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THE TRANSACTIONS of the Twenty-third Congress of the National Safety Council are published in two volumes. In addition to this volume, a larger one, containing the General, the General Subject, and the Industrial Section sessions, has been distributed to Industrial members of the Council. It is also available to other members if they are especially interested in industrial safety problems.

THE PLAN OF PUBLICATION is the same as that adopted for sessions of the last two Congresses and found to be very satisfactory. It is a condensed record. The papers of each session or division of the Congress have been assembled, edited with care and discernment to abbreviate or delete the less essential portions, and the concise results are presented for study and reference. Although not "complete" in the sense that every word is reproduced, it is a readable, interesting record which emphasizes the memorable parts of each paper and address. The original manuscripts are on file in the Council Library, *available for additional reference as desired.*

ALTHOUGH THE National Safety Council endeavors to eliminate from discussion at its conventions matters which are not pertinent to its purposes or which are contrary to its policies, the Council cannot accept responsibility for the views expressed either in the papers presented or the discussion thereon.

Street and Highway Traffic Section

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MONDAY AFTERNOON SESSION

October 1, 1934

GENERAL TRAFFIC SESSION

The opening session of the Street and Highway Traffic Section was called to order by William C. Knoelk, Vice-Chairman, Street and Highway Traffic Section,

who presided. Chairman Knoelk first introduced Mr. Martin I. Lavelle, Director of Public Safety, Cleveland, Ohio, who made a brief address of welcome on behalf of the Convention City. The Chairman then presented the following paper as the first speaker of the formal program.

Today's Traffic Problems

By WILLIAM C. KNOELK

Vice-Chairman, Street and Highway Traffic Section, and Chairman, Milwaukee Safety Commission, Milwaukee, Wisc.

The speaker said in part: Today's traffic problems may be grouped under four captions:

1. The urgent need to increase the safety consciousness of the public.
2. The vital need to increase our diagnostic abilities and facilities so that we may speak more authoritatively as to the causes of accidents.
3. The great need to continue to make mechanical improvements; to make devices "fool proof" and—as a corollary—not to rely upon mechanical devices alone; or even largely.
4. The insistent need that the enforcement be stressed, on the basis of a better understanding of human nature and on the basis of a better informed public.

There are so many calls upon the attention of the public today that merely to maintain the present interest in our problem is not enough. Public opinion must be stimulated to increase its interest in and support of the safety movement. This involves an understanding of the fact that human nature is essentially the same today as it was a thousand years ago. Any attempted stimulation of the safety consciousness is predestined to failure if it arouses general—or even appreciable—antagonism or opposition. This is the age of Mr. Common Man and he feels himself slighted if there is no appeal to his understanding and cooperation, but only a demand on his obedience. More concurrence in a project comes out of a good attitude of appreciation of need than out of inescapable logic.

This stimulating of the safety sense is particularly difficult today. There is a deep sense of injustice abroad. It has almost the fury of despair at times in its opposition to anything that represents authority, or that threatens to curb a personal inclination. Add to this the willingness of youth to "take a chance", and you may appreciate why care and caution are thrown to the winds. We used to think it necessary to go into a sort of retreat—into the peace, quiet, and simplicity of the old farm home—to regain again the calm of mental peace broken down by the pace of war-time production. What shall we say of the present anxiety and tension, when most of the thoughts of today are tarnished with age before they reach tomorrow? All of this makes for greater irritability, for less patience, for greater hazards in situations demanding "presence of mind." Thus, when an adequate safety consciousness should prompt "presence of mind", we find instead an absence of the usual and necessary control of either reason or energy.

This makes enforcement difficult, too. Engineering has made such strides in safety that it has been relied upon to an amazing degree. Education comes next as the second of the great safety trinity. We know that man must feel right to do right. Is it a wonder, then, that we hesitate to employ the full power of enforcement under all these circumstances?

But even these conditions do not portray the true picture. Safety consciousness cannot be relied upon in any case—whether all the factors mentioned are present or not—if worry or fatigue or alcohol enters into the equation.

Just how to promote a better comprehension of the significance, importance, and diagnosis of the safety problem on the part of the public will be set forth in many of the sessions of this Congress. The way lies through a more vivid, thrilling safety education and via a gripping, convincing publicity campaign.

The second great need today is to increase our diagnostic abilities so that the real causes of accidents may be evident. Obviously, this involves the subject of compulsory accident reporting, but it goes beyond that. We know, for instance, that the three "motorists' violations" or "improper driving acts" most frequently reported every year are: "Too fast for conditions", "on wrong side of road", and "did not have right-of-way." But there are such great variations in different parts of the country that the data are not fairly comparable. Furthermore, though the item of "unreasonable speed" is probably one of the outstanding causes of accidents, the phrase is not clear. The reasonableness of speed depends entirely on the car, the location, and the driver—and accident reports may not give an adequate (or even a correct) picture.

More and more frequently quoted and therefore less and less thoroughly understood, has become the theme that this age of machine development is a challenge to civilization's future and to man's preeminence. The machine is making the status of the worker insecure, so we are told. In the power, precision, uncanny dexteritory, and tirelessness of the machine, we are informed, lies a competing force that overshadows the ability of man. There is not enough consolation in the thought that inanimate machines are for drudgery and that man is created for work and for play. The shadow of the robot and his mechanical dexterity make us fearful of a modern Frankenstein.

