer to this question is a partial "yes." As long as some few trucking firms will not pay attention to the principles underlying the safety rules and regulations, the answer will still have to continue to be only a partial "yes."

IV—General Discussion and Conclusions

From the material included in this report and the work done in accumulating it, the writer concludes that although some accidents have been serious and some conditions which did exist were not conducive of safe operations, the great wave of unfavorable publicity given the gasoline transport business has so affected our thinking that we have been content to base our conclusions on the partial truths given us by the newspapers.

On the other hand there are certain problems which must be considered in summing up this entire study. It is the writer's opinion that a brief discussion of such problems and the conclusions drawn will help in the solution of similar problems in other states, although they are of primary concern to those operators routing trucks over the highways of Kansas and to the officials concerned with the regulations of the transport traffic in Kansas.

There are certain inconsistencies in the regulations of the several departments. If it is necessary for several departments to share in the formation of these regulations it is the opinion of the writer, and of several operators with whom this was discussed, that these inconsistencies can be eliminated by:

- (a) The complete revision of all laws and regulations existing and their printing in one volume.
- (b) Furnishing each enforcing officer not only with the laws and regulations, but also with correct interpretations concerning these.
- (c) The authorization of one group to enforce all laws and regulations, or of each of the several groups to enforce only some specific rules.

There is another inconsistency which is an example of what may happen when some states form regulations which differ from those of other states.

This condition applies not only to trucks handling gasoline, but to all trucks operating under the jurisdiction of a regulatory body. A truck hauling gasoline from Oklahoma into Kansas, if it complies with the regulations of both states, will be equipped with the following lights:

FRONT—2 headlights; 2 clearance lights; 1 cluster of three lights.

REAR—1 tail light; 1 stop light; 1 license light; 2 clearance lights; 1 cluster of three lights.

(The first three mentioned may be one unit.)

SIDE—2 marker lights on each side.

The necessity of having clearance lights front and rear and a cluster of three lights at top, both front and rear, has not been satisfactorily explained.

Such an installation of lights will use between 20 and 22 amperes, which imposes too great a load on standard batteries and generators, which results in burned out generators, batteries, lights and fuses. Obviously, lights that are not burning are unsafe. Of course, heavy generators, batteries and extra fuses can be installed, but such expense, since it will not make the driving of a truck any more safe, is needless.

Obviously, such inconsistencies could not exist if all states would adopt the requirements of the Interstate Commerce Commission.

As a further aid to the elimination of all contradictory regulations, it is recommended that each state select some operators of trucks and safety men to act as an advisory committee in the formation or revision of all laws and regulations which are proposed for the purpose of promoting safety.

Given consistent regulations and strict enforcement of these regulations, the safety of the gasoline transport business will depend on those responsible for the operation of each unit. There was an apparent feeling on the part of some truck drivers interviewed that the state inspectors were "cracking down." This is possibly true. The writer noted no feeling on the part of inspectors that they had a quarrel with the trucking industry. However, when the safe principles of operations, which it is their duty to enforce, are willfully violated there may be some excuse for the tendency to "crack down." A large majority of the operators of transport trucks are more than willing to

comply with the safety regulations if they understand them.

So much for the question of laws and regulations. The real solution of the problem rests with the industry.

Drivers should be selected because they are skilled in the manipulation of a truck and because they are known to be men of good habits and reliable character.

Trips must be scheduled so that the driver will get the proper amount of rest and will not be required to become so fatigued that he cannot give proper attention to the business of driving. It is not enough to instruct drivers to rest when needed.

Good equipment which will meet all reasonable standards of safety must be purchased and maintained in good working order. Tanks must be properly mounted; the

trucks equipped with sufficient braking ability, etc.

In general the safety problem of the transport business is the same as for the operation of any fleet of trucks or cars. The elimination of accidents through good safe driving will eliminate such instances as we have seen so unpleasantly spread across the pages of our newspapers. In this connection it should be mentioned that many of the accidents which have occurred in Kansas have been caused by the driver of the other vehicle involved and not by the truck driver. The elimination of the heedless drivers and of unsafe driving practices on the part of the general public must be considered if a large part of the highway safety problem, and of this particular part of that problem, the safe transportation of liquid fuels, is to be solved.

The I. C. C. Safety Regulations

By H. H. KELLY

Chief, Section of Safety, Bureau of Motor Carriers, Interstate Commerce Commission, Washington, D. C.

(Editor's Note: This is an abstract of the remarks made by Mr. Kelly.)

Mr. Kelly explained that the Interstate Commerce Commission has promulgated safety regulations applicable to interstate motor carriers operating for hire (buses and trucks). He outlined briefly the four parts which comprise these rules, including qualifications of drivers, rules of the road, certain parts and accessories necessary for safe operation and the reporting of accidents.

Although in effect only a few months, these rules have been adopted in whole or in part by 27 states, this action constituting a material contribution to the cause of greater uniformity, greater nation-wide uniformity in safety requirements. They have been reprinted by trade associations, publications, insurance companies and others, and distributed in large numbers throughout the United States. Schools have been conducted for drivers and other employees by many large carriers.

Numerous manufacturers have prepared "I.C.C. Kits" of such items as flares, fuses, etc. As an example of the rapid acceptance of the regulations, Mr. Kelly cited the Commission's requirement for amber front clear-

ance lamps, and said that any observer of night traffic on the highways could not fail to be impressed by the already general use of these lights.

He said that the Commission, in continuing action upon its "long-term program" of safety promotion for interstate motor carriers, now has under consideration further important subjects, including hours of service of drivers, the transportation of explosives and other dangerous articles, methods of controlling top speed of vehicles, and the comparative merits of laminated and "case-hardened" glass for use in buses and trucks. He said that the Commission would probably undertake in the near future an investigation into the matter of uniform standards of size and weight of motor vehicles, as specifically provided for by the Motor Carrier Act, 1935.

Outlining enforcement plans, Mr. Kelly stated that the field force of the Bureau of Motor Carriers, I.C.C., although small, is already checking vehicles as to compliance with the safety regulations, visiting carriers and advising them on safety matters, observing vehicles in operation on the highways, seeing to the proper reporting of accidents and the like. He emphasized the importance

of state cooperation in enforcement, observing that where states had identical requirements, their enforcement activities could be effectively directed to both interstate and intrastate operations.

As further indication of the Commission's practical approach to safety problems, Mr. Kelly said that the Bureau of Motor Carriers has a well organized safety program in operation for its own field personnel throughout the country, and that the fleet of official cars driven by these men is enrolled in the National Fleet Contest of the National Safety Council.

Following the addresses a film on the transportation of liquid fuels was shown

In conclusion he said that there is every reasonable expectation of notable success in the safety activities of the Commission in behalf of interstate motor carriers, not only because of its reasonable and practicable regulations, but also because of the fact that these transportation enterprises must achieve safety if they are to remain in business and their drivers must practice safety to keep their jobs. If a similar sense of responsibility could be developed in the minds of the private passenger-car drivers of the country, he felt, there would be an immediate and radical reduction in the nation's present highway accident toll.

through the courtesy of the Standard Oil Company of New Jersey.

THURSDAY AFTERNOON SESSION

October 14, 1937

JOINT SESSION WITH THE STREET AND HIGHWAY TRAFFIC SECTION

The meeting was called to order by William C. Knoelk, Chairman of the Street and

Highway Traffic Section, who presided, introducing the speakers.

Report of Joint Committee on Vehicle Loads

Presented by RALPH A. MOYER

Professor of Highway Engineering, Iowa State College, Ames, Ia.

This report, prepared by the joint Committee on Vehicle Loads, was presented by Prof. Moyer in the absence of Prof. John S. Crandell, Department of Highway Engineering, University of Illinois, Urbana, chairman of the committee.

Shortly before the Atlantic City Congress a year ago, a committee was organized to study vehicle load limitations. The subject assigned was, "What Are the Elements in the Relation Between Loads, Speeds and Grades, and

Braking Distances Which Should Govern Load Restrictions?"

Such discussion as took place during the first meeting of the Committee at the Congress a year ago dealt almost entirely with the difficulties of enforcement of any such regulations as might seem desirable, and the effect of inadequate maintenance on such performance. It was rather apparent that the Committee acknowledged the existence of the problem but recognized that the solution called for the careful consideration of the

many varied factors which relate to commercial vehicle operation.

While the primary purpose of this Committee is to offer suggestions and recommendations which will contribute to greater safety, there are certain practical limitations which must be recognized in the solution of the problem. In fairness to all of the interested parties, studies which deal with the problem should be so broad in their scope and so complete that the conclusions reached from such a study will be fair and proper. Studies in which only local situations are considered, or in which only a limited number of observations are reported, are likely to give a distorted picture of the true facts relating load limitations as they affect speed and stopping distance.

The Committee seemed to agree that it should not attempt to conduct studies for which it did not obviously have the facilities to get the true facts. However, at this time studies are being conducted in a large number

of states as a part of the state-wide planning surveys, in which the U. S. Bureau of Public Roads is cooperating, which will provide the type of information useful for study and interpretation by this committee.

In the administration of certain laws in several states, studies are being carried on, or are contemplated. Also, the Section of Safety, Interstate Commerce Commission, has conducted certain hearings and investigations and is planning further investigations along these lines.

In view of the lack of adequate information at the present time, the Committee has no definite recommendations to offer in regard to load restrictions. It is the opinion of the majority of the Committee members that this subject is of such importance that the Committee should be continued and that every effort be made to obtain these reports as soon as released, to encourage their early release, and to assist in preparing a report to be presented at the next Congress.

Selecting Street Car and Bus Stop Locations

By T. E. TRANSEAU

Assistant Director, Department of Public Safety, Philadelphia, Pa.

Street cars and buses have been a part of our municipal life for more years than most people would suspect. True, both buses and cars were originally horsedrawn. Many horsedrawn and cable cars were not succeeded by trolley cars until comparatively recent years.

Now, in many cities, the trolley cars have practically passed out of the picture. The great increase in motor buses has taken place in the last 10 years.

In the early days, little consideration was given to proper stopping places for trolley cars and buses. The amount of vehicular traffic on the streets was not sufficient for a great many years to cause any real problem. The beginning of this problem can be thought of as running parallel to the vast increase in the motor car, which, as we all know, took place following the World War.

There were less than 1,000,000 motor cars in the United States in 1911 and, by 1917, there were only 5,000,000. During 1922 alone, the increased registration was 6,000,000. As

the motor car increased, the problem of handling the trolley cars and buses likewise increased.

At the 1936 National Safety Congress and Exposition, during one of the street and highway traffic safety sessions, there was a spirited discussion on the proper location for trolley and bus stops. The writer, in attempting to arrive at a solution for this problem, wrote to transportation and traffic officials in a number of our largest cities.

Obtaining the Evidence

It was felt that, if an expression of views of those charged with responsibility for the movement of traffic could be obtained from a sufficiently representative number of cities, some light might be thrown on the differences of opinion that were not satisfactorily explained in the Atlantic City meeting.

At present, responses have been received from practically all of these cities and it is now possible to present for the first time authoritative views of the different engineers

and, in a considerable measure, to explain why practice differed in the past, and to offer some recommendations for the future.

Among the questions asked of those to whom the questionnaires were sent were the following:

1. In your city, where do the buses and trolley cars stop—near or far side, or a mixture of both?
2. Do you have any mid-block stops?
3. What has your accident experience been?
4. Do you have any decided opinion on the wisdom of near or far side stops?

In addition, it was hoped that some of those addressed would go into some detail, expressing their views and helping to throw light on the whole problem.

A summary has been made up of replies to the above questions from 11 principal U. S. cities. The names of the cities have been omitted because in the time available it was not possible to collect and digest the data thoroughly from any very large group of cities. Furthermore, it seemed impossible to get some of these cities to respond to repeated requests for information, so it was best not to name the cities. Ample opportunity will be offered for discussion, either in writing or at the sessions of the Safety Congress, to those who wish to go on record concerning the practice in their particular municipality.

The replies to the principal questions are listed in the table on the opposite page.

Analysis of Replies

An analysis of these data reveals the near side stop is in the majority in most of the cases, although most cities have some far side stops, for reasons which will be touched on later. In two cities, including the largest in the country, it was found that far side stops are in the vast majority. In one of these cases, practically all stops in the central districts are far side, and elsewhere the near side stops are preponderant.

Most cities have some mid-block stops. It is not believed that these are advisable for any reason except because of extremely long blocks. Also in the case of one city, several important bus routes lie along the waterfront and stops are made at certain piers irrespective of street intersections.

No definite information was obtained on

the relative number of accidents due to near or far side stops. In fact, it would not appear that any city has any real data concerning this matter. One engineer believes the buses in general have less accidents than the trolleys. Four cities reported their accident experience with both buses and trolleys led to the belief that mishaps were very few. One important city stated as a matter of interest that they changed from the far side to the near side stops on their trolley lines 25 years ago and they actually had less accidents in 1937 than in 1912.

The following principal arguments were advanced by the correspondents favoring the near side stop: At certain locations, if far stops were made, buses would block the cross street and also obstruct the following traffic. This would be particularly true where the parking demand is heavy. It has been stated also that, with trolley cars, far side stops may cause accidents by pedestrians passing around the rear of trolley cars.

Some of the correspondents stressed the fact that, where there are traffic signals or stop signs, it frequently would be necessary to make two stops at the intersection where the far side stop is used.

One correspondent pointed out, however, that buses sometimes tend to block the view of traffic signals, and in that particular city at important intersections signals are placed both near and far side. Several correspondents emphasized the importance of a bus or trolley stopping before crossing the intersection because of reduced speed while proceeding across the intersecting street.

In one large Eastern city where both near and far side stops are in use, it was found that a survey is in progress with particular attention being paid to the delay or lost time caused on signalized streets by the possibility of buses having to stop on the near side for red light and then stopping again at the far side. This city no longer operates many trolley cars. Although it was not so stated, it appeared from the report that a decision would be made as to the general use of near or far side stops based upon time and delay studies which were in progress during the preparation of this paper and which have not been completed.

Apparently the desire to move traffic efficiently in this city has outweighed in the minds of the traffic authorities any consideration of public safety that may possibly be inherent in the near or far side stop.

The following points were made by those who favor the far side stop:

1. In one city it was stated that trolley car loading zones are located on the near

side. These zones are 88 feet long and parking is restricted for 108 feet—street widths are insufficient to permit buses to stop in this bottleneck.

City	NEAR or FAR Side Under Present Conditions	Mid-Block	Accident Data	Analysis and Disadvantages—Opinion of Traffic Manager
No. 1	Practically all FAR in Central District. Practically all NEAR otherwise.	3 or 4 extremely long blocks	None	No comment—not enough data.
No. 2	95% FAR side.	Yes, some blocks 800' long.	Few accidents directly due to NEAR or FAR stops.	Favor FAR stops due to trolley loading zones on NEAR side. At signalized intersections FAR side stop expedites traffic movement. Also right turns are permitted on red light—NEAR side must be kept clear. In general FAR side stops believed more practical for both buses and trolleys.
No. 3	NEAR side.	Yes, some Mid-block on Water front at certain piers.	No data.	Favor NEAR side for both buses and trolleys.
No. 4	Mixture—NEAR side greatly in majority.	Mid-block on exceptionally long blocks.	No data—buses less than trolleys.	Favor NEAR side—fears buses would block cross street and obstruct following traffic. Particularly true where parking demand is heavy.
No. 5	NEAR, few FAR	Some Mid-block on very long blocks or due to other conditions.		Favors NEAR side—states FAR side may cause pedestrian accidents by people passing around rear of trolleys.
No. 6	NEAR and FAR	No Mid-block	None	Believes conditions may cause decision, says FAR side may cause two stops on red light. Recognizes ability of other traffic to pass bus easier at FAR side. Takes same view as No. 2 on blocking where trolley zones are located near side.
No. 7	Practically all NEAR side.	Few, where blocks are long.	No definite information but states very good accident experience.	Prefer NEAR side due to signals or STOP signs. See one disadvantage however, namely obscuring of signal. Now place signals on both sides.
No. 8	Open—seems to feel it depends on efficiency; studies being made. Samples indicate NEAR side most efficient so far—very long cycles.			
No. 9	Vast majority NEAR side.	Practically no Mid-block.	No data—Change made 25 years ago from FAR to NEAR side.	Like fact all modern trolleys made NEAR side. Less accidents in 1937 than in 1912.
No. 10	Few exceptions to NEAR side stops.	None	Very few accidents.	Opinion NEAR side the best—cites fact bus must come to stop before crossing intersection as important.
No. 11	NEAR side used except when FAR side seems more practical.	Do not favor mid-block stops.	Accident experience low.	NEAR side believed less hazardous because of opportunity for bus drivers and cross traffic to observe each other. Disadvantage of NEAR side is interference with movement, right turns, etc. In some places curb terminal facilities better on FAR side.

2. If bus stops were made on the *near* side where these safety zones are located it would create a hazardous condition for pedestrians crossing to and from buses or street cars, presumably because with these long safety zones, car riders do not always use the crosswalks and might be struck because of a bus obscuring vision of approaching drivers.

3. Where the intersection is signalized, the bus stop on the *far* side expedites the movement of traffic as there is no delay in one lane of traffic while buses are loading or unloading passengers.

4. *Near* side bus stops, under conditions mentioned above, would interfere with vehicular traffic which is allowed to make a right turn on a red light in some cities but must stop before making the turn. It is claimed that buses loading or unloading would interfere with this traffic movement.

Conclusions

The writer feels a very good case has been made for the *near* side stop under normal conditions. However, it is clear that those who have advocated the *far* side stop did so because they have conditions in their cities which make it virtually necessary not to stop on the *near* side of the street although there may be disadvantages in the *far* side stop.

Practically all modern trolley cars are now constructed for *near* side stops. The advantages that have been cited for the *near* side stop are undoubtedly important. Perhaps the principal one is the fact that the vehicle, be it trolley or bus, moves across the intersection at a slow rate due to the fact that it is a heavy vehicle operating from a standing start.

In Philadelphia, the traffic engineers a number of years ago provided loading and unloading zones along all principal bus routes at least 100 feet long. It was found that a modern bus needed approximately 90 feet in which to cut over to the curb so that it could load parallel to and within a reasonable distance of it.

The increasing use of traffic signals in cities makes the argument concerning the necessity for double stops of more importance. In Philadelphia, our signal cycles are hardly ever over 50 seconds, which means that if a bus or trolley is unfortunate enough to catch a red light just on the conclusion of loading, the delay need not be very great. On the

contrary, with the *far* side stop, the chances of having to make a double stop at signalized intersections appear to be about 50-50.

It is hoped that the large Eastern city previously mentioned now making a study of delay due to *near* and *far* side stops, will present these figures publicly at the conclusion of their survey. Yet—efficiency of movement alone should not be the sole determining factor on the relative merits of the *near* and *far* side stop.

It is unfortunate that none of the cities who responded to the questionnaires were in a position to furnish any data concerning relative number of accidents under the two methods. While the securing of this data may be quite impossible in some cities, it is strongly urged that wherever possible a start be made in securing accident data.

Again, it cannot be denied that in some cities the *far* side stop is preferable. Nearly all cities use some *far* side stops. In Philadelphia, at one notable location, a *far* side stop is used because the street width on the *far* side is considerably greater than on the *near* side. This permits the bus to stop in a lane of traffic which interferes not at all with moving vehicles. At another Philadelphia location, a *far* side stop is made by the bus line because the *near* side stop would necessarily be at a location where a very heavy and important right turn is made and where pedestrian traffic is tremendously heavy.

In a few other cases unusual street intersection layouts have brought about *far* side stops. Those who advocate *far* side stops appear to feel the necessity for their use in cases where there are safety zones occupying a considerable part of the street or where right turns are permitted and vehicles stand in these throats. These reasons diminish the very real advantages of the *near* side stop. It would appear they recognize the disadvantages of the *far* side stop but feel that, under their particular conditions, the advantages outweigh the disadvantages.

In conclusion, the writer believes that the evidence favors the *near* side stop, wherever possible, for the following reasons:

Operating

1. Permits saving in transportation expenses by eliminating necessity for double stops at each main street intersection when the *far* side stop is used. This permits faster

time schedules which result in a saving in wages and supervision. In addition, less rolling stock is required.

2. Saves power—fewer stops and starts reduce power consumption and use of motor fuel.

3. Reduces maintenance costs—fewer stops and starts save wear of equipment including motors, brake shoes, wheels, track, tires, etc.

4. Reduces "passing up" of passengers. This practice is encouraged by the *far* side passenger stop, thus improving public relations.