Yet there is a phase to this theme of the mechanical age that is not so frequently discussed. So greatly relieved is man of many types of drudgery by these machines that he loses his sense of proportion in the manipulation of them. There is a feeling of exhilaration in having one's power multiplied a hundred thousand times; a feeling of "sitting on top of the world." Saying it in another way, you recognize at once that this machine age has built up an attitude of mind that is individualistic, mindful of the power of self, and not always regardful of the welfare of the group. And it is this individualistic attitude—built up in spite of the concentration of population in factory centers—that is a real menace of the age. We have, then, the machine-imposed glorification of self and yet increasingly we are realizing that the group to which we belong is the bigger factor in our character and in our conduct. In this sense, too, the machine age has become a real danger. Thus the man behind the wheel may easily forget his normal social attitudes and deferences in the control of the huge horse power under the hood of his car.

The third great need to solve our modern traffic problems has to do with engineering. The contribution of our safety engineers has saved us from an even greater slaughter on the highways than we are now witnessing. It is my belief that engineering ingenuity will have to turn more definitely toward rural areas where motor vehicle deaths have increased at a much faster pace than in urban areas.

It is probably true that driving directions—signs along the highway, traffic signals, uniformity of markings—must all conform to the principle that the "reaction time" of the driver must not be needlessly lengthened. Signs should be so worded and arranged that just a glimpse conveys the desired information or instruction. Signs must be the symbols of proved traffic principles.

The fourth and final need in finding solutions to modern traffic problems lies in the necessity for greater enforcement. There is always the individual in every group who must be forced to live a social life. A sure and immediate enforcement of reasonable laws is the policy that must therefore be followed. As a necessary prerequisite—or concomitant—for such enforcement, there must be an adequate drivers' license law, a good accident reporting system, and an effective headlight and brake testing law. Without these, enforcement officers may rightfully ask the community "Why do you ask us to usurp the functions of another department of government—the legislative—and so jeopardize the effectiveness of our legitimate work?"

Schools have long recognized that teaching is not telling. True teaching is the stimulating of the learning process. Learning is effective only when it grows out of the self-activity of the learner. Motorists and pedestrians, therefore, to actually acquire a safety consciousness, must have something more happen to them than mere telling. They must be inspired, enthused, to want to learn. This is done only by doing the right thing again and again. Not only must the proper information be given out, but the right procedure must be practiced until it becomes almost automatic. The emotions play a huge part here. One must feel right to do right. Feel, in this sense, is not a matter of the tactile sensations, but has to do

with the temperature of the stream of consciousness; whether we are hopeful, buoyant, cooperative or despondent, surly, misanthropic. Whatever truth there may be in James' theory of the emotions, nobody can question the statement that to permit a lapse in the formation of a good habit is undoing most of the work that has been done. If you stop at an arterial "Stop" sign fifty times, and permit yourself knowingly to fail to stop the fifty-first time, most of the work in the formation of the habit will have to be done over. This is why I consider enforcement a big factor in education. To those who are weak, or who cannot easily act under reasonable restraint, the *big stick* is an *effective aid to memory and to the formation* of a habit.

The Menace of the Driver Who Has Been Drinking

By JUDGE THOMAS V. HOLLAND

Municipal Court, Kansas City, Missouri

The speaker said in part: Since the repeal of the Eighteenth Amendment, law enforcement agencies and those of our citizens interested in traffic safety have come to realize that the problem of the driver who has been drinking presents itself more frequently. It is not necessary for me to point out here that a person operating a motor car under the influence of liquor is a menace of the highest order. We are concerned here in finding out what we can do to reduce the number of such drivers. My observations will be confined to the gleanings from five years' experience as Judge presiding over the Traffic Court of a city of a half million population.

At the time that I took office, Kansas City had an ordinance prohibiting and providing a punishment for an offense described as "drunken and careless driving." This ordinance made no distinction in the degree of intoxication, and consequently, in order that a conviction might be made, it was necessary that the city prove the defendant to have been drunk and to have been operating his car in a careless manner. Prosecution, therefore, did not reach the driver who had one or two drinks, or whose degree of intoxication was less than drunkenness. Such a driver could be reached only under a charge of careless driving, which of course, carried less severe penalties and was considered an offense less grave.

With the passage of time, it became apparent to the officials and the community that some change must be made in this ordinance. We brought to Kansas City a certain Dr. McClintock, a traffic expert who had devoted a great deal of care and time to the study of traffic problems, who made a survey of Kansas City and presented a new set of rules and regulations and a model enforcement ordinance. This ordinance prohibited and provided a punishment for a driver operating a motor car under the influence of liquor or under the influence of a narcotic. The punishment, upon conviction, provided as a minimum a fine of $100 or 30 days' imprisonment at the Municipal Farm, with a maximum punishment of a fine of $1,000 or one year of imprisonment at the Municipal Farm, or both; this within the discretion of the trial court. The ordinance, of course, gave to the enforcing officials a control over the driver who had been drinking, but whose intoxication had not reached the stage of drunkenness. This feature, combined with the severe minimum penalty, apparently gave to the officials an ideal enforcing agency with which to proceed against the driver who had been drinking.

Bear in mind that this ordinance was passed and was in force almost two years before the repeal of the Eighteenth Amendment. Our local newspapers, out of regard for the safety and well-being of our community, gave its passage the greatest publicity; they devoted entire columns to explaining the necessity for this ordinance, the means by which its passage was effected, its purpose and the powers conferred upon the officials in connection with its enforcement. For a period of time following its enactment, and while this wave of publicity was having its effect, there was a noticeable decrease in the number of arrests of drivers charged with operating a vehicle under the influence of intoxicating liquor. But with the passing of time and the diminution of publicity, the fact that there was an ordinance

prohibiting this offense became less prominent in the public consciousness and the number of arrests for this offense began to increase. Many drivers, convicted in the Municipal Court, had appealed their cases and in the lapse of time between conviction in one Court and hearing in another, property settlements were made; and these settlements usually were made under an agreement not to prosecute, which greatly hampered the officials because it is difficult to secure the attendance and proper testimony of a complaining witness who has been paid his damage. At times the officials were compelled to believe that prosecutions under this ordinance were instituted as an aid to the collection of damages. In the meantime, loss of property and serious personal injuries were still being sustained by persons in accidents resulting from the carelessness of a driver who had been drinking.