Safety

1. The *near* side stop reduces accident hazard to alighting and boarding passengers due to the fact that vehicles following and paralleling trolleys and buses approaching the intersection are normally being decelerated and are therefore under better control. With the *far* side stop, vehicles following and paralleling street cars are normally being accelerated after leaving intersection.

2. Fewer starts and stops reduce the hazard of passengers falling inside street car or bus.

3. The *near* side passenger stop reduces possibility of right angle vehicular and pedestrian collision at the intersection, due to the fact that a full and complete stop is required at the *near* side building line when there are passengers to board or alight.

4. The *near* side passenger stop, by reducing the delay occasioned by additional stops required by the *far* side passenger stop, serves to keep the operator in a better frame of mind, which results in reduced accident proneness.

5. Change at this time to a general policy of *far* side passenger stops would require re-education of the motoring public.

More Data Needed

It seems an opportunity should be created for securing of more factual data concerning this matter and that a vast saving could be made in many cities by careful study of the various factors involved. For instance, those of us in Philadelphia charged with the responsibility for traffic movement have long felt that the average American city uses en-

tirely too long a cycle in traffic timing. Since 1931, except in very exceptional cases and then mostly at three-way intersections, no cycle over 50 seconds has been used. As a matter of fact, many of our cycles are only 40 seconds.

Our streets are, in general, narrow and permit the use of the lesser cycle. Yet, personal observation has shown that in many cities, merely because the streets are somewhat wider, cycles are in use which are out of all proportion to the real needs of the traffic, vehicular and pedestrian. Where street widths are great the minimum time required for the lesser street may be merely the walking time of the pedestrian.

Impede Traffic

Excessively long cycles hold up vehicular traffic to the extent that considerable time is lost after the "Go" signal comes on and many vehicles are not able to start until several seconds have elapsed. If this is the case, an effort should be made to shorten the cycles to a reasonable period. There can be no question that the delays imposed on vehicular traffic by excessively long cycles help to aggregate an enormous amount of valuable lost time, not to mention the psychological effect on motorists and pedestrians.

It is obvious that the full force of the statements made herewith apply to bus and trolley car transportation. Many years ago, we had one experience where traffic signals had to be abandoned on a street because of their unpopularity. This was almost entirely due to the extremely long cycles in vogue at that time, blocking of the street by trolley cars and the impatience of the motorist behind the trolley.

Correct Timing

Nowadays, we are placing traffic signals on the same street using short and snappy cycles, moving traffic safely, and pleasing motorists, pedestrians and business men.

It is strongly urged that those charged with the responsibility for the movement of traffic in our cities, and those interested in bus and trolley car operation, give some time and study to this important subject and there can be little question that whatever time may be devoted to this work will have been very wisely invested.

Near Versus Far-Side Stops

By E. J. KREH

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Determination of the relative merits of near and far side stops for mass transportation vehicles is a complex problem, involving many factors and the interests of many groups. Unless each element is considered and given proper weight in accordance with the benefits desired, one is likely to be deceived and led to believe that through change in stop location he has corrected a fault when, in reality, he has created many more. In addition, he has jeopardized the rights, privileges, safety, and convenience of other groups.

Speed, direction, and volume of vehicular traffic, signs, signals, grades, curves, width of street, location of crosswalks, street lighting, and condition of street paving are only a few of the many important factors which must be considered. Drivers, pedestrians, passengers, abutting property owners, business interests, municipal authorities, and the transit company are a few of the interested groups involved.

While speed of traffic flow is important, so are passenger, vehicle, and pedestrian safety, and passenger convenience. Which shall take preference is a debatable question answered only by careful consideration of all of the facts and interests involved.

In my experience in dealing with accidents, which has extended over more than 25 years, I have found that the location of a stop many times is a contributing factor in the cause of accidents involving the mass transportation vehicle and its passengers.

Stop locations are elements in the cause of falling in car or bus, collisions, and derailments. The safety phase of this problem alone demands the interest and attention of the transit operator. Aside from that, however, improper location of stops produces other evils which can seriously hamper the service.

A great deal of the agitation for change in stop locations originates with those interested in the speed of traffic flow. Usually, they advance their theories on the basis of consideration for that element alone.

The transit operator has as great, if not greatest interest, in the speed of traffic flow than any other group, because anything

which slows up traffic delays the transportation vehicle, reduces service, raises operating cost, and cuts revenue.

The transit operator, because he is so vitally concerned, will be the first to relocate stops if such action will minimize delays without introducing greater evil. Passengers are constantly demanding higher speeds to match the performance of the private automobile. This obligates him to do his utmost to promote the free movement of all traffic.

With their background of experience and extended interest in the problem, transit operators are unanimous in their opinion that the near side stop generally has many more advantages than the far side stop.

Because there are so many different types of cars and methods of fare collection, it is extremely difficult to set forth an argument which is logical under all conditions. It is, therefore, necessary to confine the scope to types of equipment which, I believe, are most commonly used.

The arguments which follow, unless otherwise specified, are based upon the assumption that the mass transportation vehicle receives and discharges passengers at either front or center doors, or both, and is one man operated. I set this limit merely to clarify my reasoning and not to imply that two man, rear door cars and buses are excluded. Many of the arguments apply to them as well.

On this basis, the following items are presented. We believe they justify the conclusion that the near side stop gives greater and more advantages than the far side stop.

1. To protect pedestrian and vehicle traffic crossing intersections. Safe driving requirements, as well as highway regulations, signs and traffic signals, now require slow movement or a full stop on the near side of the intersection for all traffic. Near side stops encourage adherence to these safe practices, whereas, with far side stops, there will naturally be greater approach speeds to and through the intersection by buses and street cars. Operators will be encouraged to disregard caution and slow signs, and will be tempted to beat the changing traffic lights.

2. All vehicle drivers are now educated to expect near side stops. Any wholesale modification would, undoubtedly, lead to confusion, endanger pedestrians, and cause rear end collisions.

3. When pulling into a stop, the operator's attention should not be diverted by cross traffic. With pay-leave, one man operation, the near side stop enables him to give full attention to the business of dealing with his passengers and stopping without jolt or jar in a safe place. Under the same operating conditions, with the far side stop, he is compelled to divide his attention between traffic movement and the demands of his passengers.

4. When a car or bus approaches a stop, most passengers intending to alight are on their feet walking inside the car. With the near side stop, there is little possibility of emergency brake application as the car pulls into the stop, whereas, with the far side stop, there is great possibility that thoughtless drivers or jay-walking pedestrians will commit acts compelling many sudden stops. Unquestionably, many more falls inside the car will occur with the stop on the far side. Also, with vehicular speeds through the intersection increased, the violence of emergency stops will be increased, adding to the hazard of throwing passengers.

5. With the near side stop, the street car or bus is required to make only one stop at the intersection. With the far side stop established, in many instances, due to stop signs and traffic signals, the transportation vehicle will be compelled to make two stops; one on the near side and one on the far side. It is the experience of all transit operators that most falls inside the vehicle occur when the vehicle stops or starts. The desirability of avoiding any practice which will increase the number of stops is apparent from the standpoint of safety to passengers, as well as delay to traffic movement.

6. With the near side stop, a street car or bus held on the near side by a red light after loading can keep doors open for additional loading while it waits for a change. With the far side stop, the car or bus is held with the doors closed, and the time awaiting the change in the cycle is lost.

With the far side stop established at heavy loading and unloading points, it is quite probable that a car or bus held on the near side of the intersection by a red light would be required by traffic demands to re-

ceive and discharge passengers at unauthorized near side stops and held there so that it would lose the green light entirely and be held over to the next. Then it would have to make the established stop on the far side. Also, when a car or bus is held on the near side at a non-established stop by a red light, passengers on the far side, if they observed the doors open and other passengers loading on the near side, would rush across the intersection against a red light to the near side; certainly not safe.

7. With the near side stop, the operator has view of three directions from which his passengers may come; from the left side, right side, and ahead. With the far side stop, unless jay-walking practices are encouraged and permitted, he will have view of only one direction, the right side. One of the greatest difficulties in both bus and car operation is to provide the driver with adequate view of passengers approaching from the rear. As yet, there has been no satisfactory development which will provide that view. Consequently, when a stop is so located that the driver has bad vision from three-fourths of the area from which his passengers come, accidents and delay naturally ensue.

8. Street areas in the vicinity of crosswalks are usually in better condition from the standpoint of paving than elsewhere. At night, areas in the vicinity of crosswalks are usually better illuminated. For the safety of boarding and alighting passengers, good paving and well lighted areas are important. If passengers board or alight in the vicinity of crosswalks, they are encouraged to use them; that promotes safety to the pedestrian. When passengers are received or discharged at the front or center doors, or both, it is possible at the near side stop to bring the car or bus to a stop with the steps over or in the immediate vicinity of the crosswalk. This is a distinct advantage in favor of the near side stop. It is not possible to have the same advantages with the far side stop unless loading and unloading is restricted to the rear end of the bus or car. Intending passengers usually congregate on or near the crosswalks. With front and center loading and unloading, the near side stop permits the car or bus to load at the crosswalk.

In residential districts, there is usually a grass plot between the sidewalk and the curb. Any concrete fillers are directly in front of private residences. Obviously, it is

not practical to stop opposite these fillers in front of private residences because of objections of the property owner. Under conditions such as these, the near side crosswalk provides the only available safe place. Stops opposite grass plots would be extremely hazardous to boarding and alighting passengers.

9. With the far side stop, the hazard to passengers coming to board and those alighting will increase for the following reasons:

a. Assume that the car or bus is stopped on the near side by a red light. When traffic starts to move on the permissive signal behind the bus or street car, there will be an urge to pass in the curb lane before the bus or car reaches the far side stop. It is easy to visualize the danger to passengers alighting or those coming to board under these conditions. In the case of buses, if traffic is very heavy, automobiles passing to the right of the bus might keep the bus stranded out in the center lane and effectively prohibit it from getting into the curb, with the result that passengers would have to be discharged in the street.

b. On one-way streets with vehicles passing on the left side of a street car stopped far side, passengers who have alighted at the front doors, and who desire to cross the street, undoubtedly, would do so in front of the car or bus and step directly into the path of traffic passing on the left. People usually use the shortest route. Therefore, if the front end of the car or bus is stopped 50 to 100 feet from the crosswalk, passengers who have alighted at the front end will cross there.

10. Buses stopped for curb loading on the near side have the advantage of a long radius turn back into the traffic lane. This is provided by the width of the cross street. Obviously, short radius turns back into the traffic lane are a distinct hazard to other traffic. This fact is recognized by highway and traffic engineers. On all the newer high speed highways, traffic coming into them from right angles is provided with a special lane of from 100 to 200 feet in length within which they are free to merge with other traffic at slight angle in order to create greater safety. This is exactly what is accomplished by the near side stop where the bus has the entire length of the intersection to execute its maneuver, whereas with the far side stop, the movement back into the

center lane must be executed within very confined limits.

11. Even in cities where parking regulations are not rigidly enforced, one will usually find a small area in the vicinity of the crosswalk on both near and far side free of parked vehicles. This small area on the near side provides sufficient space for the bus or street car to load or unload its passengers safely at the front or center doors. The same size area on the far side cannot be used as advantageously for this purpose. The bus in the curb lane stopping far side must have ample space not only to pull in and clear the intersection, but also ample space to pull back out into the center lane. A street car is 40 to 50 feet long. To clear the intersection, its front end will necessarily have to be at least 50 to 60 feet beyond the intersection when it stops. If parking is not well restricted, and ample space for loading zones provided far side, leaving and boarding passengers at the front and center will be compelled to weave their way between parked vehicles. Anything which hampers their free movement will lead to boarding and alighting accidents.

12. On streets heavily laden with street cars and the near side stop established, it is now possible for several cars to load and unload passengers at the same time. With the far side stop, unless traffic flows very freely, and there is considerable headway between cars, the first car might stop at the far side and several following cars anticipate that the first car will move ahead promptly. If the operator's judgment is in error, the second car might pull across the intersection and be compelled to stop behind the loading car, thus completely blocking the intersection. To eliminate intersectional blocking created by such a condition, it might seem advantageous to move the far side stop ahead to the middle of the block. However, where the block is short, this practically amounts to the establishment of a near side stop at the next intersection and really results in the elimination of one stop.

13. On two way streets, with turning movements allowed in all directions, the far side stop might create a distinct hazard. With the bus or street car stopped with its rear end near the far side crosswalk, it obstructs the view of both right and left turning traffic and would, unquestionably, lead to many head-on collisions between ve-

hicles attempting a turning movement right or left behind the standing car or bus.

14. Good operating practices make it desirable to have street cars pass over the crosswalks and switch points at low speed. Trolley contactors controlling electric switches are necessarily on the near side. These, too, must be passed at slow speed; otherwise, incorrect switch operation will occur and lead to derailments and collisions with passing traffic. Therefore, even though the near side stop is abandoned, street cars must slow down on the near side; thus any advantage which might be assumed in favor of the far side stop, from the standpoint of accelerating movement of traffic flow, is materially decreased.

In the foregoing discussion, I have dealt with this problem in the main from the standpoint of safety and traffic flow. While reference has been made to passenger convenience, I do not believe I have given that phase deserving emphasis. Trolley and bus patrons comprise the majority of the group who use public and private transportation facilities. The interests of this majority must be satisfied. Any transit operator can testify to the frequent insistent demands that stops be placed where they are convenient for riders. Wherever possible, the transit operator and the municipal authority are obligated to see that these demands are

met if they are reasonable and may be complicated with without adversely affecting other factors and interests.

It is also logical that stops conveniently located, where they will serve the greatest number of riders, facilitate loading and unloading and usually permit of the elimination of other stops. This helps to reduce the number of stops, which speeds up traffic flow.

While I have set forth arguments in favor of the near side stop, it must be remembered that the industry is not adverse to the far side stop when facts and intelligent reasoning indicate its desirability. We do believe, however, that the near side stop has many more advantages and should not be arbitrarily abandoned without careful study of each location and every factor and interest involved.

The free and rapid movement of all traffic is perhaps more important to a transit company than it is to any other interested groups. If the location of the stop is a factor in the cause of delay, and it can be remedied without conflicting with the safety or interest of others, the transit company can be relied upon to take action. The proper location of stops is a vital part of any successful mass transportation system. It is evident, therefore, that the transit company's interests must be guarded and no attempt made to set arbitrary standards.

The Balanced Fleet Safety Program

Talks presented at the Commercial Vehicle Accident Prevention School on Wednesday and Thursday mornings

By JAMES G. HAYDEN

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Appreciating that it will be impossible to cover the balanced fleet safety program thoroughly in the limited time allotted us, I shall attempt to touch only upon the high spots.

It takes a well rounded program to bring about permanent reductions in accident experience. Spotty methods or concentrated

drives may bring temporary results, but there is a tendency to revert to former conditions as soon as the employees lose their first enthusiasm. Enthusiasm so developed will not do the job alone. It takes something more concrete, something the driver can get his teeth into.

Management must want safety. I am con-

vinced more and more every day of the importance of a close relationship between the safety department and management. The officials must take an active part in the work of the safety department. This activity should not be handicapped by a lack of funds. The expenditure need not necessarily be enormous, but management must appreciate at the outset that the safety department has to be considered in the budget. It is not reasonable to expect anything approaching efficiency where it is necessary to spend valuable time developing makeshift methods and begging from other departments.

Certainly there is need for stenographic assistance. I know of a number of capable safety men who have failed to do a good job because they were forced to devote a large part of their time to matters which could have been handled more effectively by a stenographer or assistant.

An efficient safety department is a money making proposition and I can quote many instances where the expenditure on safety brings a higher percentage of profit than the regular business of the firm. For example, take the Continental Baking Company. They get \$4 back for every dollar spent on safety. Their business is bread and cake, and I doubt that the sale of these items results in a 300 per cent profit.

Management usually does not appreciate the cost of accidents. In the past, the records kept by the average fleet have been most inadequate. There has been a tendency to leave this phase of the business up to the insurance carrier. The cost of insurance is only a small part of the total. Surely we must consider such items as extra equipment and personnel, legal fees, time lost by drivers involved in accidents, telephone calls, towing, time spent investigating accidents, and the numerous other direct charges. Then, too, there are the intangibles such as loss of customers' good will, inability to meet schedules, etc.

It is of the utmost importance to have someone wholly responsible for safety. Except in a general way I shall not attempt to arrive at a warrant in number of vehicles for establishing the need for a full-time safety man. A full-time safety man can pay for himself in the fleet of fifty vehicles or over. A part-time safety man is warranted in the twenty vehicle fleet.

However, part-time safety men have not

been too successful. I have in mind one large fleet where this plan was tried. The individual selected was primarily interested in other phases of the business. Because of his dual interests, safety was pushed into the background and the accident experience was exceptionally high. The drivers in this fleet were also salesmen, and in many instances the cost of accidents far overbalanced the profit shown from sales on specific routes. In general, the problems confronting this fleet are no different from many others with which I am familiar. The difficulty can be traced to the ineffective safety department.

The railroads and many of our bus companies have long appreciated the importance of safety. I remind you that in most instances their safety men carry the title of "Director of Safety and Personnel." You will notice that safety is given first importance. The records of our railroads and buses testify to the value of an effective safety program.

Good safety men don't come cheap. Again I do not mean to indicate that you must pay enormous salaries. Rather, that standards be sufficiently high to interest fully qualified men.

His position in the organization must carry weight. He must have authority and command the respect of all employees. There is need for a close relationship between this man and the officials in high command. Management must be "sold" on safety. At least a monthly report should be required of the safety department. The safety director is obligated to see that this report is carefully scrutinized by management and that it is not pigeon-holed. There should be regular conferences between management and the safety director.

Certain departmental relationships are valuable and necessary; such as a close contact with the mechanical department. Even the best drivers cannot efficiently operate faulty equipment. The safety department should have the power to condemn unsafe vehicles, to demand a high standard of maintenance and even to assist in the preparation of purchase specifications. As specific types of accidents are traced to defects in vehicle design or operations, recommendations should come from the safety department for their correction.

While we are on the subject, we should discuss the proper care of equipment. Sta-

tistics attribute only some 15 per cent of our motor vehicle accidents to mechanical failures. On the other hand, I wonder just how many of the remaining accidents would have occurred had the vehicle been mechanically perfect. We cannot ask our drivers to be more efficient or careful than we have been in providing properly designed and maintained equipment for them to work with.

There is too much repair and not enough maintenance—many fleets not appreciating the difference. Repair bills, constituting the costly part of conditioning equipment, can be materially reduced through the closer inspection and better care of the vehicle. Minor deficiencies accumulate and soon become serious enough to require major repair. One medium sized fleet was able to reduce its repair shop personnel some 30 per cent by improving the inspection standards and increasing the personnel of the maintenance department only 10 per cent. I need not point out that the average cost of maintenance is far below that of repair.

The General Motors Preventive Maintenance Plan is excellent for reducing repair expense. Vehicles are routed through the shop in such a way as to spread the work throughout each month. Schedule sheets are prepared so that there is no question as to when such inspections are to occur. As the experience develops for each type of vehicle, these routings are speeded up or slowed down to bring the best results. Simple reports are kept on each vehicle to indicate both regular and special repair jobs. Driver abuse is just as apparent as mechanical failure. Years of research have established the mileages at which certain parts should be inspected, adjusted or replaced. A series of five work sheets has been designed to indicate the mechanical operations which are to be performed at the various mileages throughout the vehicle life. Likewise, this plan provides a systematic method of accumulating and interpreting operating and maintenance data.

The tie-up with the personnel department is of more than passing importance. Standards of employment should be established and maintained. Each employee should be required to furnish references concerning previous employment. These records must be carefully checked. If the accident experience has previously been bad, surely we want to know of it.

Each driver should be interviewed personally. Such interviews are invaluable in giving us an insight into the individual's attitude toward the work he is to do. Dissatisfied, timid, cocky, naturally troublesome or otherwise temperamentally unstable individuals usually do not make good drivers. Drivers who are repeatedly involved in accidents must be given more than passing attention.

Experience teaches us that it is practical to rehabilitate drivers who have been involved in accidents. It costs a considerable sum of money to train drivers properly. If successful corrective treatment can be applied to the "repeaters" there is not only a substantial saving but we already have some picture of what can be expected of that employee. This is not true of the new employee.

Many organizations are finding it advantageous to fingerprint employees. Although we perhaps should not deny employment to persons with a court record, we certainly should know of it and undoubtedly can make a better citizen and workman out of that person by being aware of the circumstances.