It is axiomatic among officials and members of our local Safety Council that the number of accidents increased or decreased in almost exact proportion to the amount of publicity that traffic enforcement receives or does not receive. And while the newspapers of Kansas City have always been generous and considerate in publishing details of accidents and the names of persons involved, it was considered that their efforts should be buttressed by that new, now almost universally used agency of publicity—the radio. So the Traffic Court of Kansas City went on the air. Station WHB, upon solicitation, offered to donate fifteen minutes of its time daily. It was thought that the broadcasting of the actual court proceedings, the swearing of the witnesses, the reading of the charges, the hearing of testimony and the decision of the Court in passing on traffic cases, would serve to educate the public as to traffic rules and to inform the public of the dangers attendant upon the operation of a motor car while under the influence of liquor. The imposition of penalties upon conviction would also serve as a restraining influence upon those who might be inclined to transgress.

This novel feature was an immediate success. Here, each day for fifteen minutes, was enacted a drama taken from the life of our own community. Its characters were our own citizens. The locale was Kansas City, Missouri, and the scenes were well-known boulevards and streets in our city. There were listeners by the hundreds and these increased to the thousands. Demands were made for an increase in the time of the broadcasting period. The officials of Station WHB arranged to broadcast for a full half-hour the proceedings of the Municipal Court. The result of this publicity gave to Kansas City in the first year of its operation the best record of traffic law observance that it had had in eleven years.

Kansas City thus had two new aides in controlling drivers who had been drinking; its model ordinance, and its added publicity by reason of the radio broadcast. However, it was deemed advisable that another and even stronger weapon must be forged for this purpose. Accordingly, through the efforts of the members of the Kansas City Safety Council in cooperation with the administration of Kansas City, an ordinance was passed called "The Driver's License Ordinance." This ordinance required that every citizen of Kansas City operating a motor car should acquire a driver's license. The fee was fifty cents; the license issued for a period of two years. The ordinance made it mandatory upon the Court to revoke the license of a driver convicted of operating a motor car under the influence of liquor or narcotics. It further gave the Court the discretionary power to impound for a period of time not greater than a year the automobile of a person convicted of this serious violation. This ordinance has now been in effect in Kansas City for about two and one-half years and it has proved to be a most effective force in controlling the driver who has been drinking.

Warned by the press, informed by the radio broadcasts, the beneficial effect of the passage of this ordinance can be traced in traffic enforcement statistics. The uncompromising attitude of the traffic Court and its officers has brought home to the driving public the knowledge that not only are they going to be fined or imprisoned at the Municipal Farm if apprehended and convicted of driving while under the influence of liquor, but that their license will be taken from them for the balance of the period of time for which it was issued. It is my studied opinion that the power of the Court over the driver's license and over his vehicle is of more effect than fines, imprisonment or publicity. There sits the Court with the City's witnesses before him. The passing of time has not dimmed their recollection of the incidents surrounding the accident. The episode is fresh in their minds. Settlement, intimida-

tion, or delay have not intervened to change their testimony. The Court gets the facts. The offending driver receives his just due. The testimony is from living, speaking witnesses with ample opportunity in the Court to weigh their credibility and their power of intelligent observation, and he, in the exercise of his judicial power and discretion, can then and there remove for the period for which a driver's license was issued that greatest of traffic menaces—the driver who has been drinking.

Now, it would seem that we in Kansas City have set up for the use and benefit of our citizenry very adequtae machinery for the control of the driver who has been drinking. Certainly through our agencies of publicity, the newspapers and the radio, our public should know our laws and the penalties for their violation. It would seem that a complete realization should be had of automobile operation. It should follow that Kansas City should be free from the menace of the driver who has been drinking, but that conclusion is not true. We still find on our dockets the names of citizens from every walk of life who are defendants and charged with operating a motor vehicle while under the influence of liquor. I am frequently asked concerning the effect of the repeal of the 18th Amendment on the number of cases of this nature presented to me for disposition, and I can give you the same reply as always—we do not have any more cases than we had before the repeal of the 18th Amendment, but on the other hand, we do have just about as many. I attribute the fact that there is no tremendous increase to our enforcement defenses, set up and in operation before repeal, and the rigorous enforcement achieved through this channel.

Drinking Drivers

By H. A. HEISE, M. D.

Columbia Hospital, Milwaukee, Wis.

Present day statistics on the relationship of alcohol to automobile accidents are practically worthless. Even though a person may be obviously drunk, arresting officers may hesitate to prefer charges of intoxication because they know that they cannot prove their assertions in court; since every symptom of drunkenness may be simulated by some pathological condition. Or a person may be obviously drunk at the time of the accident, but may suddenly sober up to such an extent that he can satisfactorily pass a test for sobriety. Also it is obvious that persons severely injured or killed cannot be examined by the usual methods. Furthermore it would be necessary to know the normal behavior of every individual before one could definitely ascribe his peculiarities to alcohol. Finally, the psychological inferiority produced by small amounts of alcohol can only be measured by complicated tests.

Experiments performed on volunteers indicate a measurable loss of efficiency when as little as one ounce of whiskey is consumed. This was shown in typewriting experiments, the alcohol increasing speed at the expense of accuracy. Some experiments were performed under actual driving conditions and the subjects were given from five to eight ounces of whiskey. It was found that they could perform the routine acts of driving fairly well, but were measurably slow or erratic in applying the brakes, showed poor judgment in avoiding obstacles in the road, were particularly clumsy in backing the car; and most of them were blissfully unconscious that they were driving dangerously.

All of these tests were correlated with an estimation of the amount of alcohol in the blood or urine at frequent intervals; and it was found that all persons were psychologically inferior when the alcohol in the blood or urine reached 0.02 per cent, that they were visibly changed from the normal at 0.10 per cent and obviously intoxicated at 0.20 per cent. An interesting finding is that a person accustomed to alcohol must usually drink larger quantities than the novice to arrive at the same percentage of alcohol in the blood; but then they are about equally affected.

After examining about 200 persons charged with drunken driving, using both the routine physical examination and the chemical test, the correlation was found to be so obvious that my colleague, Dr. Halporn, attempted to predict the amount of alcohol to be found in the urine from the physical examination alone. The agreement was found to be remarkably accurate, except in one case in which he estimated 0.30 per cent when the actual amount was only 0.18 per cent. This disagreement was later explained in favor of the laboratory, when a brain injury was found.

The alcohol in body fluids is the most constant finding in all cases of alcoholic intoxication, and thus furnishes scientific confirmation that alcohol may have been responsible for the symptoms. On the other hand, the absence of alcohol, or an amount out of proportion to the physical findings may prevent a serious injustice.

The Test in Action

In Fayette County, Pennsylvania, in 1924, before the chemical test was used, 34 persons accused of drunken driving were found not guilty and 21 found guilty or pleaded guilty. In 100 recent consecutive cases in which the alcohol in the urine exceeded 0.19 per cent by weight, 87 were found guilty or admitted guilt, 6 were pronounced not guilty but directed to pay the costs (meaning, "You are not guilty, but don't do it again"), and 7 were acquitted.

Butler County, Pennsylvania was unable to get one conviction in 1930, but a later communication from E. H. Negley, district attorney, states, "The chemical test for alcohol was used in 20 of the 36 cases. During the past 6 months it is used in every case unless the defendant at once pleads guilty. We have not lost a case in which it is used, and it seems to me impossible to lose a case in which it is used."

The method used to test the amount of alcohol in blood or urine is a modification of the one used by Nicloux and depends on the fact that alcohol reduces an acid solution of potassium dichromate, changing the color from orange to blue. Results are obtained which are correct to within 0.01 per cent with the ordinary test, and when traces of alcohol are examined the accuracy is even greater. A series of experiments performed to determine the specificity of the test proved conclusively that none of the substances which have been mentioned as interfering with the test need be considered as changing results in any way.

Survey of Accidents Involving Injury or Death

In order to determine the relationship of alcohol to automobile accidents, an analysis was made of 119 automobile accidents involving injury or death to 216 persons. All but two were treated in the Uniontown Hospital. As Uniontown is a city of 20,000 inhabitants, situated on the National Highway in southwestern Pennsylvania, this two-year survey comprises a fair distribution of urban, rural, and tourist traffic accidents. It should be born in mind that the "alcohol accidents" are those in which a responsible individual had more than 0.02 per cent alcohol in body fluids, an amount which has been shown to cause psychological inferiority, and not necessarily obvious drunkenness. The survey, therefore, deals with the "drinking driver"; and not primarily with the obvious "drunk".

The survey revealed that about 60 per cent of the accidents and 75 per cent of the people injured or killed were in the "alcohol accidents". It was found that while the "non-alcohol accidents" involved slightly more than one person per accident, the "alcohol accidents" were responsible for injury or death to about two people per accident. Further evidence that the seriousness of the accident is generally proportional to the amount of alcohol in the blood or urine, is shown by the fact that the average percentage of alcohol in the drivers who ran off the road or upset was 0.15 in the non-fatal accidents and 0.24 in the fatal cases. In collisions the alcohol per cent of the drinking driver in the non-fatal cases averaged 0.21.

From a study of the ages of pedestrians killed or injured, it is found that drivers striking children and old people are usually sober; when a driver strikes a person between the ages of 16 and 60 the pedestrian is most commonly to be found in the alcohol group; but if the pedestrian is sober then the driver is usually found to be "under the influence"; and in some cases both driver and pedestrian are found to be in the alcohol groups.

An interesting finding is that a sober driver usually has sober passengers in his car, and the non-drinking men are rarely found to be passengers when the host is intoxicated.

Women drivers are known to be involved in fewer accidents than would be expected from the known ratio of the number of women drivers to men drivers. This survey offers the explanation that the reason for this finding may lie in the low incidence of drinking women drivers, rather than to superior handling of cars by women.

The unmistakable role of alcohol is shown by comparing the daily incidence of accidents in which nondrinking and drinking drivers are involved. The week end peak is found to be "alcoholic", and not necessarily due to increased traffic. If traffic alone had been responsible, then the non-alcohol accidents would have shown a similar week end rise, but such is not the case.

That darkness is associated with a definite driving hazard is shown by the increase of "non-alcoholic" accidents during the early evening hours. An additional factor may be fatigue, the effects of which are very similar to alcoholic intoxication. The imbiber, however, reaches a much higher peak between 6 and 7 p. m. which is probably the result of the "cocktail hour", and another peak at midnight. In the daylight morning hours almost all accidents are of the nonalcoholic type.

The most despised type of driver is of the "hit and run" variety. In this survey six were apprehended and were examined. All were found to harbor an unusual amount of alcohol, the average being 0.30 per cent. It is possible that alcoholic intoxication adds an additional factor of fear of apprehension, or the alcohol may make capture easier, as in one case in which the zigzag tracks in the snow led from the scene of the accident to the spot where the car was found.