The training of drivers is one of the most important and effective things we can do to reduce accidents. Many commercial fleets find it especially advantageous to recruit drivers from among helpers; some prefer to train their own personnel; others hire only the expert driver. Whatever the policy may be, every driver whether old or new should have some training in fundamentals.

Every applicant should be required to demonstrate his ability to handle a car, preferably of the type he will have to operate. It is advantageous to exercise considerable of care in developing a standard driving examination, each prospect being rated on a uniform demonstration sheet. The selection program should also include examinations to detect physical or mental deficiencies. These should be followed up periodically to bring out subsequent disabilities.

Re-training is just as important as pre-training. Probably the best way to handle the former is through a series of well planned safety meetings. I stress the importance of the term "planned." In the past there has been a tendency to lean too heavily on inspirational films and speakers in selling safety to employees. If we have selected the proper kind of drivers, those who are inter-

ested in becoming more skilled in their accepted work—and I doubt if we want men who feel that driving is below their station in life—purely inspirational methods are not going to bring satisfactory results. Temporary enthusiasm will not bring permanent reductions in accident experience.

Plan your meetings carefully and give the drivers improved techniques. There are innumerable possibilities for subject material, but I tender the following as an example of the main items which should be considered:

1. Improved driving practices, safety in general, courtesy and a thorough discussion of firm policy.
2. The mechanics of the vehicle, its care and maintenance.
3. Traffic rules and regulations. We should interpret the intent of these regulations and the rights given the operator. Tie these in with company policy and likewise require the drivers to become familiar with the legal wording. Also, cover standard signs and signals and their part and purpose in the control of traffic.
4. Accidents. Cover thoroughly to include past accidents, common situations, unusual accidents, seasonal hazards, what to do in the case of an accident, etc. Determine the three or four main types of accidents experienced in your fleet and let the drivers join in on a blackboard discussion of their cause and prevention.
6. First aid.
7. An explanation of the physical problems entering into driving such as reaction time, stopping distance, skidding, passing distances, centrifugal force, force of impact.
8. Loading and unloading, how to lift large and small articles, proper storage of cargo, etc.
9. The necessity for, and proper use of, special safety equipment, such as flares, flags, chains, sanders, foglights, windshield wipers, spotlights, tarpaulins, etc.
10. Psychological and physiological tests.
11. A scored examination.

I mention psychological tests because of their educational value and not as a possible means of selecting drivers. To date we have had little success in establishing a definite relationship between the scored ratings gathered from such tests and the operating ability or accident proneness of drivers. As defects

or disabilities are indicated, it is important to discuss them with the individuals concerned, pointing out where medical correction is necessary or where compensation will give improved results. These tests further tend to indicate to employees that management is carefully scrutinizing physical condition and driving ability.

Don't make the mistake of holding too many safety meetings; certainly not more frequently than once each month. It is well to break the monotony by providing food occasionally. These affairs need not be pretentious. Light fare like doughnuts and coffee, sandwiches, cider, apples, etc., are all that is necessary.

The examination is important. Drivers will be more attentive and assimilate more of the information presented if they understand there is to be a "quiz."

We should give some thought to the persons who are to act as instructors. In the past we have concentrated on the driver, neglecting to give proper emphasis to the capabilities of the individual who must act as the intermediary. Instructions should be prepared for use by the teacher and regular meetings arranged for instructors only. In instances where these individuals are plant or terminal superintendents, it may be necessary to handle this through personal contact.

Every fleet should have its own safety manual. This treatise should cover departmental policy, traffic rules and regulations for those states covered by the fleet, what to do in case of an accident, first aid, the causes of vehicle fires, what to do in case of a fire, location of terminals, legal representatives, insurance carriers and adjusters, etc. These manuals make good material for discussion in drivers meetings. Not only should the employees be required to become thoroughly familiar with the content, but examinations should be given to determine proficiency.

A complete record of accidents is probably the one most important item in the good fleet safety program. Instruct drivers carefully in the proper reporting and handling of accidents. All accidents, regardless of severity, should be investigated. As each accident report is received in the department, it should be thoroughly reviewed and tabulated on a tally sheet. This form gives a running account of the monthly experience and permits prompt filing of the accident report, or its routing to other departments.

I would suggest one of two methods for filing the accident report. First, that the report itself is put in the individual driver's file with his complete record. A simple cross index card file can be used to give the overall experience by date. Or, second, that an individual record card be developed for each driver and the accident information be transferred to this from the report. The accident reports would then be kept by serial number in a special file.

It is well to keep a special folder for each employee. Information should be included on his employment record, references, accident reports, mileage, complaints, violations and such corrective treatment as has been recommended and applied.

It is important to make it pleasant for the employee to report unsafe or defective equipment. Many organizations actually hinder the proper maintenance of their equipment by establishing an atmosphere that makes the employees hesitant to register complaints for fear of losing employment.

I hope the time will come when there will be some central clearing house—undoubtedly in each locality—where records are kept on all drivers operating in those areas. I am sure that you all know of instances where drivers have been discharged for one reason or another by one fleet, only to be hired by another just around the corner.

At the end of each month the information tabulated on the tally sheet is summarized. This summary is then used to develop a thorough analysis as to type, location, equipment involved, time of occurrence, age and experience of drivers, weather conditions, condition of the driver and vehicle, etc. Prepare breakdowns for each type of operation or terminal and an over-all experience.

There is no greater safety department asset than statistics to indicate an improved experience. Plot the trend as indicated by number of accidents, accident rates (number per 100,000 miles of operation), and costs. Having made such reports, you are obligated to see that it comes to the attention not only of the high officials in the company but likewise of every individual who should be interested.

Knowing the type and circumstance of your accident experience, steps should be taken to suggest the proper corrective treatment. The three or four main causes of accidents in your fleet should be established

and a concentrated effort directed at their reduction. Accidents can be diagnosed both individually and collectively. In the individual analysis, the past experience of the driver should be reviewed.

We have been working on a method for studying the individual similar to that used in traffic engineering at the intersection. If you are not familiar with the collection diagram, I might say that it is a simple method for superimposing accidents. In traffic engineering we have found that accidents of a similar type occur at specific locations. Studies made so far seem to indicate that drivers likewise have similar accidents. Steps to correct such experience are not necessarily involved or technical.

For instance, take the case of the individual who had experienced a number of side-swiping accidents. A close scrutiny of this operator's driving habits brought out that he was so overly conscious of the hazards of driving that he failed to take his eyes off the road ahead to look to the side or rear. When this was pointed out, this individual operated for more than eighteen months without even a fender scratch. This is an example of the simple treatment which actually brings results.

Responsibility should be established in every accident. The kangaroo court or review committee method of accomplishing this has been gaining in favor. These committees should be made up of representatives of the safety department, superintendent of foremen, perhaps insurance and auditing, and an equal number of drivers. The drivers should definitely be represented.

Some feel that this plan will not work because of the tendency on the part of the drivers to favor their fellowmen. Nevertheless, in actual practice we have found that the drivers are more critical than the other committee members. There is a lot of educational value in this method of approach. Employees become more safety conscious in knowing that driving records are under "scrutiny."

The safety supervisor should provide forms so that branch terminals and other isolated groups can report periodically on their safety activity. Such reports should include information on all safety meetings, the minutes of such meetings, those present and absent, outstanding recommendations, progress made since the last meeting, the

findings of kangaroo court or review committee, penalties recommended or enforced, awards presented, and the accident statistics. Some fleets require special memoranda from safety men and the manager or superintendent respecting all "repeaters." This is an excellent way to be sure that special attention is given the drivers who have been involved in more than one accident.

If employees are to be disciplined for bad records, they should be rewarded for accident-free records. This can be handled through some form of award or bonus. The only complaint we ever hear about such awards is that it should not be necessary to pay employees to do something which is already a part of their job. This may be true, but the fact still remains that this method *does* bring results.

There are various types and methods of awards. Probably the most common is the no-accident award similar to that presented by the National Safety Council, where the driver is given a certificate and medal to indicate every consecutive twelve months of accident-free driving.

Generally, the type of award should depend on the type of driver and operations. Some fleets operate with colored drivers, where gaudy prizes bring the best results. A cash bonus is always well received. It is important to give something the driver can use. In scheduled operations, such as in bus or taxi fleets, it is often possible to make awards on the mileage or fare basis. In many instances the base rate of pay is reduced so that the poor driver gets slightly lower than the average and the exceptionally good driver slightly more.

In any award plan there should be a deferred payment as well as some recognition for the shorter periods. One bus company pays a quarter of a cent per mile for every thirty days in which no accident is experienced; likewise, a quarter of a cent per mile in addition for every six months of accident-free driving. We all like to try again, and the shorter award provides the stimulus in this direction.

One taxi company awards 2 per cent on all money booked during 30 consecutive days of accident-free driving. For every consecutive 90 days, \$2.50 in addition; for every consecutive 180 days, an addition of \$5; and for every 365 consecutive days, an additional week of vacation with pay.

Many firms use the point system. One plant gives the driver a credit of one point for every accident-free mile driven. Accidents are debited on a sliding scale, the minimum being 1,500 points for an accident where the driver was not at fault and a maximum of 8,000 points for total responsibility. A credit balance of 2,500 points gives the driver a \$10 bonus, at which time he is debited 2,500 points if no accidents have been experienced. The debit balance of 8,000 points restricts the driver from operating a company vehicle. He is then laid off or put on some other type of work.

Under this plan the driver could have a minor accident, not his fault, every 2,500 miles indefinitely but would receive no bonus. He could have an accident where the responsibility was doubtful every 5,000 miles or an accident where he was not necessarily reckless every 8,000 miles. This plan is based on and adjusted to the company experience so that the good driver could have an average number of accidents and yet not be discharged. I wonder at the desirability of setting any number of accidents as the expected goal.

Probably the most important thing in connection with the presentation of awards is to place emphasis on the show and ceremony. Company executives should be present and take part in the presentation as an indication of sincerity. You can assist in the promotion of good public relations by having some representative present from the police department. We must not forget the assistance which the wives of our drivers can give us, and they should occasionally be invited to a dinner or dance. I even know of some fleets where management writes a letter to the wives of drivers who are involved in accidents, asking them for cooperation.

A contest can always be considered another worth-while activity. An over-all competition should be arranged between the leading units such as divisions, garages, etc. Local contests can be established as separate units of the major competition. A large trophy should be provided for presentation to the winner. This prize would rest in the possession of the winner during the period of the next contest, to become the property of the unit winning it three times. Again it is advantageous to provide a dinner or banquet in connection with the presentation of the contest awards.

A house organ or monthly bulletin should be sponsored by the safety department. Contest winners can be announced and no-accident drivers listed as a regular feature. Some firms also indicate the names of drivers who have had accidents. Likewise it is good to review several of the more serious accidents each month, pointing out both the hazardous practices which undoubtedly caused the accident and the desirable procedures which should have been observed. These bulletins can also include items each month on seasonal hazards. Most of you are undoubtedly familiar with the National Safety Council's pocket-size magazine, "Safe Driver," which goes out each month to drivers of affiliated member organizations.

Every terminal should have at least one bulletin board. Safety posters should be changed regularly. Recently a number of fleets have been posting actual photographs of accidents on their bulletin board with great success. A number of fleets are now using safety patrol cars. In most instances, the main objective of these units is to assist the driver, prevent cargo losses and do actual road checking rather than to make mechanical repairs.

Another fleet has been using the moving picture camera successfully. As complaints are received on bad driving practices, or as some one in the organization sees evidence of such practices, the camera man goes out and takes pictures unbeknown to the drivers involved. Later, the desirable and proper practices are staged and photographed. These films are then shown at the next meeting

of drivers. In other words, an attempt is made to prevent accidents before they occur.

I need not point out the value of dash cards and safety letters. I appreciate that it takes some time to handle this phase of safety, but I sincerely believe the results are worth the effort. Some firms are requiring drivers personally to change the dash cards each week in their vehicle.

At this point I want to touch upon the regulations recently adopted by the Interstate Commerce Commission for the control of the inter-state carrier. To date these regulations do not concern the private operator. However, in the interest of standardization and in view of the fact that these regulations are not overly stringent, I know of no better means of pushing uniformity than by their adoption by every operator.

We know that accidents can be reduced. If your experience is high, you can likewise show results. Commercial vehicles, registered in the National Fleet Safety Contest, have reduced accidents some 47 per cent since 1930. Reports were received from 74,013 vehicles traveling 1,263,547,000 miles over a twelve months period, with an average accident rate of 2.67 accidents per hundred thousand miles. Presented in a different manner, this figure indicates an experience of 37,500 miles per accident. As you know, all accidents are reported regardless of how small the damage or who was at fault except where the vehicle was properly parked.

The National Safety Council will welcome requests for further information on the development of a fleet safety program.

ADJOURNMENT

Committee on the Driver*

THURSDAY AFTERNOON SESSION

October 14, 1937

The meeting was called to order by the Honorable John Gutknecht, Judge, Municipal Court, Chicago, and Chairman, Committee on the Driver, National Safety Council.

What Are the Fit and Unfit Drivers?

By A. R. LAUER

Associate Professor of Psychology, Iowa State College

A. Fitness for driving is dependent upon several factors—operating simultaneously or successively. Research reveals several types of unfit drivers. These types may be grouped into five categories:

1. The irresponsible driver.
2. The incapable driver.
3. The untrained driver.
4. The unthinking driver.
5. The over-confident driver.

B. The classification is elastic and a driver may belong to one or more groups at the same time and in varying degrees. He may also change from one group to another over a period of time. There is evidence that one or two rather serious accidents removes the most intelligent drivers from class 1. It is obvious that class 3 may be temporary although, by ordinary methods of learning to drive, 10 years are necessary to develop a safe motor vehicle operator.

C. A certain few may be classified as incapable drivers. These persons should be allowed to drive only under restricted licenses or by special permits.

D. The methods of improving driving

fitness are varied and need be rotated to keep the driver "on his mettle." A few suggested are:

1. Classify unfit drivers according to their abilities and types of accidents.
2. Train those who are inexperienced in time or service. Training must be specific and according to needs.
3. Saddle responsibility on the irresponsible and unthinking driver by strict enforcement and revocation practices.
4. Create attitudes toward safe driving and try to persuade the over-confident driver of his fallacy. A few dangerous attitudes will be discussed.

E. Good roads, per se, will not reduce accidents. Even super highways will introduce more new hazards than they will eliminate from present types. This does not mean that roads should or could not be improved. It means that as long as men who have not been thoroughly trained drive cars, accidents will persist. Whether the highway costs \$12,000 or \$6,000,000 a mile, the unfit drivers will continue to get into jams until they are properly disciplined by one of the following methods:

1. Training and suitable experience.
2. Sufficient highway patrols.
3. Limited privileges of driving.

*Editor's Note: The four following addresses were made at the Committee on the Driver Symposium, "What Are Fit and Unfit Drivers?" The talks of Dr. Lauer, Mr. Marsh and Dr. Viteles are presented here in outline form, while Dr. Lee's speech is briefed.

4. Public sentiment in favor of safe driving.

F. Suggested methods for handling each type of unfit driver will be discussed.

Driver Requirements

By DR. R. L. LEE

General Motors Corp., Detroit, Mich.

The Committee on the Driver has assigned me the subject "The Minimum Essentials Required by Automotive Engineers in the Drivers for whom they Build Their Cars." This is indeed a difficult assignment, for the industry from the very beginning has devoted itself to the task of building its products around people as they come. All sorts of people—from the shortest to the tallest—from the weakest to the strongest—and from the youngest to the oldest. We have never felt that we could have our customers made to order, although there were times when we wished we could. So I believe I am safe in saying that as far as physical requirements are concerned, the effort required today in the control of a modern motor car is well within the capacity of a child much too young to drive in traffic.

Much has been done by the industry to bring this about. Over the years brake pedal pressures have been constantly reduced, also clutch pedal pressures, gear shifting has been simplified and improved to a point where the slightest effort is now required. Automatic and semi-automatic gear shifts lessen even this slight effort. Steering gears, through constantly improving mechanism, now may be operated by the frailest driver. Through independent springing, front wheels with improved steering geometry tend to keep cars going in the direction in which they are headed.

In the past, the motor car needed constant attention to keep it in safe working order. Automatic chokes and accelerator operated starters make it possible for the amateur to start his engine under all sorts of conditions, and avoid stalling in dangerous situations. Power plants have been improved to a point where they do not need the attention they formerly required. In other words, the industry has done its best to make allowances in its products for the deficiencies, negligence, and carelessness of the drivers.

So again it would be extremely difficult for us to establish the minimum requirements of drivers for safety, for we realize that the control of a motor car has been so greatly simplified that it can be mastered by even the rankest amateur in a very short time, in fact we are convinced that the ability to manipulate the controls of a car is only one small part of the requirements essential to safe driving.

A knowledge of the rules of the road, a knowledge of the habits and behavior of the other fellow, the judgment of speeds and distances, a proper attitude toward the potential hazards of the road, a respect for others' rights, health and self-control, patience and the ability to concentrate all are vital to safety on the highway. Out of these only a few are related to automobile design.

In spite of this we as motor car manufacturers, realize that for the sake of public safety and the future growth and welfare of our business, there must be certain minimum requirements drivers must meet, before they are permitted to use our streets and highways and before the safety of the public can be entrusted to their care.

While the establishment of these requirements is difficult to say the least we have many examples before us. Railroad engineers, conductors, trainmen and flagmen must pass rigid examinations before they are entrusted with the safety of their passengers. In fact, all those engaged in activities involving public safety must measure up to certain standards before they are permitted to operate.

So from past experience, it is logical to assume that now, since motor cars have become so numerous and public safety so much involved in their use, the time has come when the operators of these vehicles must be examined for their fitness and licensed accordingly. And the automobile industry is solidly behind efforts to bring this about.

However, in establishing these requirements, we must have as a basis, an accurate knowledge of the cause of the most of our accidents. With so many drivers involved in traffic, so many complicated situations with accident possibilities and hundreds of factors which can and may enter into these situations, the task of identifying the characteristics in driver license applicants which are indicative of accident proneness is difficult in the extreme.

If most of our accidents involved a small per cent of drivers, the problem would be infinitely simpler. For we could locate and examine such drivers and identify the abnormalities responsible for their accident proneness. Unfortunately there is little data indicating that the bulk of our highway accidents involve a minority. While an examination of the accidents in a community for a given year, will disclose that a small percentage of the total number of drivers were responsible for all the accidents of that period, next year a new minority moves in and takes the place of the old. This process continues until over a period of years, we find that most of our accidents involve a large percentage of drivers in that community. What this seems to indicate, is that most of our accidents involve drivers who have been driving for years without accidents. Of a necessity these people must know something about driving, traffic rules and have proved their ability to cope with the vast majority of situations.

In one study made of the accident records of Massachusetts, it was found that 75% of the accidents involved drivers who had been driving on an average of four years per accident.

Let us suppose in such a case that this average driver makes one daily round trip between his home and his office. In modern traffic it is reasonable to suppose that, as a result of his driving experience, skill and judgment, he successfully avoids fifty potential accidents in which he could have been involved had he not been vigilant—50 potential accidents in one trip—100 potential accidents for the round trip—250 round trips for the year would account for 25,000 potential accidents successfully avoided for that year. Multiply this number by the four years, and we have the astounding total of 100,000 potential accidents avoided. Place above the line the one accident he does have, and we have a fraction which I believe

exemplifies the highway accident situation we are striving to correct.

When we consider the variety of conditions of road and street, of weather and road surfaces, of varying degrees of driving skill, and the millions of possible traffic combinations, there is little wonder that we have difficulty in attempting to identify characteristics in the individual applying for a driver's license which are likely to place that applicant in the accident-prone classification.

We know definitely that in spite of the distribution of accidents among seasoned and experienced drivers, there is a class of drivers responsible for more than their share of accidents. These drivers must be located, corrected or removed from traffic. However, once this is done, the over all accident situation is only slightly affected.

In spite of the ability of human beings to compensate for their physical deformities and deficiencies, we know that there are certain extreme cases where the dictates of common sense should prohibit them from the use of the motor car in public. We know that certain diseases render people incapable of safe driving—sight and hearing enter into the picture—the ability to read traffic signs is a factor. Regardless of data or the lack of data regarding the physical or mental condition of people involved in highway accidents, past experience in other fields should enable the medics, psychologists and psychiatrists among us, to formulate a practical procedure for examining driver license applicants. This of course is entirely out of the realm of the automotive industry.

The need for a knowledge of driving rules and regulations is obvious.

We now come to driving skill, which in the last analysis should be the most reliable indicator of a driver's fitness to take his place in traffic. A person's driving behavior in traffic, theoretically at least, should reflect either the lack of, or the possession of essential requirements for safe driving. Even though we know that there are many clumsy and apparently unskilled drivers who in some manner or other manage to get by for years without accident, driving performance seems to be the best measure of trustworthiness we have at our disposal.

Unfortunately, driving proficiency has been gauged intuitively by experienced observers. We have very little accurate data

regarding details of the driving behavior of accident-prone and accident-free drivers.

In the aeronautical field flying tests have been definitely established and standardized for all flying license applicants. It seems to us that a study of the driving behavior of various classifications of people in traffic for common characteristics should be helpful in the establishment of a scale of minimum driving requirements. It may be, before we are through, and after the obviously men-

tally and physically deficient have been eliminated from our consideration, we will find that efforts to establish means of determining driving ability will be more productive of results than efforts to determine accident proneness—in fact, due to the tremendous number of factors involved, we may be forced to accept driving tests as our principal gauge of driving fitness.

At least that is the way we think in the Automotive Industry.

The Highway and the Driver

By BURTON W. MARSH

Director, Safety & Traffic Engineering Dept., American Automobile Association

1. When consideration is given as to where responsibility for accidents falls as between the highway and the driver, there is a frequent tendency to place most of the blame on the driver.

This is done on the basis that even if some highway conditions are not good, if the driver is well fitted he can negotiate almost any highway condition satisfactorily.

The tendency to place blame on the driver is also doubtless based in part on the fact that bad highway conditions exist and many will continue to exist and hence it's the driver's job to negotiate them safely.

The situation reminds me of the attitude of industry some decades ago concerning machine hazards. Operators should know the hazards and adjust for them at all times. It was hard for a time to obtain a realization that much could be done to reduce the inherent hazards of machines and that human nature being fallible, it was NOT sound logic to reason that no matter what machine hazards existed, the operator should ALWAYS be able to adjust to them and safeguard himself from them.

2. Despite considerable progress through highway and traffic engineering and enforcement control, MANY existing highway conditions constitute hazards which place a very high quality of fitness on the part of drivers, and

3. Numerous existing highway conditions require a higher quality of fitness than many drivers possess AT ALL TIMES. This fact is clearly indicated by accident records

which indicate highway conditions which considerable numbers of drivers do NOT satisfactorily adjust for.

Examples:

- (a) "Death" curves.
- (b) Many high accident locations (in fact much of traffic engineering corrective procedure is directed against *unreasonably* bad highway conditions or conditions directly related to the street, intersection or highway).
- (c) Inadequate sight distance for the apparently reasonable prevailing speed when approaching the corner, curve, hillcrest or dip.
- (d) Unexpected and inadequate "advance-posted" narrow roads and bridges.
- (e) Bad shoulders—especially where they are not uniformly bad and hence where the driver believes the shoulder is reasonably good.
- (f) Culvert heads too close to the edge of the hard pavement—especially where these are not well marked so that the driver is adequately forewarned both day and night.
- (g) Inadequate road widths for traffic conditions—especially where there are considerable numbers of wide buses and trucks coming in the opposite direction and where shoulders are bad.
- (h) Lack of provisions for pedestrians and cyclists where these are found in considerable numbers.
- (i) Signs which are non-standard, too

small, poorly placed, non-effective at night. (Maryland directional signs parallel to the road.)

- (j) Signals which are non-standard, poorly located, wrongly operated.
- (k) Varying curvatures (without easements) and varying grade conditions without day and night-effective indication of safe operating speed.
- (l) Lack of center lines where needed and inadequate lane indications.
- (m) Slippery pavements, especially when not marked and when existing only in non-uniform stretches.
- (n) Highway conditions of various sorts which constitute especial hazards at night.
- (o) High crowns, especially on curves and when combined with slippery pavements.

4. We do not know the extent to which highway features are important factors in accidents because of the tendency to blame the driver in such accidents and because we do not have satisfactory *criteria* or "measuring sticks" with which to judge the extent of blame which should be assigned to highway conditions.

A splendid new feature of state highway planning surveys will gradually provide such measures. I refer to the new plans for accident studies.

In the meantime we largely, though not wholly by any means, wait until highway locations prove to be unusually high accident locations and then study what to do about them.

One very crude criterion which should be more applied, I believe, is:

WILL A SOMEWHAT POORER THAN AVERAGE DRIVER BE LIKELY TO HAVE TROUBLE HERE?

5. We sorely need to develop such criteria as a basis for remedying existing highway hazards.

We need to make such information available to all persons dealing with highway matters.

6. Highway remedies to bring the whole highway to a condition so that the somewhat poorer than average driver can reasonably be expected to avoid troubles will fall into several classifications:

- (a) Adequate signs, signals, markings and islands.

(b) Adequate physical corrections such as increasing sight distance, removing culvert heads, constructing wider bridges.

(c) Relocation of sections of highway.

(d) Design and construction of modern highway facilities to replace whole sections of highways.

7. Future highways must be—and are being—designed to counteract for experience-proved defects or conditions which numerous drivers do not always meet successfully.

They must and will reduce the burden upon the driver to appraise conditions and to drive safely.

Examples of such modern highway features include:

- (a) Divided highways.
- (b) Wise use of islands.
- (c) Well designed traffic circles.
- (d) Grade separations, especially clover-leaves.
- (e) Acceleration and deceleration lanes for entering or leaving vehicles.
- (f) Longer sight distances and more uniform sight distances—especially non-passing sight distances.
- (g) Uniform curves properly "eased."

8. The degree of driver fitness required today by many existing highway conditions is FAR above or beyond that now checked or required by even the best state driver licensing tests.

Examples:

(a) Physical condition as for example, Vision. Many signs too small and hard to understand at present customary driving speeds—pedestrians on highway at night call for exceptional vision, low glare-effect and quick glare recovery—dips are often extremely hard to identify unless vision is VERY good and alert attention is given.

(b) Knowledge. Many slippery curves demand much better knowledge of centrifugal force and friction than many drivers have—much better understanding is necessary of when it is safe to overtake and pass.

(c) Judgment. Many existing highway conditions call for a high quality of judgment.

- (d) Skill
Many a narrow road calls for skill in a high degree of skill in steering, as for example, when there is a bus or truck coming and a culvert lead nearby, bad shoulders, a narrow bridge.
- (e) Alertness, Vigilance, Ability to maintain constant attention—Many highway features mentioned above call for high fitness in these qualities.
- (f) Attitude
The appreciation of responsibilities imposed because of bad highway conditions must be of a high order.
9. While many existing highway conditions are unreasonable for the driver of

even average fitness and while there is a major challenge to correct them as rapidly as possible, we must in the meantime—realizing that some such conditions will exist in places for years—devote much greater efforts to:

- (a) Educating and training and retaining drivers in a much better way than we have done to date. Such efforts must produce sound habits as well as much better judgment, skills, attitudes.
- (b) Driver licensing and re-licensing tests must be VASTLY improved to make sure that driver fitness is of a satisfactory quality to negotiate even unreasonable highway hazards without accident and without causing *some one else* to be involved in a crash.

Fit and Unfit Drivers

By MORRIS S. VITELES

Director of Personnel Research and Training, Philadelphia Electric Co.

A. A large proportion of accidents result from "bad habits" of operation, habits which are comparable in kind to those which spoil a man's game of golf or tennis or quoits, etc. Specific instances will be cited to illustrate accidents that can be avoided by developing operative habits which receive practically no attention from the salesman or friends who in most cases train new drivers.

B. Much stress is laid on such habits in safety education and propaganda, but mere "telling" does not lead to "doing." Education and propaganda are not proper substitutes for habit training, which can only be carried on under actual operating conditions.

C. The development of safe driving habits in the case of inexperienced drivers calls for the extension of high school training programs of the type that have recently

been developed by investigators in this field.

D. Training of inexperienced drivers must be supplemented by the re-education of experienced drivers who have formed "bad" driving habits. The value of such re-education of experienced drivers is shown in the preliminary results of a recent experiment, initiated by the Philadelphia Electric Company, which calls for the correction of bad driving habits of experienced drivers before they are permitted to operate cars.

E. Re-education in driving must be based upon an exact and complete analysis of the driving habits of the so-called "experienced" driver. Such an analysis can only be made by means of a road test in which the driver operates under actual driving conditions.

F. Practical principles for the conduct of the road examination and of subsequent training will be discussed.

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HAROLD F. WEIN, West Penn System, Pittsburgh, Pa.

GEORGE R. WHITMORE, Illinois-Iowa Power Co., Peoria, Ill.

MONDAY AFTERNOON SESSION

October 11, 1937

The first session of the Transit Section was called to order by R. A. McArthur, Public Service Coordinated Transport, New-

ark, N. J., Vice-Chairman of the section, in the absence of Chairman Parker.

Mr. McArthur introduced the speakers.

The Coming Traffic Revolution

By ROSS SCHRAM

Twin Coach Co., Kent, Ohio

We now face the condition of having 125 city owned motor vehicles per mile of paved street, if all are in service at once. Can efforts for safety through education and persuasion cope with this gargantuan task?

Knowing the actual extreme of the situations now existing on the streets, the com-

mon man's public carrier industry should call attention not only to the crookedness of the course of present day vehicle traffic, but also to the crookedness of the thinking which encourages the aggravation of our zig-zagging city traffic. The National Safety Council, local safety councils, city adminis-

trations, editors and Parent-Teacher Associations admonish about highway safety, in printed matter, which, piled end to end, would rival the Empire State Building in height; they blast away with detonations louder than those in the General Electric lightning factory at Pittsfield. It is all with questionable permanent result. Why talk about designing safer motor coaches with street traffic soared as it is today?

Under the Regulations of the New York Transit Commission and various other American utility boards and commissions, granting adequate maintenance, I claim that motor buses and trolley buses are upwards of 95% safe and fool-proof at the present moment. Inside the coaches, improvements will come, but only as standardization and a matured industry develops. If the regulatory bodies which are so empowered would only see the wisdom of focusing the major part of their attention on the segregation or regimentation of street traffic, they could, with one sweep, do more than years of technical supervision on the design and functioning of public carrier motor vehicles. In the same way, if the American Transit Association, which has spent five years of major effort in developing the so-called modern street car had exerted more of its cooperation in the same segregation of traffic on the highway, we would all see a greater reduction of collisions in the street, to say nothing of the freeing of traffic and the reduction of congestion.

What I tell here is substantiated by files and data forwarded to me by 50 men in the city transit business, whom I asked for data as to street vehicle collisions and their classification. The facts which they sent me are confirmation of the recommendation I make herewith. They had not the slightest idea of the position I might take, when they gave me this data, and can, in no way, be charged with aiding and abetting propaganda for the utilities. The value of their records lies in the fact that they come from 50 representative cities in all parts of the country, and they are from men who have struggled with the problems of safety in the streets for public passengers for from 15 to 30 years.

I firmly believe that the first step in the solution or amelioration of the present situation in the streets is a traffic revolution, by patrons of common carriers. Of course, they can go on struggling, but I foresee them with a developing national spirit.

Their rights, dramatically and properly presented, by some smart politician, will bring on this revolution over night, in some forthcoming hot municipal campaign.

Passengers carried during 1936 by the public carrier surface industry, were a little over ten billion. Rapid transit and electrified suburban railroads carried about two and one-half billions. It is, of course, difficult for the layman to estimate with any accuracy, the number of passengers carried by private automobiles when traffic is greatest, that is, when folks are hurrying either to work or home to dinner. Most folks do not know how greatly disproportionate is the percentage of persons traveling in the street in private cars and in public carrier vehicles. Only one in six people in cities over 100,000 own an auto.

An authentic check which was arranged between 8 and 10 A.M. and 4 and 6 P.M. on September 9th, near the intersection of Woodward Avenue and Verner Highway, in Detroit, showed a total of morning in-bound and evening out-bound traffic as follows:

Private autos	3,950
Buses	229
Street cars	131

Of course, the autos did not average two persons per car, but we will give them the benefit of the doubt. Therefore, we grant they carried 7,900 people.

The small sized buses in use there, averaged, conservatively, 35 persons per vehicle, or 8,015, and the street cars 100 persons, or 13,100, making a comparison of 21,115 people riding in public vehicles against 7,900 people riding in autos.

I give you this check because it is authentic and is an example on just one avenue, of what checks would show if made here and there throughout the American cities, as to the bad deal the public carrier rider is getting in the streets.

For instance, in the normal rush hour, public transit operation in an average busy city is carrying on with a one-half to two minute schedule, with vehicles transporting 75 to 150 persons each, in or out of the area, on a single route. On even a two minute headway, this means, in round figures, at least 3,000 human beings per hour on a single line, with 100 persons to a vehicle. Multiply it by the many different down-town routes.

The minority in private cars usurp the

major part of your right of way. In cities with a population of 10,000 or more, the 1936 tabulation indicated 982 separate and distinct communities; 430 of these are now served wholly by buses. Only 62 are now served exclusively by street cars. Last year, a total of 3,710 buses were bought for service on city streets, compared to only 399 surface street cars. This is nearly one-third of all the buses built in 1936. It does not include 2,610 inter-city buses which went into service in 1936, and naturally traversed city streets to and from terminals. At the end of 1936, there were 37,868 trolley cars in service; 22,104 city buses and 1,200 trolley buses. The total street cars decreased by 3,000. These are official figures, compiled by Transit Journal. Whereas Mr. Common Carrier Rider and his family, in years past, hurried to work and home to dinner on a double track street car line covering eighteen feet in width in the center of the city street, more and more of their number are now traveling by motor bus, or trolley bus. In fact, the motor bus passengers increased in 1936 over 1935 by 27%. Whereas trolley cars riders increased only 1½%, trolley bus riders leaped 40%.

The motoring public has cheered the passing of the street cars in the center of the street, and the resultant freeing up of automotive travel. Municipalities have saved untold money in the reduction of street widening demands.

But, here is the rub. Here is what starts the great American zig-zag traffic game.

Mr. Common Carrier Rider has breathed a sigh of relief for his wife and children inasmuch as in most cases, they can now get their transportation at the curb, but these thousands of motor buses, the more modern of which, including electric trolley buses, have accelerations ranging from three to four miles per hour per second, poke their noses into the curb loading stops, and quickly thereafter, shoot back into the free moving traffic near the center of the street.

For a block behind, there is a jam and a breaking of high strung nerves of every automobile driver, as the public carrier coach straightens out. The private car driver likely thinks only of personal affairs; he is driving by instinct, not with his wits fully alert as in the case of the bus man.

People who drive by subconscious instinct should be placed in segregated lanes. It will be a protection for themselves and all others

in the streets. The records are piling up rapidly, due to the increased speed of coaches and the miserable regulation of parking, to show that accidents in the middle of the block between coach and automobile, either passing or backing out from a parking space, will soon rival those at intersections, the expected spot of greatest traffic terror. Lane segregation of traffic seems inevitable and as necessary as steel rail regulation of traffic in a railroad terminal.

Whereas the all-electric railway line in most cities had an average speed of nine or 10 miles an hour, the motor coach lines are now offering a speed of 12 to 14 miles an hour. The private car owner finds it increasingly harder to run circles around the new buses.

Lane traffic segregation is inevitable at some speed. We have now reached that speed.

The common carrier speed had to be lifted from the old nine or 10 miles an hour to 12, as matter of self-survival.

We must realize the situations where car tracks are still in the center of the street, with parking along the curb, and how, today, we are trying to run high speed, rubber-tired common carrier lines between the trolley car space and the parking space, zig-zagging in and out of this 35 or 40 mile an hour mighty river of private cars.

There is no place officially left in the street arrangement for the great majority, the common carrier rider.

If, as the records show, only one person in six in cities over 100,000 population owns an automobile, why not a common carrier rider revolution?

What would be the platform?

1. The elimination of parking on all public carrier streets during the two to two and one-half hour morning and evening rush periods, and the assignment of the in-bound or out-bound lane adjacent to the curb solely to public carrier vehicles.

2. Compulsory far side stops for public carrier vehicles.

The benefits to accrue are:

- A. This would, in many cases, permit increased speed closely rivaling New York underground rapid transit, which only averages 15 to 16 miles an hour. In many cities, rapid transit, so-called, can never be afforded except in this manner.

- B. This must completely eliminate for the period named, the hazard of parked cars turning or backing into on-coming rush hour traffic.

- C. This must reduce by an even greater percentage, the striking of rear ends of coaches by on-coming, poorly braked automobiles.

- D. This must reduce drastically, the hazard of collision at the intersection by right or left hand turning automobiles with motor coaches. Traffic KNOWS where the bus will be.

- E. In many instances, they might, with advantage, create center-of-the-block loading stations, eliminating loading stations at the following intersection, which has been known to be extremely hazardous, for reasons peculiar to itself.

- F. This exclusive inside operating line for public carrier would increase the safety record of every coach driver on a line of this kind, by cutting almost in two, the area of vigilance necessary.

- G. This whole procedure must reduce, unless mathematics lie, the side-swipe hazard by 50%, to say nothing of the shortening of the ride to and from work of the greatest number.

Here is the best political program one can imagine in municipal politics. There can be no legitimate objection because, to start out, it might be arranged that the merchants who lose parking facilities in the morning, would get them back at night, while his friend across the street lost them. Of course, that would be a political compromise, but traffic reforms come piecemeal. There is no substantial reason for not prohibiting parking on both sides of the street, thereby benefiting many of the lines, where, at the rush hour, there is considerable traffic in opposite directions.

Of course, it would be suicide for a public carrier Utility, as it were, to advocate a plan of this kind, as sensible as it may be proven.

Nevertheless, it is my prediction that some group with political acumen is going to make a major political issue, if you want to call it that, out of the rights of Mr. Common Carrier Rider. It would be a likely program for a labor leader in behalf of the workers. They are going to organize precinct by precinct, and supply a logical and verbal argument for the millions of common carrier riders, for the sake of obtaining for them

not only safety, but rapid transit to and from their homes. They are going as petitions to city councils, once rightly organized. What we really need is more politics and not less in traffic regulations! On safety councils we need more men who have to ride public carriers and who know what it means to raise car or bus fare for a big family each week.

Here and there, trouble will pop, and in many cases, the down-town property owners association will yell curb rights, but no one who has seen many records and surveys of how people get to and from down-town stores, doubts that the down-town merchants in this year of 1937 who would oppose this kind of parking would be foolishly opposing their own best interests. The other extreme of this liberal viewpoint on traffic segregation is the attempt to install parking meters.

Furthermore, it is pertinent that all should give thought to the creeping tendency to use small and even higher speed buses on the main arteries such as is being done in Detroit and Buffalo, to cope with private car operation. That part of the public which uses them approve heartily, quite naturally. They race away at the traffic lights with the private car traffic, and in the use of smaller coaches, enjoy a more frequent headway. Those who use them are those who can afford to pay 10 cent fare, but the businessman and public carrier riders should consider what this effort of a few common carrier operators may ultimately bring about in their respect.

As an illustration of this result, if carried to the Nth degree, remember that in cities the size of Detroit and Cleveland, it requires 2,000 or more of the larger type vehicles to serve the public. If full resort is made to these small type coaches, you can multiply the number of vehicles by four at least. Therefore, instead of having 2,000 public carrier vehicles on your streets, you will have 8,000, and in supplying the increased number, the public carrier fare structure must be raised to meet the great increase in driver labor, with injury to the down-town business, because the higher the fare, the fewer trips the outlying rider's wife and family can afford to make downtown.

Already, in Detroit, there are signs that this kind of service is eating into the patronage of the lower fare car lines sufficiently

so that the day is in sight when the street car rider will be forced to pay something more to even up the additional cost of trying to handle the city's whole public carrier transportation in almost deluxe taxicab vehicles.

There was a day when the public carriers sought fare increases, but today, it is the exceptional public carrier which is not striving to find ways of holding down the fare, or to possibly reduce it in order to attract greater volume.

We know that citizens traveling on cars and buses are in the great majority, and their riding habit is a direct criterion of the prosperity of the community. If you hem them in with fare obstacles or reduced public carrier speeds, you are cutting down the liquidity of your transportation, and lessening the equal chance of all merchants in every district to enjoy some of it.