Conclusions

(1) Education of the public regarding the role of alcohol in automobile accidents may decrease the number of accidents.

(2) The chemical test for alcohol in body fluids has been proved to be practical in confirming alcoholic intoxication; and also may prove that certain symptoms are not due to alcohol. Conviction of drunken drivers is practically assured, and persons who are not intoxicated are protected by the chemical test.

(3) A survey of 119 consecutive accidents demanding hospital treatment for the injured or resulting in death indicates strongly that present statistics regarding the role of alcohol in automobile accidents are greatly in need of revision.

TUESDAY MORNING SESSION

October 2, 1934

Traffic Law Enforcement

This Tuesday morning session was opened by Mr. Clifford Davis, Vice Mayor and Commissioner of Fire and Police, Memphis, Tenn., who presided. After briefly stating the objects of the session, the Chairman introduced the first speaker.

Handling the Case of the Driver Who Has Been Drinking

By CAPTAIN RAY ASHWORTH

Police Department, Wichita, Kansas

The speaker said in part: In the past it has been a very difficult problem for any policeman or any police department, in arresting a man for driving while intoxicated, to be confident that he could carry that case to Court and convict the man of the charge of being drunk while driving.

As you all know, pressure is brought to bear by political or other outside sources, and if there is a drivers' license law in the state, an effort is usually made to change the charge from driving while intoxicated to something of lesser importance, so that the driver will not lose his driver's license. It has been my experience that about the only person who ever gets arrested and convicted for

driving while drunk is the man whose sole method of earning a living is driving a car. If they don't have any luck with the Police Department, they go to the prosecutor; and if they have no luck there, they seek outside assistance of some person of prominence in the community; and sometimes it seems that almost everybody in town writes the judge or the prosecutor a letter in the interest of the man who has been arrested. The result is that the case is probably carried over on continuances a number of times, the policeman in the meantime is out on his duties and makes a number of other arrests for drunken driving, and some two or three months later, or maybe longer, the trial comes up in the District Court. That policeman is supposed to testify that six months ago he observed a man in the street who was drunk, driving a car; and then the defense attorney asks him how many men he arrested in the meantime, and if the defendant could touch the end of his nose with his finger, or walk a straight line.

The only satisfactory method that we have ever found (and you will excuse me if I refer to the procedure in my own department), when an arrest is made for drunken driving, is to require that every officer who comes in contact with this man shall submit a report, covering in every detail the man's condition when he was arrested. With these reports on file for reference, and as a matter of record, the policeman can state with authority that he arrested a certain man on such and such a date at a certain hour in the evening, that the man was drunk, that he was driving an automobile, that he hit the curb, that he ran into a tree, and that when he finally got out of the car he was unable to stand without weaving, that his eyes were glassy, that you could smell liquor on his breath, and every other incident, everything that led the officer to believe that the man was drunk.

In this manner we have succeeded in getting convictions in about 80 per cent or better of our drunken driving cases. We have found also that the politicians know that such evidence usually amounts to a conviction, although in some cases they go right along to save the driver's license, if they possibly can. However, it was not always possible to prove that a man was drunk while driving when we arrested him on this charge, and we felt that such people should not go scott-free. So we have made it a rule, when we arrest a man who has been drinking while driving, not only to book him for driving while intoxicated, but also to place a charge against him of driving in a reckless manner; and this has brought about more convictions.

If your City Prosecutor or County Prosecutor is so inclined, in cases of this kind where double charges are placed, he will bring the man to trial on the lower charge, and if you explain that you cannot get a conviction for drunken driving, you will probably get a conviction for reckless driving and thereby this man does not go scott-free.

I think that many police departments have been searching about for a long time for some method by which they would be able to prove beyond a reasonable doubt that a man who had been drinking was really drunk. Clever lawyers are always trying to show that a driver arrested for drunkenness really has a fractured skull, or some peculiar disease, that would seem to indicate intoxication. The Police Department of the future, which is going to deal in an intelligent and successful manner with the driver who has been drinking, must necessarily adopt some method of determining the amount of alcohol that a person has consumed. We must be able to make some kind of test in our police laboratory, something that will be accepted by the Courts, which will enable us to prove that the drunken driver is really intoxicated. In our own city we have been playing with this idea for some time, although we have been no more successful in our methods than other cities, where this problem continues to be a serious stumbling block to the enforcement of the drivers' license law.

Stopping the Leaks in Traffic Law Enforcement

By JUDGE WILLIAM C. LARSON

Municipal Court, Minneapolis, Minn.

The speaker said in part: Fundamentally, the way to prevent leaks in traffic law enforcement is for the police and the courts to pursue violators relentlessly in order that they may be observed, apprehended and given such warning or legal punishment as the circumstances may warrant. There are, however, various lines of activity which the police systems, the courts and the public may pursue which will aid very materially in bringing about a greater degree of enforcement.

Some of these activities appear to me to be of major importance, such as: An increased common responsibility of all policemen, both on and off traffic details; an increased degree of impartiality of enforcement both by the police and the courts; a greater public support for enforcement; improved mechanics of enforcement; simpler and more understandable traffic laws and regulations; concentration of enforcement on violations resulting in the greatest number of accidents; and an increased use of auxiliary agencies, such as school patrols.

Many policemen, because they are not on definite traffic detail, believe that traffic violations are no serious concern of theirs. They center their attention on burglaries, larcenies and similar crimes, feeling that the responsibility for traffic law enforcement rests with the traffic squad alone. Every police officer should be thoroughly schooled in traffic law enforcement, preferably in police schools established for this purpose.

It has been repeatedly demonstrated that a patrolman can give valuable assistance in traffic law enforcement without interference with his other duties. In many cases attention to traffic violations has resulted in the capture of desperate criminals.

The automobile in the hands of the reckless produce more deaths and destruction than do murderous gunmen. A report of the Philadelphia Department of Public Safety in 1932 showed twice as many automobile deaths as homicides in that city. The ratio for 1931 was two and one-half to one.

Leaks in traffic law enforcement should not be permitted through policemen not on traffic detail being permitted to shirk this particular responsibility. The importance of vigilance in this branch of duty should be stressed by all department heads.

Impartial enforcement of traffic laws is important, not only because it is just, but because partiality develops serious leaks in enforcement. Knowledge that a driver "gets by" with flagrant traffic violations not only breeds contempt in the offender, but in others who learn of his or her success in evading punishment. The resulting increase in violations which naturally must follow partiality furnishes another leak in enforcement which may be readily overcome.

Policemen acting conscientiously in the discharge of their duties need every ounce of support which may be given them by their superiors and the public in their efforts toward fair and impartial enforcement. To fail to give this support simply leads to loss of morale and an increased number of violations. Adequate authority should be vested in the head of the traffic bureau in order that the men under him may depend on him for support.

Courts, too, must realize that failure to provide impartial justice will nullify the work of the most conscientious policemen, as well as destroy the department morale.

An analysis of traffic law enforcement in one large American city in 1930 showed that in 75 per cent of the court cases, the drivers involved escaped punishment.

We must recognize that the courts have an important part as well as the police in forming the actual enforcement policy of the city. A failure of convictions, however, cannot be blamed entirely upon the courts. Improper or inadequate mechanics of traffic law enforcement may weaken the prosecution so much as to make convictions impossible.

It is a fundamental principle that in matters heard before traffic courts, as well as every other court which deals with cases of a criminal character, the proof must be of a character which convinces the court or jury of the guilt of the offender beyond a reasonable doubt. In line with this doctrine and to which courts must adhere when doubt as to guilt exists, the offender receives the benefit of the doubt.

In some cities the percentage of convictions runs very high. This may be attributed in part at least to the fact that the police who have been charged with the administration of the traffic enforcement division have been thoroughly schooled in their work. They have a thorough knowledge of the code and the degree of proof required to sustain a charge.

One of the important matters under mechanics of enforcement which will help to block possible leaks through failure to convict is the steps to be taken by policemen after an accident. The policeman acting in an accident should invariably make a complete report, using either his department's prescribed form, or writing the form himself. He should include in the report a suitable diagram of the accident. He should obtain names of all persons involved, and the names of a sufficient number of witnesses, for a strong court fight in case there was a traffic or criminal violation. He should get the facts for his report at the place and time of the accident.

Submission of such reports to the traffic engineers also may lead to remedial measures which will prevent similar accidents at the same or other locations.

It may be well for an assistant city attorney to be designated to give instructions in the matter of obtaining proper evidence for criminal prosecutions. I have always felt that work of special accident squads is of great value.

Use of squad cars which has become quite universal rather than motorcycles for traffic law enforcement was recommended for Minneapolis by August Vollmer, well-known police authority. For one thing, Mr. Vollmer declared the radio service which would be available to traffic officers in squad cars would help in enforcement work.

Another mechanical step in halting traffic law enforcement leaks is the proper maintenance of all traffic signal apparatus. Improperly performing equipment or a signal that is hard to see provides an excellent alibi for the driver charged with traffic violations.

Concentration of enforcement on types of violations causing most deaths and injuries will help to halt leaks where they might do the greatest damage. With this thought, the police departments and traffic courts should keep in mind that certain violations contribute to the greatest number of deaths and injuries. The greatest number of accidents is the result of a few common offenses, such as a failure to yield the right-of-way, excessive speed, driving on the wrong side of the road, reckless driving, cutting in, failure to give the proper signal, passing a street car, passing on the wrong side.

It would be well for persons responsible for traffic law enforcement to remember that nearly one-half the drivers causing deaths or injuries in the United States in 1931, committed one or more of the above offenses, thereby causing 59 per cent of the deaths and 49 per cent of the non-fatal injuries.

Of pedestrians killed or injured, more than two-thirds were guilty of crossing between intersections, playing in the streets, crossing against the signals, coming from behind parked cars, riding or hitching on vehicles, or making diagonal crossings.

In Great Britain it has been proposed that penalties be provided for walking dangerously, and steps be taken for the creation of crossing places for pedestrians. British "jay-walkers" who escape death under motor cars are to be legislated out of existence—it is hoped.

Violations occurring in the vicinity of school buildings obviously must be given close attention, but since the available police personnel ordinarily does not permit the patrolling of streets in the vicinity of schools, dangerous traffic violation leaks may be largely prevented by the use of so-called school patrols, comprised of selected pupils.

Minneapolis and other communities have had excellent results with such patrols, despite the early objection of Minneapolis school authorities that children in buildings with only six grades, as is generally the case in the Minneapolis elementary schools, are not old enough for this responsibility. The efficiency of the system, however, is seen in the fact that comparatively few violations occur where school patrols are established. There have been but very few traffic accidents involving

school children in our city. Motorists generally have found the pupils honored with school patrol duty to be efficient and businesslike.

Another leak concerning which much has been said is that of so-called "fixing" of traffic tags or summons. This in the past has been a very serious handicap to rapid and better enforcement. The driver who did not have a friend on the police force, in the court personnel, or in the mayor's office to take care of it just wasn't much of anybody. Only "suckers" paid their fines and went to jail. The peculiar and distressing feature was that the "sucker", instead of being angry at the better connected driver, only envied the other's good fortune.