A minimum of 40 to 50 per cent of the income on the public carrier goes to pay the men who drive you, and as attractive as a small vehicle operation may be, in getting through traffic, it is only A, B, C, mathematics to know that if you increase by three or four times the number of vehicles, this percentage of outlay grows and traffic authorities know that nothing less than a minimum 10 cent fare will support it, even with the most justifiable capital structure. Many drivers must work short hours because of unequal number used in base and peak schedules. The operating companies, therefore, often guarantee a minimum wage, which makes rates for hours worked, extremely high.

Everything seems to indicate that the only intelligent course to pursue by American cities in the rush hours, is to segregate the common carrier traffic in a lane of its own and there is no other logical place than that next to the curb. This will help everybody, including the private car driver. The common carrier public will then travel at rush hours in greatest safety at the lowest possible fare, and the highest speed.

Herewith are pertinent excerpts from the data furnished the writer, from cities varying in size and situated in many states. They are proof of the menace of rush hour parking throughout the entire nation. They cry out for lane segregation of bus traffic at least in our larger cities.

1. The American Transit Association, before the Interstate Commerce Commission

(I.C.C. Docket No. MC 2, Witness H. S. Simpson, Exhibit No. 29) showed that motor coach collisions reach a peak in the three hour period between 3 and 6 p.m.

2. One of the largest surface railways in the country segregated the total bus collision accidents, showing 30.7 per cent of the collisions were caused by vehicles passing, going in the same general direction as the bus; 19.4 per cent of the collisions were when the bus was struck in the rear by a vehicle following; 12.3 per cent were collisions when the bus was making right angle turns. These four types account for approximately 63 1/2 per cent of the total bus collisions.

This operation shows the majority of its collisions to buses between four and 6:30 p.m. The bus mileage per collision type of accident is almost twice as great as the corresponding mileage for street cars, one man or two men combined.

3. Boston's figures show 26.21 per cent of the collisions over a four year period were those with the vehicle and street car traveling in the same direction and 12.85 per cent at right angle turns. In Boston, because of the character of its streets, there is very little difference in the collisions per vehicle between street car and motor coach equipment.

4. The Buffalo operation shows that where automobiles struck a street car or bus, in 24 per cent of the cases, the car or bus was standing, 43 per cent where the vehicle was making an angle turn, and 25 per cent where the automobile was passing the moving car or bus. They believe one of the greatest factors causing bus collisions is vehicles pulling from the curb, frequently without giving a signal.

5. Davenport, Rock Island, Moline. The greatest number of collisions occur between 4 and 6 p.m. the majority of which are side collisions on approaching intersections, or collisions with the rear end of the public carrier vehicles. The second largest group result from collisions with coaches endeavoring to get in and out of loading zones.

6. Providence. Next to collisions between street cars and private cars, the greatest percentage of collisions is due to vehicles pulling from the curb without a warning signal. Collisions of buses and trackless trolleys as compared to street cars is at least 50 per cent less.

7. St. Louis shows its greatest number of

vehicle collisions between 7 and 10 a.m. and between 4 and 7 p.m., 60 per cent of the bus collision accidents at intersections and 39 per cent between intersections. The same property shows that 33.9 per cent are where a vehicle collides with a car or bus as in a side swipe, and 7.7 per cent of their accidents were when a vehicle crashes into the rear end of one of their pieces of equipment. 8.7 per cent are caused by vehicles pulling from the curb and 10.2 per cent when the vehicle is making a right angle turn. Vehicles cutting in as in the center of the block, cause 16.9 per cent of their accidents. Less than 4 per cent of their accidents are with pedestrians. The collision accidents for 10,000 miles are almost 50 per cent less in the case of buses over street cars.

8. Atlanta. The majority of collisions occur between 5 and 6 p.m. The majority of the collisions are side swipes. They also indicate the percentage of collisions is materially higher on street cars than on buses.

9. Pittsburgh. The greatest number between 8 and 9 a.m. and 5 and 6 p.m. A rough division of the collision accidents shows: 1. Side swipes between bus and passenger vehicle in the same direction. 2. Right angle collisions at intersections.

10. Detroit. 72 per cent of collisions are with other automotive vehicles, 1.9 per cent with pedestrians, while 19.7 per cent are where other vehicles strike the rear of standing buses. Street car collisions are 55 per cent greater than bus. 40 per cent of the collisions occur between 3 and 7 p.m. and the other high period between 7 and 8 a.m. These two periods produce more than one half their accidents.

11. Washington. A great majority of their accidents occur in late afternoon hours up to 5 p.m., their rush hour coming earlier due to the civil service population. Almost half of the 1,694 bus collisions in 1936 were caused either by autos travelling in the same direction or with autos pulling out from the curb, or with autos hitting the rear of their buses. They had 214 bus collisions while the vehicles were making turns at the intersection. An interesting comment from Washington is: "The greatest single factor causing bus accidents in our streets today is the lack of appreciation by the general motorist of the quick acceleration and deceleration of the motor bus."

12. Philadelphia. Greatest number of col-

lisions between 5 and 6 p.m. The greatest majority of accidents happen near the intersection. In 1936, 50 per cent of their collisions were where the vehicle hit the bus to the rear of the driver's seat. They had 62 per cent less collisions per 100,000 miles in 1936 bus operation than in their street railway operation. Pertinent comment: "Carelessness or lack of anticipation on the part of the drivers of other vehicles following or paralleling our buses is responsible for the 56 per cent record of vehicles side swiped or rear end collisions."

13. Pacific Electric, Los Angeles. The most collisions occur between 3:30 and 5:30 p.m. and mostly at intersections. The number of collisions involving street cars and motor buses are in ratio of 10 to 1. Careless driving and lack of anticipation on the part of the privately owned vehicle is the greatest single factor.

14. Memphis. Greatest number of collisions 7 to 9 a.m. and 4 to 7 p.m. Their comment is to the effect that collisions are greatest as a result of pulling from the curb and rear end contact by following cars. Coach collisions are one half the street car collisions. Comment: "Failure of private car drivers to make proper signal or to show proper caution in pulling from the curb or in making left hand turns at intersections cause most of the accidents."

15. Spokane. Most of their collisions occur in the evening rush hour and they cite as the greatest factor, automobiles leaving the curb; rear end collisions due to quick stopping of the motor buses, accelerated by the alertness of the coach driver when he receives a signal from inside the bus as a passenger wishes to alight. Comment: "We have found it absolutely necessary to train our drivers to drive in the right hand lane of traffic. We have learned when travelling near the center of the street, autos attempt to pass on the right side, creating a hazardous condition for the coach driver and alighting passengers."

16. St. Joseph, Mo. "We think the greatest single factor for the cause of collisions in the street is the carelessness of the private car driver." Of their collision accidents, 39 per cent were side swipes and 29 per cent rear end, and 15 per cent curb parking. Bus and street car collisions are about even.

17. Charlotte, N. C. The majority of col-

lisions occur in pulling into or pulling away from designated stops and by being run into when the coach is stopping or standing at designated stops, particularly where coach is unable to get close to the curb on account of parking. The greatest single factor in the cause of collisions is the quick deceleration of the bus.

18. *Canton.* The majority of collisions occur between 3:30 and 6:30 p.m. 50 per cent of their collisions are where a following vehicle hits the rear or side of the coach.

19. *Knarville.* Street car collisions are more than twice the number of motor bus collisions. The greatest number of motor bus collisions are between 6 and 8 a.m. and 3 and 7 p.m. 66 per cent of the accidents occurred at intersections and 34 per cent between blocks. 25 per cent of the collisions are where the private car cuts in. In fact, the figures seem to indicate that 75 per cent of all collisions are with vehicular traffic moving in the same direction.

20. *Roadnoke.* 50 per cent more collisions are reported with street cars than buses. The greatest number in the afternoon rush hour. A great majority of their down town collisions occur in the middle of the block, as a result of cutting in traffic.

21. In a total of 39,010 motor accidents in *Massachusetts* in 1936, 33,476 occurred on the straight-away when one of the two vehicles involved had cut out of traffic or was operating on the wrong side of the road.

22. *Jackson, Miss.* The greatest number of collisions occur in the afternoon rush hour from 4 to 7 p.m. Out of 56 accidents in the past nine months, 39 of them were where the automobile hit the bus. Jackson has practically eliminated street car operation, and finds a safety factor with the increased use of coaches, and in this nine month period, 23 buses had 56 collisions, whereas 14 street cars had 66 collisions. Comment: "The greatest single factor causing collision accidents is the lack of control of traffic in the street."

23. *Akron.* Greatest number of collisions occur between 4 and 6 p.m. The greatest percentage of their collisions occur at intersections where private cars are making left hand turns. Comment: "The greatest single factor in the cause of bus accidents in the street is the cutting in to and getting away from stops by the buses."

24. *Columbus, Ohio.* The greatest num-

ber of collisions occur between 4 and 6 p.m. With 94 collisions in the first six months of 1937, 46 occurred at intersections and 20 of these were caused by the bus being struck from the rear. Buses travel three times the mileage of the street car before having a collision.

25. *Fort Worth.* Most of the collisions occur during the afternoon rush hour. In 1936, bus collisions were 33 per cent less than car collisions, on a mileage basis. Comment: "The greatest contributing factor is carelessness on the part of the private car driver."

26. *Baltimore.* The greatest number of collisions occur between 4 and 6 p.m. and 9 and 10 a.m. The bus collision record shows 45 per cent better than the street car. The most predominant cause for collisions is autos pulling out from parking spaces without sufficient warning. Insofar as collisions resulting in considerable damage to the greatest number, 40.8 per cent occurred in the middle of the block and 36.4 per cent at intersections.

27. *Toronto.* The majority of accidents occur at street intersections and between the blocks where vehicles make contact with the bus in attempting to pass it. For June 1937, the records showed 44 per cent were vehicles coming out of side streets; 11 per cent where they were cutting in; 17 per cent colliding with rear of the bus; 28 per cent colliding with the side of the bus in passing it. The ratio shows 27 per cent more street car accidents than bus accidents. Comment: "A recent study shows of all traffic accidents at intersections having similar traffic handling characteristics, accidents are more than twice as prevalent at the signalled than at the unsignalled intersections."

28. Another very large Eastern property reports the greatest number of collisions in the afternoon rush hour. In 1935 their records show that the greatest number of collisions were as follows: First: Parked automobiles. Second: Side swiped in the same direction, the latter being identical in number with parked auto collisions. In 1936 travelling almost four times the mileage the bus system had only twice as many collision accidents as a comparison.

29. *New Orleans.* The greatest number of collisions occur between the hours of 7 and 10 a.m. and 3 and 7 p.m. The majority of their collision accidents occur at places other than at street intersections. Street

cars had nearly twice as many collisions per 1,000 miles than the buses. Comment: "Our people are definitely of the opinion the greatest single factor contributing to these accidents is the lack of care exercised by the drivers of private vehicles."

30. *Denver.* The majority of collisions occur between 7 and 8 a.m. and 3 and 7 p.m. These are broken up 25 per cent at intersections, 35 per cent in the middle of the block and 40 per cent at loading zones. Their compiled figures indicate these causes.

At intersections:

25% motorists disregarding signals.

25% motorists making irregular turns.

25% motorists taking the right of way.

Middle of block:

40% motorists side swiping bus and overtaking or passing it.

40% pulling from curb without adequate signal of the coach.

15% bus driver side swiping parked machines.

At loading zones:

25% hitting rear of bus.

15% buses hitting parked auto.

30% motorists making turn around standing bus.

30% motorists striking bus leaving zone.

Buses operated over three times the mileage per collision as did street cars.

31. *Youngstown.* The greatest number of collisions are between 4 and 5 p.m. 69 per cent occurred at intersections and 31 per cent between intersections. Of the total number of collisions, 40 per cent occurred in congested areas. 57 per cent of all collisions are of the private car with the bus. Comment: "The greatest factor is crowded streets caused by poor enforcement of parking regulations, and the only improvement possible in reduction of traffic hazards is the enforcement of parking regulations on an intelligent basis, and with proper respect for the rider of the greatest number."

32. *Birmingham.* Most of the collisions occur between 4 and 6 p.m. 72.5 per cent of the collisions occurred at intersections. Segregating their collision accidents, we get the following:

Automobile side swipe of buses 22.1%.

Overtaking automobiles cutting in ahead of bus 11.5%.

Automobile colliding with rear of bus 11.5%.

Bus colliding with parked autos 8.4%.

Bus side swipe of autos 7.6%.

Buses ran 9,350 miles per collision while street cars ran 7,560 miles per collision. Comment: "Collisions with street cars are caused by inefficient handling of autos, by all kinds of drivers. While we have a drivers license law in the State, no examination is required. One of our greatest difficulties is diagonal parking and the hazard involved with the parker of that vehicle backing out without proper visibility."

33. *Erie.* The most of their collisions occur between 4 and 7 p.m. The majority of collisions occurred from autos moving out of parking space or endeavoring to get in to one. Of all their troubles, 62 per cent can be segregated under this caption. Incidentally, 50 per cent are on the right side of the bus and 12 per cent are on the left while 8 per cent are collisions at the rear of the bus with the vehicle stopped. Comment: "The main cause of collisions is the motoring public's unwillingness to observe the rules of the road. The greatest single step to eliminate accidents would be elimination of parking on narrow streets and during rush hours."

34. *Minneapolis.* The majority of accidents are in the afternoon rush hour. 75 per cent of them are right angle collisions and side swipes by autos. Bus collisions are slightly lower than street car collisions.

35. *Trenton.* The majority of collisions occur between 3 and 6 p.m. Most of these are at intersections where the bus is required to make a turn. Comment: "Next to enforcement of traffic regulations on the part of the private car driver, the adequate assignment of street spacing for various types of traffic will help most."

36. *Harrisburg.* The greatest number of collisions occur between 8 and 10 in the morning and 4 to 6 in the afternoon. "Most of the collisions occur at intersections and are almost entirely due to autos cutting around or cutting in ahead of our vehicles. We have very many more collisions with trolleys than with buses." Comment: "A great proportion of our collisions are due to buses turning out into traffic after loading or unloading at the curb. This has not been helped by directional signals on the bus."

37. *Ruckford, Ill.* Most of their collisions occur between 6 and 9 a.m. and 3 and 6 p.m. The majority of collisions occur at

the business district as a result of cutting in and cutting out.

38. One of the largest bus operations in the country states the larger number of collisions are between 8 and 10 and 4 and 7, and the greatest percentage occur at or near intersections. Their records are divided into two classifications, those where the coach hits the vehicle, and the vehicle hits the coach. The ratio is 4 to 1 cases where the vehicle struck the coach. Comment: "The greatest single factor in the cause of bus collisions is violation of regulations of traffic, and faulty assignment of street space for different types of traffic is a great contributing factor."

39. Oakland. Most of their collisions occur between 4 and 6 p.m. and the majority are at intersections. Records show 18.41

collisions per 100,000 miles for street cars and 8.24 for motor coaches. Comment: "Greatest factor in the cause of collisions is the attitude of the general public in taking chances."

40. Los Angeles: 15 per cent of their collisions are between 6:30 and 9:30 a.m. and 32 per cent between 3:30 and 6:30 p.m. 46.7 per cent of their collisions occur within 50 feet of cross streets or in a cross street, and 45.3 per cent with automobiles passing the public carrier between streets. Out of 3,350 accidents, 2,300 of them were collisions where the vehicles were travelling in the same direction. In other words, weaving of traffic was responsible. Summing up, out of 6,433 accidents, 4,300 were collisions between private cars and public carriers going the same way.

How to Make Good Bus Drivers Out of Street Car Operators

By F. G. BUFFE

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In the past ten years there has been a decided change in mass transportation insofar as the vehicle used is concerned. In 1927 city transit lines operated a total of 61,881 surface cars and 8,854 motor buses. In the year ending December 31, 1936 these same companies operated a total of 37,800 surface cars, 22,100 motor buses and 1,154 trolley buses. This radical changeover is still in the progressive stage, and is going forward rapidly. Especially is this true of the comparatively recent development of the trolley bus.

The operating efficiency and passenger appeal of the gasoline motor bus, the need for extensions to meet shifting populations, the changed riding habits of the people, the imperative necessity of meeting automobile competition and the need to reduce operating expenses are some of the reasons which have brought about this change. In many of the smaller cities rail cars have been entirely abandoned and motor buses substituted. In Portland, Ore., a city of 301,815, the transportation system has been largely changed over to trolley buses.

I do not mean to infer that for many years to come there will not be a place for street

cars, especially the recently developed modern car, but their use will be restricted to heavy lines and larger cities.

The situation has presented of course a personnel problem to all operators. There is a surprisingly low labor turnover in transportation work, and as a result it became necessary to train men, who for many years had had fixed habits in operating street cars, to operate motor buses. The inference should not be drawn that this choice was a forced one or done only to maintain employment. Most operators today I think will agree that where physical requirements are met, trained street car operators make the best bus drivers.

There are of course physical qualifications which must be met. Many men now efficiently operating street cars should not be transferred to the new vehicle, either because of age or failure to measure up to certain definite physical requirements. These men have acquired deeply fixed habits which have become second nature, and they have reached an age where an entire change of habit is very difficult, and in some cases impossible. Bus operation requires definite physical standards which some men are unable to meet—these

are particularly those of sight, hearing, and reaction to outside stimuli. There are also considerations of personal appearance, mannerisms and disposition to which attention must be given as the operator of a motor bus is in much more intimate contact with his passengers than is the operator of a street car.

As a general rule, however, experience has demonstrated that efficient street car operators when properly trained and who meet bus requirements make the best operators of motor buses in city transportation work.

Perhaps the better way to approach the subject would be to examine a typical operation and its methods of training. Kansas City presents a good laboratory for this purpose. It was one of the city companies which early recognized the value of the motor bus, and in 1915 combined motor bus operation with its street cars. Kansas City presents most of the problems of the large city, and many which others do not have. It is extremely hilly, the downtown area is fairly confined, many main heavily traveled streets are narrow, the percentage of automobile ownership is high, and while winters are not generally severe, they can be depended upon to furnish storms which tax all the resources of the transportation department.

For those who are unfamiliar with the property, a few words of explanation might be of interest in connection with the subject. Kansas City, Mo., and Kansas City, Kans., with their surrounding suburban area, constitute practically one contiguous municipality for commercial purposes. Population is in excess of 550,000. The Kansas City Public Service Company furnishes mass transportation. It has at the present time 279 miles of rail track; maintains 484 street cars and has a fleet of 214 motor buses. None of these buses is over five years old, and the fleet is confined to the standard metropolitan type vehicle. The mechanical department was recently awarded the Gold Award by "Bus Transportation" for the city operating company having the best maintenance methods and getting the best results in 1936.

Bus operation was inaugurated in 1935 with a fleet of 71 vehicles, 18 of which were 63-passenger double deck six-wheel buses. While they were the best the market offered at the time, they were far from being the up to date, fast vehicles available now.

In the twelve years of bus operation, from the beginning there has never been a bus

operator on the property who did not serve an apprenticeship on the street cars. Until a year ago this street car requirement was three years, but it was recently dropped to one year. Therefore our experience has been entirely with street car operators who have been trained as bus operators.

When bus service was instituted there were some in our organization who argued that the bus operation be separate and distinct, and that operators should be recruited from the ranks of taxicab drivers, truck drivers, etc., because of their driving experience. We decided however that our bus force would be taken from our own organization and that the bus operation would be another division of our transportation department, operating with the same personnel and supervision.

Except for the actual manual and physical operation of the vehicle the duties of the bus operator and the street car operator are the same as the street cars are entirely one man operated. These cover the collection of fares, issuance of transfers, observance of company safety regulations, handling of schedules, securing witnesses for accident cases, making reports, courtesy, passenger handling, etc. In addition, our street car operators were not only familiar with these details and were trained in them, but they had through long connection with the company become familiar with its policy, its management, and had absorbed the organization spirit. They were old members of the family, and we decided that it was much easier to teach these men the physical operation of the new vehicle than it was to recruit new men whose only qualification was that they had at some time or another been familiar with automobile operation. We found that we could select sufficient men trained in street car operation for the original operation of buses who had had some truck and automobile experience. Many of them had driven trucks in the War.

After a street car operator's application has been accepted for bus service, he is sent to the bus division for his preliminary training. Any man may apply for bus position and applications are accepted on a basis of company seniority. The applicant must pass physical tests and otherwise meet requirements. A practice course three and one-half miles long has been laid out with left and right turns, level ground, grades, and all other road conditions that would be met on a regular bus route. The applicant is assigned to a road instructor. The student spends six to eight

hours on this course, starting, stopping, and handling a bus until he can shift and reverse shift without raking gears, and make smooth starts and stops. He is given general mechanical instructions so that he will be able to tell when the bus is not operating properly, but there is no effort made to give him any highly technical instruction. After the student-bus training he spends 115 hours on the road with operator-instructors, working on each of the routes on the system. Upon completing his training he takes written and oral examinations by a division superintendent. He is handed a city traffic code and, upon being assigned to duty, a road instructor goes with him for the first two trips.