In Minneapolis this deplorable situation largely has been eliminated through the use of triplicate traffic violation tags. This method was proposed some years ago by the National Safety Council, and it has been adopted in a number of cities. Not only does this check give stricter enforcement and increase the fines collected, but it relieves policemen and officials of much of the tedious labor of listening to the pleas of friends and most casual acquaintances. The best the offender can do now is to save his voice for a long argument with the traffic judge, the only person with authority to settle his case.

One of the most difficult things a traffic judge has to contend with is the constant pressure and solicitation for leniency in behalf of offenders. It comes from the business and professional man, as well as the butcher, the baker and candlestick maker. Yet when the Court takes a stern attitude in the handling of violators, and this receives press comment—he is praised by everyone for his firmness. Every one seems to be for the principle of rigid enforcement. Yet our best citizens do not hesitate to solicit the judge in the aid of serious violators.

Police officers and members of the bar and bench know that no law can be adequately enforced if it does not have sustained public support; consequently, public support becomes a mighty weapon in the halting of leaks in enforcement.

The citizen who is made to realize that violators of traffic regulations are dangerous to himself and his loved ones, will want enforcement, and his resultant actions will help plug the leaks of inadequate enforcement.

An educated public will be more active in support of the efforts of the police and courts than a public which does not know the why or wherefore of its traffic laws. Consequently, aid in enforcement may be fostered by getting the people to understand the various laws and regulations and the common-sense reasons behind them. Thorough knowledge of the various rules and regulations naturally inculcates in the driver a greater driving sense. Pedestrians are clearly in the need of more education to the dangers which confront them. The particular danger of midblock crossing of streets must be stressed more than ever.

The driver who knows the danger to safety involved in the violation of traffic laws will take a much more active interest in the arrest and punishment of violators than someone who has never given a thought to the rules and regulations and the reasons for their enactment. Also, the well-trained and educated traffic officer will receive more respect than the ignorant, poorly-trained officer. The alert, well-groomed officer can help avert traffic law violations simply by the respect for the law that his appearance fosters.

We are all more or less familiar with the work of police traffic bureaus. We have learned they are valuable in preventing traffic leaks through consolidation of traffic work and the specialized services they may render. Such a bureau brings about a better understanding among police officers of the city on the policies of traffic law enforcement.

Another means of stopping enforcement leaks which has been largely adopted is the use of reports of accidents and arrests in compiling information on drivers' records. The information on these records may help stop the leaks by which recurring offenders escape adequate punishment. Also the records will help to cause prompt arrest of repeating drivers and to insure adequate punishment.

Still another step to help stop enforcement leaks is to reduce to a minimum the necessary appearance in court of officers for witness duty. Loss of regular recreation time to appear in court repeatedly will tend to dull an officer's desire to make justifiable arrests.

Much may be said concerning particular violations in their relation to our accident toll. I think that we are agreed that the three maniacs of the road are the drunken driver, the careless driver, and the speed fiend. The courts should take judicial notice of the fact that gasoline in the carburetor and alcohol in the operator will eventuate in disaster.

The Minnesota drivers' license law, as well as the drivers' license law in other states, is having a salutary effect upon this group. While the present drivers' license law has done much, a great deal more must be done toward strengthening it, and toward a more rigid program of enforcement, if we are to conserve lives and property which are unnecessarily lost.

Report of Committee on Enforcement and Police Activities

By FRANKLIN M. KREML

Director, Bureau of Accident Prevention, Police Department, Evanston, Illinois

The speaker said in part: Shortly after its appointment in 1932, your committee conducted the National Traffic Law Enforcement Demonstration, in which 30 cities were entered, 17 of which submitted reports which were full enough to provide a basis for definite conclusions. The information gained from these reports has guided the efforts and activities of this committee during the two years that have elapsed since that time. The outstanding contribution of this demonstration was the development of the "enforcement index," the number of convictions for offenses involving driven vehicles per accident involving personal injury or death, which affords a measuring stick for evaluating the enforcement activities of cities.

The reports in this demonstration clearly showed an inverse relation between convictions for traffic violations and personal injury accidents. Convictions for the three serious offenses of driving while intoxicated, reckless driving, and speeding revealed an even more definite inverse relationship. This latter was borne out by the fact that convictions for all other less serious offenses did not produce so great an inverse effect upon personal injury accidents, pointing to the need for strict enforcement with regard to the more serious offenses in the interest of accident reduction. The enforcement indexes showed that the cities with the highest enforcement indexes averaged lower in motor vehicle deaths than those cities with the lower indexes, or poorer standards of enforcement.

Another outgrowth of this demonstration and study was the advocacy of what has been termed "selective enforcement," by which is meant concentration of enforcement activities against those offenses most commonly involved in accidents, and at the times and places of their most frequent occurrence. In order to carry on a program of selective enforcement, the committee has recommended the maintenance of an accident spot map to reveal the high accident frequency location.

A third study has been on the subject of the use of a warning tag system for minor violations, which gives the violator an opportunity to demonstrate that he is not a "repeater" before he is arrested. This system has been in use in many cities.

Finally, your committee has studied and urged the adoption of "accident investigation" and "post-accident enforcement" by cities.

During the past year this committee has been amalgamated with the Committee on Police Activities, which has expanded its view of the enforcement situation and brought it into closer contact with police problems and methods, which should prove helpful in the future.

In submitting this final report of its activities before relinquishing its duties to the new committee, we wish to give our impressions as to what lies ahead in the field covered by this committee. There are two lines of endeavor along which the work can be most profitably directed. These are research and promotion. In the field of research (the more important one) there are several problems presenting themselves for solution.