The younger men naturally are somewhat easier to train insofar as the mechanical operation is concerned. Many of them have had previous truck experience and of course all of them have driven automobiles. Their previous operating habits have not become so firmly set, they are more adaptable and learn more easily and faster. They are inclined to be less cautious. They have a liking for speed and unless checked they are liable to leave a terminal a little late in order to step on the gas a bit.

The older men are more cautious, not so sure of themselves, and have old habits to change. Many of them are not so familiar with automotive equipment. It is sometimes necessary for them to spend three or four days on the practice course before they learn the mechanical operation thoroughly. They have been used to rail operation where the road ahead is the one to watch. This being clear they can let their eyes wander from side to side, which does not do so well on a bus which has to be steered. They have a good idea of side clearance from their former experience.

All students both young and old experience muscular soreness in the back and legs and it takes some time to get over this and accustom their muscles to the strain of bus operation.

Supervision is constant and cooperative. The supervisors follow a daily routine covering all of the important points of operation. The staff consists of the division superintendent, his assistant and road instructors. They work along the lines of helpful cooperation and of constant instruction. Discipline is not relaxed but there is an avoidance of the old driving methods and of suspension that penalize an operator's family as well.

The men appreciate this and respond.

A good neat personal appearance is insisted upon but there has been little trouble in securing it. Bus operation seems to make an operator very conscious of his appearance and the bus operators exert themselves in this regard more than do the car operators.

Each operator is held personally responsible for violations of the city transit code.

There must be very close cooperation between the mechanical and transportation departments. Poor operation can seriously affect maintenance as well as cause road delays. Operators are checked frequently on their mechanical operation.

The buses on the whole have a better accident record than the street cars. Steps are lower, passengers are under closer observation of the operator, the vehicle can be steered, it loads and unloads at the curb.

There is no definite relation between the accident records of a car operator and the same man on a bus. Many men will improve their previous record when they go on a bus. Accident records improve with experience. For the group of our men with 10 to 12 years of service their records show 2.3 accidents per year. Newer men run between 3 and 4.

In making bus operators out of street car operators there is one problem which seems impossible to limit by hard and fast rules. As bus operation increases and as street car runs available decrease, there is more of a shift on the part of the older men. A transportation company naturally operates under rules of either division or system seniority. In either case men applying for bus positions are considered in accordance with their seniority standing. Should there be an age limit?

In Kansas City we have purposely set no definite limit. Management reserves the right to pass on qualifications. Under our system of collective bargaining a man has the right to appeal his case to a committee for review.

We require a strict physical examination on entering service. We also require a yearly examination of all bus operators. Occasionally a man in late fifties applies and the Superintendent of Transportation will discourage his application. We have one operator of 61 who entered bus service three years ago after 27 years on the cars. He passed all examinations, operates on our heaviest line and is one of the best operators we have.

TUESDAY LUNCHEON SESSION

October 12, 1937

The luncheon session was devoted to a round table discussion. The first part, on "Periodical Physical Examinations," was led by E. E. Grover, Manager of Claims, Columbus and Southern Ohio Electric Co.,

Columbus, O. The second part on "What to Do With the Accident-Prone Driver," was led by W. A. Brown, Director of Safety, Tennessee Electric Power Co., Nashville. Brief summaries follow.

Periodical Examination of Employees

In introducing the subject Mr. Grover discussed the values to be realized in maintaining the health of transit employees in relation to accident prevention. A well man is more likely to avoid accidents and injury to himself than a sick man. Having a check of the men's physical condition reduces the likelihood of having claims presented, based on alleged injury resulting from hidden and obscure causes.

He described the system used in his company, which retains a physician (not on full time) to conduct the examinations and to advise the employees. The company also employs a registered nurse to assist in keeping a check on health matters. Examinations are held at regular intervals, ranging from three years among the younger men to periods down to six months, or even more frequently, in special cases.

He described the company's experience in dispelling distrust among the men. The men now see that the object of the program is to keep them on the job, not to find reasons for disqualifying them. Mr. Grover stated that such a program can be established and carried on, with wisely chosen medical as-

sistance, at a reasonable cost, and that it is definitely an important factor in prompting safety work. In their case, it has been instrumental in effecting important savings in their industrial compensation rates.

In subsequent discussion it developed that in a number of companies which have established such a program it has been unusual for the program to cause a man to lose his employment. In some cases it has been necessary to take men off the front end of street cars and put them on the rear, or even to take them off the cars entirely; however, in virtually every such case, the men have been placed in other work.

In a few cases, they have been retired on annuity.

Dr. H. E. Fisher and M. W. Bridges Chief Surgeon and Safety Engineer, respectively, of the Chicago Rapid Transit Company, also spoke, endorsing Mr. Grover's conclusions and emphasizing that the program need not create friction between management and men. It has been possible to place every man removed from his normal occupation, as a result of physical defects, in other more suitable and less hazardous work.

What to Do with the Accident Prone Operator

In opening the discussion Mr. Brown referred to studies of the subject, speaking particularly of the investigation carried on in the Boston Elevated Railway by Dr. Slocum and the study conducted on the Cleveland Railways, with Metropolitan Life Insurance Company collaboration.

He pointed out that all companies have a small percentage of operators who have a disproportionately high number of accidents.

He referred to the claim sometimes put forth that certain accident tendencies are innate in particular individuals, and that very little can be expected of training, except of

a negative value. He raised for discussion the question, "What can we do with the accident prone man? Is training an effective corrective method?" The experience of many transit companies tends to support the theory that it is, he said.

W. J. McCarter, of the Cleveland Railways, supported the conclusion that the number of men who cannot be trained out of accident proneness is extremely small. He stated that most accident prone men are so because they lack something—in most cases the will to prevent accidents.

His studies of the subject, he said, disclose

that there is practically no statistical relationship between slow reaction time and accident proneness. This is because the slow reaction time men have had the will to train themselves out of their trouble. It is harder to train older men, not because it is harder for them to learn, but because they have lost the will to learn. The principle will hold that accident prone men can be trained out of their troubles if they can be imbued with the will to correct their faults.

Several other delegates spoke, most of them upholding the view that men disposed to accidents can be helped to prevent them.

WEDNESDAY AFTERNOON SESSION

October 13, 1937

JOINT SESSION WITH COMMERCIAL VEHICLE SECTION

Maintenance of vehicles, psychological tests for operators, and the parking problem were discussed by speakers at the joint ses-

sion. A complete report of the meeting will be found in the section of this volume devoted to the Commercial Vehicle Section.

ADJOURNMENT

Child Education Section

Officers 1936-37

General Chairman—FREDERICK ARCHER, University of Alabama, Tuscaloosa, Ala.

Vice-Chairman—AGNES SAMUELSON, Superintendent, State Department of Public Instruction, Des Moines, Iowa.

Secretary—MARION TELFORD, Education Division, National Safety Council, New York City.

Executive Committee Chairman—FREDERICK ARCHER, University of Alabama, Tuscaloosa.

Elementary School Committee Chairman—LESLIE R. SILVERNALE, Supervisor of Safety Education, Public Schools, Cleveland, Ohio.

Secondary School Committee Chairman—EDWARD E. GREENE, Vice Principal, Arsenal Technical Schools, Indianapolis, Ind.

Statistics Committee Chairman—R. H. WATERHOUSE, Superintendent of Schools, Akron, Ohio.

State Safety Activities Chairman—CHARLES H. ELLIOTT, State Commissioner of Education, Trenton, N. J.

Officers Elected for 1937-38

General Chairman—MILLARD C. LEFLER, Superintendent of Schools, Lincoln, Nebr.

Vice-Chairman—J. ANDREW HOLLY, Director of Instruction, State Department of Public Instruction, Oklahoma City, Okla.

Secretary—MARION TELFORD, National Safety Council, New York City.

TUESDAY MORNING SESSION

October 12, 1937

ACCIDENT RECORDS, THEIR MEANING AND USE

The meeting was called to order by George Melcher, Superintendent of Schools, Kansas City, Mo., who presided.

The four addresses revolved about accident records, their meaning and use, and how they may be obtained.

Student Accident Statistics—The Facts and What They Mean

By A. D. BATTEY

Assistant Statistician, National Safety Council

In 1935 accidents caused 21 per cent of all the deaths occurring to children 5 to 14 years old. Twenty-five years earlier, in 1910, accidents caused only 13 per cent of all deaths. Then, they resulted in only one-eighth of the child fatalities; now, they cause nearly one-fourth of the death total.

Does this mean that accidents resulting in death doubled in number during these years? It does not. In fact, if you state the problem in terms of death rates (that is, the number of children killed out of each 100,000 children) you will find there was actually a decrease from a rate of 34 in 1910 to a rate of 32 in 1935. Then why the increase in their importance? Throughout these 25 years doctors made great progress in the prevention of deaths from disease among children, with the result that in the latter year they occurred only half as frequently as at the beginning of the period, if account is taken of the increase in population.

Why has the prevention of accidental deaths lagged behind that of disease deaths? First, because organized work in safety education on a national scale covers only about half of the period. It is generally stated that it began about 1922. Second, the size and the growth of the motor vehicle accident problem had begun to make itself evident in 1922, and it has been growing ever since. This is not a problem that can be completely solved by safety education work in the schools. If we disregard motor vehicle accidents in the 5 to 14 age group for a moment we find that fatalities from other types of accidents went down about 40 per cent, thus nearly equalling the reduction in deaths from disease. The fact that most of this decrease came after 1922 should be a source of great satisfaction to every one working in the safety education field.

The difficulty of solving the child motor vehicle accident problem is compounded of the impossibility of keeping children out of the streets all together, and the immense increase in the hazard. It can be estimated that total miles travelled in 1935 by motor vehicles was nearly three times as great as in 1922. In some communities the hazard has undoubtedly increased much more than three times. Therefore, one might well be

amazed that there was a decrease of 14 per cent from 1922 to 1935 in the motor vehicle death rate of children 5 to 14 years old.

The sudden increase in traffic volume in 1936 appears to have caught the children only partly prepared for it, for the death rate rose to 13.2 or 9 per cent higher than for 1935.

However, figures now available for 1937 indicate that the 5 to 14 years death rate for the year is about 3½ per cent below 1936, despite an increase in motor vehicle travel this year of 11 per cent. If you can reduce motor vehicle deaths even that much in the face of an increase in the hazard, you can take pride in the accomplishment.

This point seems clear: If school children were as careless today as they were in 1922, their motor vehicle death rate might well be twice as great as it is.

Now, as to what we found out about student accidents through our analysis of the monthly reports submitted by cooperating school systems. First, let us take an over-all view of the reports. They came from cities ranging in population from a million to a thousand. They represent the eastern part of the country to a somewhat greater extent than other parts, but they sample the student accident experience as far north as Minnesota, as far south as Tennessee and as far west as central Kansas. They include the records of 830,000 students for the nine months from September to May.

During these nine months a total of 19,109 accidents were reported, each one serious enough to require a doctor's attention or cause at least one-half day's absence from school. In individual grades the number of accidents reported ran from 375 in the kindergarten to 2,031 in the seventh. A large part of this difference is to be accounted for by differences in enrollment. There were only 37,200 kindergarten pupils, compared with 68,100 in the seventh grade. This makes it necessary to reduce all the accident figures to some uniform rate basis. The method we have chosen is to state all student accident figures as the number which occurred in each 100,000 student days—that

is, the number of accidents which, on the average, occurred among each 100,000 students during one day. These rates place all grades on an equal basis regardless of enrollment, and also make it possible to compare one school or school system with another or one month's experience with another.

The rate per 100,000 student days for the kindergarten pupils was 5.7, while that for the seventh grade was 17.0. Thus, the older pupils had three times as many accidents, on a uniform exposure basis, as the children in kindergartens. If you consider only the raw accident totals presented a moment ago, your conclusion would be that they had nearly six times as many. This is an illustration of the need for rates based on exposure.

The rate for all grades was 13.1. The kindergarten rate was the lowest, followed by the first grade with 9.7. In the second and third grades it was 11.0 and 11.3, and in the fourth and fifth 13.3 and 13.6—each pair of rates representing an increase of about two accidents per 100,000 student days over the preceding rates. In the sixth grade it advanced more moderately to 14.5, then in the seventh jumped to the maximum of 17.0. From this point on there was less change. The eighth grade rate was 16.1. In the first year of high school it dropped to 14.4, then in the second and third years rose to 15.0 and 15.7. Finally, in the last year, it declined to 13.2.

So much for the over-all view of the frequency of student accidents. We now know something of the size of the problem but we still could not make effective plans for greater safety because we have not yet considered what kinds of accidents occur or where they happen. On the location of accidents, the available statistics show that 18 per cent occurred in school buildings and 17 per cent on school grounds, a total of 35 per cent for all school property. Those accidents which occurred on the way to or from school constituted only 7 per cent of the total—less than one in 10. Accidents occurring in the children's homes made up 28 per cent of the total, more than one in every four, which indicates that the accident prevention problem will never be solved until we receive the whole-hearted cooperation of parents in support of our safety education work.

Places away from school or home (vacant

lots, parks, streets) have the largest proportion of accidents, 30 per cent. Here the degree of control which may be exerted is least, and the greatest dependence must be placed on the habits we seek to develop through safety education. It should be pointed out, therefore, that the records of the last five school years showed no signs of improvement for this class of accidents. The rate per 100,000 student days was even a little higher from September, 1936, to May, 1937, than in earlier years.

Now, for some details about the accidents at different locations: In school buildings, accidents were more frequently reported as happening in the gymnasium than for any other location during the last school year. One-third of the school buildings total occurred here. For junior and senior high school grades, alone, they made up 40 per cent of the total. Accidents on stairs were next most important, but there were less than half as many of them as of gymnasium mishaps. They, also, were recorded most frequently in the high schools. Class room accidents occurred as often as those on stairs, but they were more numerous in the elementary grades than in high schools. Accidents in vocational shops were a little less frequent, but were confined almost entirely to the upper grades.

On the school grounds football, alone, made up 15 per cent of the total, but in senior high schools these casualties were half the total. Baseball accidents came next with 11 per cent of all school ground accidents. These were distributed much more evenly among all grades. Apparatus accidents, in total, were less numerous, with few above the elementary grades. Unorganized, rough-and-tumble play was involved in nearly half of the school ground accidents, which may not be surprising to those of you whose duty it is to supervise playground activity.

Accidents occurring on home premises are classified by type of accident rather than by exact location or activity. This classification was chosen in designing the forms, because it apparently would give more useful information than either of the other methods considering the space available on the forms. From the reports received last school year it is clear that falls occurred more frequently than any other type of accident, making up 40 per cent of the home total. Frequency was highest among ele-

mentary school pupils, but it stayed remarkably high through the high school grades. Cuts and scratches comprised 20 per cent of the home total and burns only 10 per cent. However, nearly half of the deaths resulting from home accidents were classified as burns.

Only part of the accident summaries received showed details of location for the accidents occurring away from school or home. For the school systems giving this information it appears that motor vehicle accidents comprised about one-fourth of the total, other street and sidewalk accidents about one-third, playgrounds other than school one-tenth and other locations nearly one-third. Motor vehicle accidents occurred somewhat more frequently among the

younger students, but the non-motor vehicle injuries were most numerous in the junior high school grades.

Absence from school as a result of accidents averaged 3.4 days per case for all grades, but there was much variation from grade to grade. In the kindergarten the average absence was 5½ days, and in the first grade a little over 4 days. In contrast, the seventh grade average was slightly above 3 days, while in the senior high school it was only 2¼ days. There are no data available to substantiate it, but I believe this decrease in average absence is due more to the parents' desire in the case of younger children to make sure that recovery is complete than to fundamentally more serious injuries.

How Accident Facts and Records May Be Used in Curriculum Building

By ROSE WICKEY

Curriculum Dept., Public Schools, Kansas City, Mo.

The school of today attempts to meet the practical conditions of life and to relate its work to the problems of modern civilization. At the same time it must build up the structure of a right relation to life. Not only the practical results to be achieved, but also the effects on character and viewpoints toward life, must be considered. Useful habits, practical knowledge, and a wholesome philosophy of living are the desirable outcomes of any type of education.

Where does safety enter into this educational plan? In the first place, no more vital problem faces society today than that which involves human safety and progress. Secondly, safety education means more than the mere training of people to avoid or prevent accidents. In a broad sense, the term safety comprehends all that goes to make life worth while—health, efficiency, security, happiness, opportunity, exploration, experimentation, progress.

Safety does meet the two criteria outlined in the preceding statements, and does, therefore, have an important place in the school curriculum. The two recent Kansas City bulletins on safety, mentioned at the outset, make the following statement as a part of

their underlying philosophy: "Safety is a way of living. It is not an end in itself, but a means to an end: joyous play, new adventure, efficient work, helpful service. Like other factors which help make living complete—character, health, correct speech—safety is an integral part of the school curriculum. It cannot be taught as an isolated subject, but must have definitely planned consideration in relation to all the activities which make up the life of the school. Every department, whether administrative or instructional, has the responsibility of providing safe conditions for work and recreation, of developing safety habits and attitudes, and of imparting useful information."

The following are specific instances of how our committees used accident facts in their curriculum building in the field of safety.

Their work from the outset was based on the two-fold principle (1) that an effective program of safety education must consider the hazards peculiar to the student and

¹ *Safety in the Curriculum—Junior and Senior High Schools*, p. 12. *Safety in the Curriculum—Elementary Schools*, p. 11. Kansas City Public Schools, Kansas City, Missouri.

the community in which he lives as well as those of nation-wide importance, and (2) that accidents can be avoided and it is important, therefore, to have all the facts about their occurrence in order to know how to prevent them. They made a comprehensive survey of accident records for both the nation and the local community embracing such points as the following: various types of accidents, chief causes of accidents, places where accidents most frequently occur, and time of day or season when accidents are most common.

This general study of existing facts was followed by an intensive consideration of the accident problem in relation to children of elementary and high school levels. Certain significant facts were tabulated and arranged in two tables for use by the classroom teacher: the table for the elementary school bulletin emphasizing especially the 5-14 years age group; the table for the high school bulletin, the 14-24 years age group.

Using this study and tabulation as a basis, the committees then built a very comprehensive chart with a classified arrangement of common accidents, their causes, and places of occurrence. Under each type or cause of accident, they listed the safety practices that would prevent the accident and that should become habitual with the children.

This chart is published in the elementary school bulletin and is referred to in the high school bulletin. It is intended as a ready reference source for teachers and as a means of checking the effectiveness of safety instruction in so far as habits of action are concerned. The chart is by no means the subject matter of the course, but it is the foundation on which the subject matter is built. Its items are not presented as learning units, but as desirable practices and knowledge to be acquired in normal, everyday living.

Safety education must not make life drab for the child. It must not fill him with fears or take adventure and play away from him. Rather it should help him to realize that, to do all the wonderful, joyous things he wants to do, he must keep himself strong, well and safe.

As has been stated, the accident facts were gathered first and the desirable safety habits listed in connection with these facts. Then content, or subject matter, was deter-

mined: Such content as would permit these habits to be acquired in as natural a situation as possible and as would develop large, basic understandings and right relationships.

A detailed analysis was made by the committees of natural situations and opportunities offered by the daily school program for acquiring safety knowledge, habits, and attitudes. The daily school program was interpreted to include the general school routine, the various subject fields, recreation, and extra-curricular activities.

Under general school routine were included such opportunities as entrance to, or exit from, grounds, building, and room; passing in halls and on stairways; care of wraps; use of lockers; use of drinking fountains and wash rooms; and conduct in cafeteria, gymnasium, auditorium, shop or laboratory.

In considering the subject fields, those fields were chosen in which safety enters naturally; e.g., the social studies, nature study and the sciences, health and physical education, industrial arts, home economics, English, and art. In the high school various types of accidents were allocated to certain subjects for study; e.g., motor vehicle accidents to civics, American government, general science, physics, auto mechanics, and biology; drowning to general science, health and physical education; gas accidents in the home to general science, physics electrical shop, and home economics; accidents in industry to civics, chemistry, economics, and industrial arts; and so on.

In extra-curricular activities were included opportunities, such as arise in connection with safety clubs, junior safety councils, patrol or traffic squads, automobile clubs, and first-aid units.

There are frequent times when the *direct teaching* of safety is essential, when teacher and pupils are consciously attacking the accident problem. This is especially true in upper grade and high school levels. Here again accident facts connected with the school, home, community, or nation are responsible for the cooperative study.

In the beginning, I stated that one of the functions of any type of education is to help the individual build up right viewpoints, broad understandings, and a wholesome philosophy of life. The following are some of the emphases made by our committees in their treatment of this phase of safety education.

In the field of the social studies:

The prevention of accidents is the preservation of life for activities that are of worth and interest both to the individual and to the community.

The welfare, happiness, and progress of society depend largely on intelligent adjustment to the changes incident to an industrial age: increased tempo of life activities, high-powered machines, and rapid development of the automobile.

Throughout the ages, attitudes toward safety have resulted in legislation to provide for the welfare and progress of humanity.

The safety and well-being of the community depend upon individual observance of law and respect for authority.

The present machine age provides greater comforts and conveniences of life, but at the same time increases the hazards and dangers of life.

The family, school, industry, and community require the willing cooperation of every individual if the desired safety results are to be accomplished.

In the field of the sciences:

Man's welfare and progress depend upon his wise use, modification, and control of his environment, and on his ability to adapt himself to those aspects of nature that he has not yet learned to control.

This is an age of science, and modes of present-day living are dependent on contributions from the field of science.

A knowledge of properties, principles, and processes in the sciences is a valuable aid in meeting health and safety problems.

Man's use of matter and energy has added to the complexity as well as to the ease of modern living.

The more civilization becomes the product of man's ingenuity, the more artificial and complex it becomes.

The chief value of transforming or transmitting energy is that work done thereby will make life more satisfactory and more safe.

In the field of health and physical education:

Health and safety are prime requisites of a happy, zestful, and useful life.

Prevention and control of hazards to health and safety are conducive to the welfare and progress of the community.

Cooperation in community health enterprises is a safeguard to personal security and well-being.

In the field of home economics:

Among the factors responsible for interdependence in family life are accidents, illness, unemployment, and old age.

The great number of accidents prevalent in the home can be reduced only through knowledge of the common dangers and hazards of the home and through provision for preventing or meeting them.

Safety devices, control of disease, regulation of employment, and insurance are among the means being employed by society for individual security and independence.

Application of knowledge and skills gained in the various departments and subjects of the school make the home more safe and pleasant.

Cooperation, understanding affection, and courtesy are essential to safe, happy home life.

In the field of the industrial arts:

Acquaintance with materials, knowledge of simple mechanical devices, ability to operate simple machines and to handle tools properly are important factors in overcoming many common hazards and dangers.

Knowledge and skills gained in school shops are useful in discovering and in correcting common hazards and dangers in the home.

Many safe practices in school shops are fundamental to safe practices in the field of industry.

The confident, dependable, safe operator of machines is an asset to a world that must depend on machines for the necessities of life as well as for its comforts and luxuries.

If some basic truths, such as these, are developed in the various subject fields, pupils will acquire a deeper understanding of, and a constructive attitude toward, this problem which menaces human life and well-being. They will at the same time be building a sane philosophy of life.

Accident facts and statistics furnish one very good approach to safety education in the high school. Then is the time when strong appeal can be made to the intelligence. Then is the time when the youth likes to feel that he is a necessary force in a great movement or crusade.

Let figures, graphs, and pictures show the awful toll that accidents are exacting in the way of death, injury, money, and unhappiness.

Make comparisons involving records and statistics: accidents in the United States versus those in other countries; accidents in the home state versus those in other states; accidents versus disasters (Chicago fire, San Francisco earthquake, sinking of the Titanic, Ohio River Valley floods, New London school explosion, etc.); accidents versus fatalities in the wars in which our country has engaged; accidents in various age groups; etc.

Emphasize especially the tremendous problem that the nation faces in moving the mass of traffic on its streets and highways. Stress the fact, and prove with statistics if need be, that incompetent driving is the leading cause of motor-vehicle accidents. The high school youth is vibrant, eager, receptive, and he is legally eligible to drive a car. Impress upon him that learning to drive involves much more than the acquisition of mere mechanical skills which make the car perform.

Confront, I repeat, the high school student with the enormity of our national accident problem and the insecurity in which this problem involves our true wealth and happiness; then capture his enthusiasm and enlist his aid in the campaign for human safety. Above all, help him to realize that the adventures of the benefactors of mankind, Pasteur, Gorgas, Edison, Byrd, Lindbergh, and countless others, are thrilling because they were met with intelligence, forethought, and carefulness.

Such considerations as those I have just mentioned in connection with the motor-vehicle-accident problem influenced our committees in their preparation of Part IV of the safety bulletin for high schools. This part is in reality a course in driving for high school students, and is entitled "How to Become a Competent Driver." There are five units in the course, the names of which answer the question implied in the title of the course. These names are:

1. Develop Correct Driving Habits.
2. Understand the Motor Car.
3. Become Familiar with the Highways.
4. Consider All Users of the Highway.
5. Observe Traffic Regulations.

The first unit of the course deals with

that type of training which contributes to the development of good driving habits; the second includes a simple study of the motor car itself; the third points out the importance of becoming familiar with the various uses, types, and conditions of the highway; the fourth reminds the young driver of his great responsibilities toward others who use the highways; while the fifth deals with the efforts of humanity since earliest history to regulate its traffic problem.

In this course, as in other parts of the bulletin, great basic truths and understandings are emphasized in the hope that the youth will become a driver, competent in every sense of the word; skillful in mechanical operations, conscious of the great power in his control, considerate of others and fair with them, respectful and obedient to law, generous, courteous, open-minded, careful, safe.

At the outset I stated that any type of education to be effective must meet the practical conditions of life and at the same time build up right viewpoints toward life. In the light of that statement, my conclusion will have to be that the test of safety education must be a reduction in the number of accidents and the acquisition of right standards of living.

While the scroll of "Accident Taxes for 1936, Due and Collected from the American People" gives staggering information, still statistics do show enough decline in spots where education has been particularly stressed—notably in the elementary schools and certain industries—to prove that education is an effective means of meeting the accident problem and that it is the chief hope of future endeavor. Much satisfaction comes from the record of accident reduction in the 5-14 years of age group, and we in Kansas City are particularly proud of the fact that October 6, 1937 marked the close of a year in which no child of school age in our city was killed by a motor car.

As for right viewpoints, I believe that the palm goes to the same age group of children, that of 5-14 years. This story came to me the other day of a small kindergarten child who was having his first experiences in meeting the problem of following the directions and guidance of schoolboy patrols while crossing the street with many other children. In talking over his difficulties with his teacher, he said, "Miss Blank, I know

I'm just a little fellow, but I'm trying awful hard."

That is the type of attitude which will help lower our accident taxes. That is the type of attitude which will meet the accident problem, the most serious of all con-

temporary problems. That must become the viewpoint of everyone of us, for safety is the civic and moral responsibility of every man, woman, and child. "I know I am only one individual in the great group of humanity, I know I am only a little fellow, but I am trying awful hard."

Accident Records—How They May Be Used in Teaching Safety at Home

By IRMA GENE NEVINS

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Kansas State Teachers' College, Pittsburg, Kans.

The success of using accident reports depends on the cooperation of the members of the family with the agencies which are interested in safety. This involves being acquainted with the purpose and objectives of the safety council. The fact that these organizations are not based primarily upon commercial sources is a valuable asset together with the fact that the material presented is sound and based upon an interest in humanity.

In using the accident records one is impressed by the fact that the quantitative accounts should be used as a basis for a qualitative program. The accumulated facts point the direction toward which all thinking people should motivate their action. This means to arouse an interest in creating a place of safe living and to create a desire to think through the course of action.

One of the first points to consider is, why are people hurting themselves or causing others to be hurt? There must be a motive, for people do not desire to hurt others except in rage; few people have the intention of killing themselves except in a case of despondency. As one checks the records and finds the cause for the great number of accidents, he is impressed by the fact that the motivation of being safe has not been strong enough. In dealing with accident statistics the old algebraic formula is turned around; for one finds "x" the unknown in algebra. In safety we have the unknown; our known is "boy standing in water touching the electric wire equals accident." Our problem is to get people to realize that the equal sign is important.

Statistics which have been collected definitely point the need for safe living. The National Safety Council, through its various departments, has presented us with much valuable information. It is our problem to acquaint the public with these facts. There are two ways in which one can look at this information; one, from the national point of view and, two, from the local. The human brain is accustomed to figures, but if the figures are larger than the ten's they lose their significance. To say that 39,000 people lost their lives in the home last year means nothing, in terms of visualization. To say that 40 people in the local situation were killed is something that can be grasped and visualized. It is our purpose to make concrete the statements which have been collected. Many times breaking them down to fit the local situation will aid the public in understanding what one is talking about. As one studies the accident records of the home, the information which has been collected by the national and local groups, one finds certain facts which seem to be significant. The first point is:

1. Most accidents are unintentional. The home maker many times does not realize that flour thrown into incinerator will burn, or that an electric light cord run under a rug may be worn and short circuit.

2. The second reason for an accident in the home is over fatigue on the part of the parent or the child. Many times, our lady in the home, in her desire to do too much, becomes too tired and an accident results. The housekeeper places her emphasis on the wrong thing and finds to her sorrow the

evaluation of her work was improperly placed. To wash and iron on the same day may cause her to drop the iron and burn her foot.

Fatigue Factor

The child in the home may be at too high a tension and over fatigued and he does the thing he did not intend to do. He did not intend to trip over the rug, knock the vase off the table and break his arm. He was so tired that his legs would not coordinate and he became a victim of something, for which he should not be blamed.

It has been said that spanking time for the child is 5 p.m. on regular days and 4 p.m. on holidays. I do not know whether this is accident time; it would be, however, very interesting to find out.

3. The third reason for accidents occurring in the home is that familiarity may make one unaware of the conditions as they exist. In this situation familiarity may breed accidents for one sees the thing so often he fails to realize that there is a need for a change. The frayed rug in the living room is an excellent illustration, for the member of the family being in a hurry trips and falls.

4. Placing the wrong emphasis on economy is a reason for disaster in the home. The much used illustrations are; the wiring of the house by an amateur electrician or the cleaning of one's clothes with gasoline.

5. Sometimes we women make the statement that this is a man's world. I wonder what indictment the children could make of us, if they could dare voice their opinions? I think we would find that the home, with its furnishings and equipment are all made for the adults. The child must adapt himself to a situation which is beyond his strength, his energy and comprehension. Consequently an accident is the result many times.

6. The putting off until tomorrow is another cause of accidents in the home. Putting off the purchasing or installing of an electric light handy to one's bed, has been the cause of more than one serious injury.

Another statement of importance in the accident picture is "I'll fix it tomorrow." This indifference to the needs of today has caused a great amount of heart ache and physical pain.

This brings to our consideration a safety measure which might be adopted by the utilities companies. If each company would send a man to each home to check their commodity as to its condition, methods of installing, and equipment, each place would be a safer place in which to live.

After analyzing the accidents and finding the reasons for them, our attention must then be directed to a means of preventing their recurrence. I think there are five questions which should be broadcast to all housekeepers:

1. What can I do to make my home a safe place?
2. How can I accomplish it?
3. Who is to do the fixing or make the needed change?
4. What kind of an evaluation will I give to the labor after I am through?
5. How can I maintain a mental balance which will enable me to be safe even though hurried, tired, and emotionally upset?

Many times the facts that are accumulated from the accident records must be sugar-coated and presented in such a way that the interest of the family will be aroused. Sometimes one must teach without the learner being aware of the fact that he is being taught. The family group must come in contact with the accidents facts and yet not feel as if they are being driven to learn.

One of the best methods of presenting the accident facts is through the medium of the printed page. This involves the using of cleverly written articles and news stories which interest and hold one's attention. This cannot be too frequently presented, for again interest will not last if one continually sees an accident writeup. The publication of the records must be in such a way that they prove constructive, and are concrete; this calls for organization on the part of the person who writes the article.

Radio Valuable

Another excellent means of attracting attention to home safety is through the spoken word. The radio is an excellent means of obtaining the public interest, especially if the program is planned in an interesting way and has definite objectives. The police of Wichita have used the public address system to reduce traffic accidents by calling

attention to traffic regulations and the need for obedience to rules.

The use of pictures is a third, important method of creating a desire for safety. Sometimes the use of the graph is of importance, especially if it tells a story.

The movies, a combination of the spoken word and picture, is one of the most effective ways of stimulating interest. A special safety picture attracts attention to the needs of change or adaptation in the home. We need more pictures which create a desire for inspection, changing and making our homes safer.

Persuasion Needed

One of the important things that one realizes the more he studies is the need for persuading people to be safe. The educator can force the child to learn the frequency, the cause and the result of unsafe conduct; yet this does not guarantee action. We cannot coerce people into being safe, but we can persuade them. This is not an easy thing to do, for most people think of an accident as something happening to the other person, but not as something happening to themselves.

Many habits of living in our complex civilization are such as to be a detriment rather than an asset to safe living. It is our goal to make this a safe place in which to live and to enable the people to live happily together in the changing world. This may be accomplished by supplying experiences which enable one to participate in an ever-changing dynamic society. In order to provide the experiences which are satisfying and safe one must consider the environment. The records plainly tell us that the home is not "home safe home," that the school building is not a place of rugged individualism, that human physical development hasn't kept pace with the mechanical advances. The pedestrian can't jump any faster than he did 10 years ago, even though faster cars have been made.

With many examples like the above we realize that safe living involves all situations in life. Therefore it is necessary that an environment in the home, school, and community be created in which one can experience safe living.

In the home, cleanliness and orderliness must not rank above safety, but go hand in hand, for we know that good order is a

requisite for safety. The living room may be spotless but the halls and stairways may be an invitation to an accident. The kitchen may be clean and orderly, but the matches or a pan of hot water may be placed so that a child would be unsafe there.

The school buildings of today are so constructed that to be safe one must cooperate with others. They are quite different from the one-room school houses of yesterday where in case of fire, each child could run and jump and be safe. The car driver and the pedestrian must recognize the rights of the other and in so doing provide an environment in which both will be safe.

The second point to consider in the providing of safe surroundings is the actual experiences of the individual. One needs to notice what the child, the adolescent, and the adult like to do, the events which attract and hold their attentions.

The accident records presented to the different ages should relate to the safety of the group. The child is not interested in knowing how many people were killed last year by the automobile, but he is interested in knowing how to cross the street correctly. This involves the learning of habits which relate to the needs of the group in question.

In most situations compulsion is necessary to take the child past the stage where he shows little or no interest in the safety of himself and others, into the period in which he can understand the reason for certain actions. Direction is essential for safe living; values must be taught, for one does not inherit the best methods of controlling himself.

Need Help from Home

Creating an interest in the use of accident records in the home is a problem of first magnitude. We cannot say definitely how it can be solved; we know that in the teaching field we need more help from the home. Parents are always generous with time and effort and money in helping schools to carry out projects of benefit to their children. What we need to do is to arouse them to help the school in working out and establishing a place where safe living and experiences can be used in the home.

Most parents want clean, orderly, safe, and pleasant homes, but not all achieve that goal. Many times I think this is true due to lack of motivation and knowledge. The

broadcaster of the accident records must have this thought in mind—the persuading of people to be safe in the home and in their every-day experiences with other people.

I have mentioned the use of the printed word, the spoken word, and the pictures in contacting the home. Another which should be used is that of the schools. The activities of the home and the school should be coordinated and these two agencies must cooperate. The schools have the source of information on which to base their safety teachings and practices; these should in turn be taken to the home. The most common agency to accomplish this is through parent-teachers associations. It is true that many people cannot be contacted through this medium, but it is a means by and through which the accident facts can be brought into the home. This last year, the chairman of the safety committee of the National Congress of Parents and Teachers sent to the home of each member much valuable material which can and should be used in creating a desire for safe living.

The Federation of Women's Clubs and

the Women's Civic Clubs are interested in advancing the course of safe living in the home. Many excellent programs have been prepared and are in the process of preparation which have and will arouse thinking about and renovating the existing condition.

All of this brings us to the point which is most essential in safe living. This is the ability to think through one's course of action. The ability to think depends upon the knowledge that one possesses. One cannot successfully think out what he should do, if his thinking is hindered by fears, ignorance and prejudices.

Fear limits one's course of action, and knowledge liberates him. If we can truly interpret the meaning of the accident records and use them as a means of liberating all people, then we have accomplished something that is invaluable. The records give us the tangible thing with which we can work. We must take these and use them in an intangible way, to strive to reach our goal—to make the world a safer place in which to live.

Collection and Use of Accident Records

By MRS. PEARL GOETZ

Intermediate Grades' Supervisor, Baltimore Public Schools, Baltimore, Md.

The problem of accident reduction and prevention holds individual aspects for each school. Physical conditions within and without school buildings vary a great deal. There are wide differences in the sizes, types, and equipment of school playgrounds. The homes and neighborhood from which a given group of children come offer advantages or handicaps which may be very different from those of children in another community.

All these factors determine to a great extent the number and kind of accidents common in a certain school. For this reason it is essential that each school plan its own program for reducing or preventing accidents. Such a program would take into consideration the total number of accidents for all the schools in a given locality, but more

particularly an accident summary which shows the number and kind of accidents for the school in which the program is to be carried out.

In the Baltimore schools the following steps are generally used in obtaining accident records and using them to plan helpful programs:

1. An accident committee is appointed early in the school year when the Junior Safety Council in a given school is organized. It is the duty of this committee to obtain and compile information on accidents in the school.

2. The chairman of the accident committee visits every room about the first of each month to collect the accident record cards. The following information is included on these cards:

STUDENT ACCIDENT REPORT**Who was Hurt?**

Name..... Address.....

Age..... Sex..... School attended..... Grade.....

When Did Accident Happen?

Date..... Time..... A.M..... P.M.

Where Did Accident Happen?

At school?..... If so, in building or on playground?.....

On the street?..... If so, where?.....

Was this an automobile accident?.....

If on the street was it on the way to school?..... From school?.....

At home?..... If so, was it in the house?..... Outside house?.....

If somewhere else, state where.....

How Did Accident Happen?What was person doing when hurt?.....
(playing baseball, crossing street, jumping

rope, climbing stairs, sawing wood, washing dishes, building fire, etc.)

Describe the accident.....

What Kind of Injury was It?

(Broken arm, fractured skull, cut finger, bruised toe, burned hand, etc.)

Was a doctor called?..... If so, state his name and address.....

Number of days kept from school.....

Signature of Teacher.....

3. The accident committee, under the guidance of the safety advisor, compiles the data from each classroom. A record of this completed report is forwarded to the Baltimore Safety Council.

4. At meetings of the Safety Council, the chairman of the accident committee presents a summary of the class accident records for the previous month. He discusses the reasons for the accidents and suggests ways to prevent similar accidents.

5. Remedial measures are planned and ex-

ecuted. If a certain type of accident seems to be common throughout a school, a school assembly may be devoted to a discussion of the problem. This is followed by work in each classroom in which the teacher tries to utilize accident data in connection with the teaching of the regular school subjects, so that proper attitudes toward safety may be realized.

Safety education, therefore, is embodied in the entire curriculum. If a school acci-

dent affects only the children of one class, the remedial measures are emphasized only with that group of pupils. In such cases the preventive work may be largely a matter of trying to improve the attitudes of certain individuals who through carelessness become involved in accidents and of others who may be responsible for causing accidents.

It is felt by teachers in Baltimore that work of the kind where attention is directed

to individual children is one of the more important factors in reducing school accidents.

For the past three years in Baltimore another activity has stimulated interest in accident prevention—an annual safety campaign. The wide variety of safety programs and activities carried out by each school is ample evidence that the problem of accident reduction is assuming greater significance in our educational program.

TUESDAY AFTERNOON SESSION

October 12, 1937

SAFEGUARDING THE SCHOOL CHILD

The meeting was called to order by J. C. Kansas City, Kan., who introduced the Harmond, Principal, Argentine High School, speakers.

What Have We Learned from the New London, Texas, School Explosion?

By DAVID J. PRICE

Principal Engineer in Charge, Chemical Engineering Research Division, Bureau of Chemistry and Soils, U. S. Department of Agriculture, Washington, D. C.

The explosion in the Consolidated School Building at New London, Texas, on March 18, 1937, was the most serious school disaster that has ever occurred in America. As the result of this explosion approximately 300 boys and girls, ranging from fifth grade to high school age, were either instantly killed or died from the effects of injuries received in the explosion.

At the request of Governor James V. Alfred, the writer was detailed by Secretary Henry A. Wallace of the Department of Agriculture to cooperate with Texas State officials in the investigation of this explosion.

The Consolidated School of the district was located near New London and many of the pupils were brought to the school in buses. The estimated average enrollment for the district at the time of the disaster was more than 700 pupils.

The building was of reasonably good con-

struction with brick walls backed with hollow tile and having steel beam columns and girders. The auditorium was located in the center of the building, with the high school rooms at the north end and the grade school rooms at the south end. The main building extended from north to south for a distance of 254 feet, with wings at each end about 136 feet in length. Although most of the class recitation rooms and offices, as well as the auditorium, were on the upper or what was commonly known as the first floor, there were also classrooms on the lower or basement floor on the east side of the building at the end of both wings.

The space on the lower floor on the west side of the building and directly under the rooms on the floor above was practically unoccupied "dead space," used principally for storage.

The school building was heated by 72 individual gas steam radiators, and the gas

for heating at the time the explosion occurred was obtained from a nearby residue gas-pipe line owned by one of the oil companies.

The explosion, which occurred about 3:10 p.m., shortly after the classes had begun work in the last period of the day, appeared to be on the lower floor underneath the classrooms on the first floor. The concrete floor was blown upward and many of the pupils were hurled up into the air. The walls collapsed and the roof fell, burying large numbers of boys and girls in the mass of brick, concrete, and steel debris. The investigation showed that the explosion was caused by the ignition of an accumulation of natural gas in the unoccupied space under the class recitation rooms, when a portable plug electric connection was made to start the operation of a sanding machine in the adjoining manual training shop.

The complete report of the investigation of the explosion, which includes recommendations for the prevention of similar occurrences, has been published as U. S. Senate Document No. 56. Copies can be obtained without charge from the Chemical Engineering Research Division of the Bureau of Chemistry and Soils, U. S. Department of Agriculture, Washington, D. C.

The important question at the present time is what will result from the New London, Texas, explosion insofar as the adoption and application of safety measures in the schools of America are concerned? Traumatic as the occurrence was, we must recognize that the Iroquois Theater fire in Chicago on December 30, 1903, in which more than 600 people lost their lives, resulted in the development of many safety measures for the protection of people in public buildings. Adequate exit facilities, fire-resistive stage materials, fire escapes, fire drills, systematic inspection and similar measures for the protection of life have been applied with incalculable value.

The most important developments in the investigation of the explosion in the Texas schoolhouse can be summarized as follows:

1. It must be recognized that open or unoccupied spaces underneath class recitation rooms are dangerous. Such spaces are too readily available for the storage of combustible materials or explosives, or for the accumulation of dangerous gases and vapors.

2. Inspection and supervision of school

buildings, during construction and before and during occupancy, by competent officials is vitally necessary. This must include the inspection of heating and lighting equipment and appliances and similar installations from the standpoint of safety before boys and girls are allowed to occupy the building. *The safety of occupancy is of the most fundamental importance.*

3. Hazardous processes should not be carried on under or adjoining class recitation rooms. The isolation of manual training room operations, smith and forging operations, carpenter shop work, automobile, motor, and engine repair work, and the location of these operations in buildings separate from the main school building is desirable.

4. The inherent danger of using the basement under class recitation rooms as a garage for buses, automobiles, trucks, etc., must be recognized. The necessary storage of gasoline, oils, and other flammable liquids in connection with the operation and maintenance of garages introduces a serious hazard in the development of consolidated high schools, particularly in rural areas.

5. The use of effective malodorants for detection of escaping combustible gases due to leaking equipment or other causes, when the gas used for heating or lighting has no odor or toxic effect, is vitally necessary.

6. The importance of the further development of alarm and warning devices in connection with the operation of combustible gas indicators as adapted to school buildings and other institutions where large numbers of people are exposed to explosion hazards, has been clearly shown.

The National Board of Fire Underwriters has developed a Self-Inspection Blank for Schools which has been approved and adopted by the National Association of Public School Business Officials. This form recommends that the inspections be made each month by a group consisting of a member of the teaching staff, the building custodian, and a member of the local fire department. The completed reports should be filed with the local Board of Education.

The National Board also has developed a booklet entitled, "Fire Prevention and Protection as Applied to the Public and Parochial Schools," which explains the salient features pertaining to proper maintenance and safety conditions of schools. This

booklet is particularly useful for school principals and building custodians.

The New London, Texas, disaster has renewed interest in inspection plans for school buildings. One outstanding example is the action taken by the Department of Public Instruction, Commonwealth of Pennsylvania. On March 13, 1937, that department sent out 13,000 copies of this self-inspection form with an urgent request that the local school officials throughout the State make immediate check of school conditions.

The Texas Inspection Bureau has been actively conducting a campaign for the self-inspection of public schools since the disaster at New London. A special letter with the caption, "Can It Happen in Your School?", and emphasizing the importance and value of regular inspections, has been sent to every school district in the State. This campaign already has given encouraging results.

The Oklahoma Inspection Bureau has prepared a special pamphlet on school fire hazards, and has done splendid work in bringing this matter to the attention of school officials in that state.

The National Board of Fire Underwriters advised the Department of Agriculture under date of September 11, 1937, that self-inspection methods have proved both practical and effective in American schools. Since September, 1934, the National Board has been called upon to furnish, without charge, more than 425,000 copies of the Self-Inspection Blank for Schools, and their records indicate that the plan has been used in approximately 1,100 communities throughout the country. These self-inspection forms and booklets are available to local school and fire officials. Requests should be addressed to the National Board

of Fire Underwriters, 85 John Street, New York, N. Y.; 222 West Adams Street, Chicago, Ill.; 1014 Merchants Exchange Building, San Francisco, Cal., according to the location of the community concerned.

In order that the tragic explosion in the New London schoolhouse may not be just another "unusual disaster," the following concerted action program is recommended to all responsible and interested agencies in order to prevent similar occurrences in other school districts:

1. Arrange for immediate inspection of school buildings, with special attention to basements, unoccupied spaces, open and dead spaces under classrooms. All combustible material should be promptly removed and steps taken to prevent the future storage and collection of flammable and other dangerous materials.

2. Provide proper agencies for passing on construction plans for new school buildings or improvements and additions to existing buildings with respect to safety for occupancy. See that all heating and lighting equipment and appliances are installed by properly trained workmen in compliance with requirements of recognized standard codes, and that all possible safety measures are adopted before school children are allowed to occupy the building.

3. Arrange to isolate all processes involving fire or explosion hazards from underneath class recitation rooms or in close proximity thereto.

4. Make provision for extension of methods for inspection and supervision of school buildings and similar institutions as now applied in urban centers to consolidated and other schools in rural areas.

5. Provide for systematic and regular fire drills under supervision of competent and qualified authorities.

Making a Non-Technical Survey of a School

By KENNETH N. BEADLE

Supervisor of Safety Education, St. Paul Public Schools

The contributions made to educational progress by the use of the survey are distinctive, and practically every phase of public school work has been influenced by the studies which surveys have brought forth.

Perhaps no movement in education has contributed more to the professionalization of educational administration than the work of the survey.

This method of advancing education is

particularly essential in developing a relatively new phase of the curriculum, such as safety education, in order to meet the situation that exists and answer the criticism by an unprejudiced statement of conditions.

Over 30,250,000 children, according to the National Education Association, leave their homes every school day of the year, perhaps careful in crossing streets, but hurry into danger of fire, danger of panic, sickness and accident, imperiled in buildings long condemned by health officials and fire marshals as unsanitary and unsafe.

A safety survey in the public schools should include a careful analysis of the various conditions that exist on the playgrounds. Common hazards which are being found in our survey include such things as using pieces of brick and broken cement for bases on the ball diamond, playground surfacing composed of rough abrasive cinders, foot scrapers at the door that stand up with knife-like sharpness, buckled sidewalks that are impossible to walk on when covered with sleet, and retaining walls of various heights that are not protected with adequate fencing.

Retaining walls surrounding a playground present many hazards. Quite commonly we find walls up to three, four and five feet high with no fences built on top. There are also walls up to 14 feet high that are topped only by pipe fences with two rails. Last year at one of the grade schools, a boy fell from the top of such a wall and was killed. Constructed on some of these walls are woven wire fences which are not sufficiently high to prevent their being easily mounted.

We discovered a practice of placing woven wire fences around retaining walls with the rough sharp ends of wire projecting up into the air instead of extending down at the bottom, as the fence had been designed to be used. The purpose in doing this was to create a dangerous barrier over which it might be more difficult to climb. Our safety education division has protested vigorously against this practice. We have taken the stand that it is not justifiable to place any safety hazards as a deterrent to prevent children from damaging property.

Fences on top of these walls are unsatisfactory unless they can be constructed close enough to the outer edge of the wall to prevent children from climbing along the ledge outside of the fence. A 10, 12, or 14 foot wall which is 20 inches wide and which

has a fence placed squarely in the middle of it, making a 10 inch ledge, represents a challenge to any boy. With very little imagination, the wall and fence can be made to represent dangerous exploits in climbing hitherto unscaled mountain peaks. All the lecturing in the world will not keep boys from such an adventure. The only remedy is to avoid building a structure in this way or to change the construction.

I have talked somewhat at length about this matter of retaining walls just to indicate how many aspects there may be to one safety hazard. In the final analysis, of course, neither schools nor playgrounds should be built where retaining walls are necessary.

A comprehensive study of pupil accidents by the National Safety Council has indicated that 38 per cent of injuries to school children, resulting in absence from school, occur to pupils while in the school building or on the playground, and the greatest number of accidents in the building happen in the gymnasium.

Gymnasiums, shops, laboratories, corridors, stairways and the like should be singled out for emphasis. Factors to consider in surveying a gymnasium are: Construction and location in accordance with proper standards, utilization of space, giving first consideration to participants, and providing seats for spectators well out of the way of participants. If the floor surface is slippery, adequate preparation to put it back in shape for use is essential. Overcrowding play space also presents a serious hazard. Projections such as radiators, sharp corners, uprights and any other obstructions should be padded. All apparatus and equipment should be periodically examined. All activities taking place in the gymnasium should have supervision at all times.

An important essential which is still all too frequently neglected is a medical examination for all individuals who will participate in strenuous activity. Every physical education department should be equipped to administer first aid to major and minor injuries. Where a nurse is not on the school staff, first aid cabinets and manuals should be kept in the physical education office, and the principal's office.

Shower and locker rooms should have adequate protection against the spreading of contagious disease. All lockers, locker room floors and shower rooms should be sprayed

regularly with a disinfectant. A towel and laundry system will eliminate the filthy towel that three or four different boys use each physical education period. Regular attendance to toilet facilities is amazingly neglected in many schools. Supervision of locker rooms will prevent many of the accidents that occur in these places.

Where there is a swimming pool, there can be tragedy if there is no proper organization and supervision. Sanitation of the facilities as well as the individual is essential, and every pupil should be taught to swim.

The industrial arts department is a group that is perhaps the most conscious of safety, yet an inspection here should be included as a very necessary part of any survey. Brief suggestions for consideration might be: Condition and inspection of equipment, ample space between machines, adequate machine guarding, repairs made promptly, proper clothing worn, adequate instruction for using machines, continuous supervision of shop activities, injuries properly taken care of and accidents reported promptly.

What about halls and stairways? Are they adequately lighted? I have seen students fall down stairs because they couldn't see, and they couldn't see because the janitors insisted upon keeping the lights out to satisfy the school board who were bent on reducing the light bill.

Is the surface on the halls and stairs so highly polished that it causes slipping and falling? Are repairs around the building made promptly? Is freedom from obstruction in the halls given sufficient consideration? Is the schedule of passing to and from classes arranged to avoid congestion and confusion? Is there a school patrol organized to direct traffic in the building and around the school grounds?

Car parking around a school building is a condition worthy of recognition. Parking at the curb on the same side of the street where the school building is located presents the dangerous possibility of school children running out into the street between the cars. Last year this was the direct cause of death to a high school boy in St. Paul. The adjacent side of the street surrounding the building must be kept clear of parked cars to insure protection from this kind of accident. School buildings situated on corners offer a still greater hazard than those in the center of a block.

A check might be made on the number of pupils who ride bicycles. Is anything being done to discourage their riding to and from school where it is not necessary? Is the risk of riding bicycles of great enough importance to establish standard rules and regulations for riding? Is a bicycle club organized for the purpose of giving instruction to these people and establishing rules for safe riding? According to "Accident Facts," 350 people lost their lives in 1935 as a result of accidents while riding bicycles, and 200 of these were children between the ages of five and 14. In 1936 there were 650 accidental deaths on bicycles and 300 of these were children under 15 years of age besides the additional thousands injured.

We have discovered so far in 35 schools, which are not quite half the number of public schools in the city, that over 4,600 pupils own bicycles. A bicycle safety league has been organized in cooperation with the police department and the automobile club in order to extend membership to every pupil in the city who owns a bicycle. Membership is optional, but the opportunity is presented in such manner that those who pledge themselves to abide by the rules and regulations set up, do so sincerely and honestly. To continue stressing safety in bicycle riding, plans are being made to organize separate bicycle clubs in each school.

A major item in any school survey is fire prevention. A more complete check list is suggested in a bulletin issued by the Child Education Section of the National Safety Council to School Executives in December, 1936.

The arrangement and construction of the building is the first consideration. What portion of the building, if any, is not fire-proof? Have the floors, room partitions, outside walls and roof covering been checked regularly? Are there wooden stairs down into an open hall? Is the heating plant in a separate fire-proof room with fire resistance doors? Is all woodwork protected from hot pipes, stoves and burners? Do all doors open outward, not in—like those in a school in Ohio where 174 children perished?

Is the building equipped with automatic sprinklers? Are all emergency exits easily accessible and clearly marked? Can the fire signal in the building be operated from several places, especially the janitor's room, principal's office and from the corridor in each wing of the building?

Are fire escapes provided in accordance with the school code? Are they adequate in type, size, and number, and are they kept in good condition? Are fire drills held in accordance with the law? Are drills made at irregular intervals and at unusual times, such as during assembly periods? Is the building adequately equipped with fire extinguishers of the proper types and in accessible locations? Are these extinguishers inspected regularly, recharged annually, and the nozzles kept free from corrosion? Is there a fire hose on each floor, and is it inspected periodically?

All electric appliances and wiring should be periodically checked by an experienced electrician, in order to make a fire prevention survey complete.

To continue our investigation and study for the safety of school children, is there a plan for reporting accidents? If this matter is not put on a sound basis and handled systematically, negligence and indifference will be the cause of losing much of the beneficial results that could be obtained from such a study. In a long time plan for a program of safety education, a continuous survey of student accidents is invaluable in setting up machinery for the prevention

of accidents. The information obtained is priceless in developing a course of study to meet the need of any given locality. This plan was adopted in our school system starting early last April.

It may interest you to know that in only two months' time, reports of 350 accidents occurring to school children were recorded. Of course, most of these were minor injuries and undoubtedly many accidents were not reported. Forty-five occurred in the school building, one hundred three on the playground, 56 on the street, 14 at home in the house, 59 at home out of doors, 14 were automobile accidents, and 76 accidents occurred elsewhere. The total number of days lost from school was 474.

A survey of a school involving a study of causes and prevention of accidents should never be terminated, but rather should be a continuous process. Any school administrator can easily make a preliminary survey of his school.

There are at least three types of inspection blanks now available to schools from the United States office of Education, the National Board of Fire Underwriters, and the National Safety Council.

School Building Hazards

Ewing B. Fergus, Branch Manager, Kansas Inspection Bureau, Wichita, Kan., spoke on "What Shall We Do About School Building Hazards?"

FRIDAY MORNING SESSION

October 15, 1937

JOINT SESSION WITH STREET AND HIGHWAY TRAFFIC SECTION

An account of the joint session of the Street and Highway Traffic Section and Child Education Section, a panel discussion on "The Drivers of the Future," will be found in the Street and Highway Traffic Section of this volume.

ADJOURNMENT

Home Safety

THURSDAY MORNING SESSION

October 14, 1937

The session was called to order by Rosamond Losh, Executive Secretary, Children's Bureau, Kansas City, Mo., and Chairman of

the Home Safety Committee, National Safety Council. The meeting was in the form of a panel discussion.

THE HOME ACCIDENT PROBLEM

The panel discussion of the home accident problem was led by F. C. Lynch, Director, Kansas City Safety Council, Kansas City, Mo. Panel participants included:

Melville Carr, Director, Life Saving and Accident Prevention Service, American Red Cross, Chicago.

Mrs. Frank Goodnow, Girl Scouts, Inc., Kansas City, Mo.

Mrs. Edward Hammett, Chairman on Public Safety, General Federation of Women's Clubs, Sheboygan, Wis.

Mrs. W. A. Hastings, Vice-President, National Congress of Parents and Teachers, Madison, Wis.

A. A. Rall, Safety Supervisor, Kansas City Power and Light Co., Kansas City, Mo.

Captain Fred C. Mills, National Director, Health and Safety Service, Boy Scouts of America, New York City.

The consensus of the panel was that the proper approach is not now being made to the home accident problem and that there

is need of greater cooperation between the various groups concerned with home safety.

The need was stressed for better and more uniform building codes and for safer equipment and appliances. It was pointed out that women were the most important factor in obtaining safe appliances, since they spend about 80 per cent of their time in the home and either purchase directly or influence the purchase of the preponderance of appliances.

Enforcement of home safety principles, it was agreed, must come from within the home. Thus it must come about through education, and this education must start in the cradle.

Following the discussion an address on "The Psychological Approach to the Study of Home Safety" was given by Dr. Paul A. Witty, Professor of Education, Northwestern University, Evanston, Ill.

The session closed with a demonstration of "How Puppetry Can be Utilized in Teaching Home Safety."

ADJOURNMENT

Accident Prevention Equipment Manufacturers

Who Exhibited at the Twenty-Sixth National Safety Congress
and Exposition

Kansas City, Mo., October 11-15, 1937

Exhibition Hall—Municipal Auditorium

Aetna Casualty & Surety Co., Hartford, Conn.

Automobile Driving Tests.

Arntzen, Inc., Chicago, Ill.

Auxiliary & Emergency Stretcher First Aid Equipment.

Automatic Traffic Control Corp., St. Paul, Minn.

Traffic Actuated Control Equipment.

Bear Manufacturing Co., Rock Island, Ill.

Vehicle Inspection Equipment.

Bendix Products Corp., South Bend, Ind.

Automotive Equipment.

Crouse-Hinds Co., Syracuse, N. Y.

Traffic Signals and Floodlights.

Dual Parking Meter Co., Oklahoma City, Okla.

Parking Meter Equipment.

Donald F. Duncan, Inc., Chicago, Ill.

Parking Meter Equipment.

Eagle Signal Corp., Moline, Ill.

Traffic Actuated and Fixed Time Control Equipment.

Enameted Steel Sign Co., Chicago, Ill.

Day and Night Steel Reflecting Signs.

Harley-Davidson Motor Co., Milwaukee, Wis.

Police Motorcycles and Equipment.

Hnof Products Co., Chicago, Ill.

Motor Vehicle Speed Control Governors.

Indian Motorcycle Co., Springfield, Mass.

Police Motorcycles and Equipment.

Juvenile Wood Products, Inc., Fort Wayne, Ind.

Automobile Safety Seats for Children.

The Karpark Corp., New York City.

Parking Meter Equipment.

Liberty Mutual Insurance Co., Boston, Mass.

Automobile Safety Service and Insurance.

Lumbermens Mutual Casualty Co., Chicago, Ill.

Automobile Safety Service and Casualty Insurance.

The Martindale Electric Co., Cleveland, Ohio.
Highway Safety Signals.
McCloskey Torch Co., Toledo, Ohio.
Bomb Shell Torches and Truck Flares.
Metropolitan Life Insurance Co., New York City.
Insurance.
Michigan Malleable Iron Co., Detroit, Mich.
Traffic Stop Signs.

Rich Signs Corp., Wichita, Kans.
Highway Reflecting Traffic Markers.

S-W Supply Co., Girard, Kans.
Highway Railroad Signals.

Threeway Signal Co., Oklahoma City, Okla.
Safety Signal Equipment.
Traffic Boy, Inc., Canton, Ohio.
School Zone Traffic Signs.

United States Steel Corporation Subsidiaries, Pittsburgh, Pa.
Steel Products and Cement.

Weaver Manufacturing Co., Springfield, Ill.
Vehicle Inspection Equipment.

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