Your committee has attempted to conduct some research into the problem of the quantity of enforcement as related to its effect upon the accident rate. Another problem, however, even more important and far-reaching in its implications, is that of the quality of enforcement. This we consider to be one of the major research problems to be taken under consideration by this committee. The re-

search of the present committee has established a definite relation between the quantity of enforcement, but our conclusions give no answer to the problem of quality of enforcement. That is, can more good be accomplished by numerous small fines or a relatively small number of large fines? The answer depends upon whether one regards enforcement as having best accomplished its purpose when it reaches out and strikes at the greatest number of violators, or when by its severity in a few cases, it serves as an examplary means and an indirect deterrent to potential violators. Undoubtedly the conducting of another demonstration somewhat along the lines of that conducted in 1932, but different in some ways, would furnish a partial or full answer to this question.

As regards the second line of endeavor for the future, that of promotion, we believe that there are equally great opportunities for work of real value to the field by this committee. Since the committee can only do effective work with accurate and relatively ample information in hand, the main promotional activity upon which this committee can well embark is that of encouraging reporting enforcement activities by cities. Increased reporting will give a much fuller and more reliable picture of what the enforcement situation is and will greatly facilitate the development of new and better means of enforcement by this committee.

Second, this committee can do untold good by the encouragement and promotion of better enforcement in the several cities. Such can be done to a large measure through showing the cities what constitutes good enforcement and its relationship to the accident rate, as based upon the committee's research into the subject, and by fully publicizing all developments of a new nature in the field of enforcement, so that they may become universally adopted.

Finally, there is a good deal of promotion to be done by this committee in regard to encouraging the use of the Council by cities. Cities must be informed of the numerous valuable services the Council affords them, for their use will both aid them directly in accident reduction and will stimulate cooperation with the work aims of this committee toward more effective enforcement means.

TUESDAY AFTERNOON SESSION

October 2, 1934

Public Education

The session was opened by William C. Knoelk, Vice-Chairman, Street and Highway Traffic Section, and Chairman, Milwaukee Safety Commission, Milwaukee, Wisconsin, who presided. The chairman briefly outlined the purposes of the session and then introduced the first speaker.

Teaching Safety by Movies

By ARNOLD H. VEY

Traffic Engineer, Division of Traffic Control and Regulation, State Department of Motor Vehicles, Trenton, N. J.

The speaker said in part: The motion picture method of teaching highway safety provides one of the best and most recent means of reaching a large number of people in a comparatively short time. Unfortunately, until a short time ago, there did not exist many appropriate safety motion pictures. However, recently a number of good safety films have been prepared, some of which are: "The Crossroad Puzzle" developed by the American Automobile Association and the National Automobile Chamber of Commerce; "Why Be Careless?" by the John Hancock Mutual Life Insurance Company; "Why Be a Goose?" by the Automobile Club of Southern California; "The Verdict" and "Ask Daddy" by the National Safety Council; "The Hit that Scored" by the Bell Telephone Company; two teaching films developed by Eastman Teaching Films, Inc.; and "Public Enemy No. 1" by the New Jersey Motor Vehicle Department.

There is considerable evidence from studies conducted by educational groups throughout the country that motion pictures provide one of the best facilities for teaching. These studies indicate that children in schools, for example, learn from 30 to 40 per cent more about facts of geography, science, health, etc., when films are used in conjunction with these lessons than when no films are used.

If this is the case in teaching school subjects, undoubtedly it is equally true that movies will show a similar result when used in teaching highway safety.

The use of movies in teaching highway safety is merely another method of visual education. We are, of course, familiar with the visual educational methods used in the past, such as, stereopticon slides employed during the course of lectures, classroom studies, etc., as well as the numerous visual methods used by advertising concerns, such as billboards, posters, exhibits, etc.

It is difficult, by actual measurement, to establish the value of movies in safety educational activities, as invariably such movies form merely a part of safety educational endeavors. However, I believe it can be said, without fear of contradiction, that the use of movies in street and highway safety work is an excellent means not only of demonstrating the seriousness and scope of the accident problem, but also the proper use of the highway.

The development of sound synchronization with the screen has further enhanced the value of movies in teaching highway safety. Sound safety movies not only permit education through the sense of sight, but also through the sense of hearing. The use of sound in motion pictures produces, I believe, a more attention-compelling film. I do not mean that safety movies of the silent type (of which there are now many in use) are not of value. Silent films have their place and should be continued to be developed.

Sound movies have certain limitations, the greatest of which is that few organizations, with the exception of theaters, have available sound projection equipment. The majority of schools now have projection equipment suitable only for silent films. Also, the showing of sound films requires, to some extent, a greater technical knowledge than for silent films, and therefore sound films are not as suitable for school showing, for example, where either a student or some member of the faculty acts in the capacity of operator.

These objections, to some extent, may be overcome by the use of portable equipment operated by trained operators who transport the equipment from place to place throughout the State. This is the method used in New Jersey during the past year. The operators of the Motor Vehicle Department's portable equipment are members of the Department's Inspection Force who have been instructed in the proper operation of this equipment.

The size of the film may also enter into the problem of preparing and showing safety movies. Here, again, most organizations now owning projection equipment have equipment suitable only for 16 mm. films. It is possible, however, to reproduce 16 mm. films from original 35 mm. films, if desired.

There are, of course, numerous subjects which may be treated in a safety movie. Our experience in New Jersey has indicated that there are certain fundamental features which should be a part of a good safety movie. It must be attractive and, to some extent, thrilling or spectacular. On the other hand, thrilling and spectacular scenes should not be used in a manner to cause a lessening of the educational value of the movie. If statistics are used, they should be in simple and understandable form and wherever possible should be compared with outstanding catastrophes to make ready comprehension possible. For example, in the New Jersey film recently prepared, the following comparisons have been used:

> 1,666 New Jersey soldiers were killed or died of wounds received during 19 months of the World War, and 1,998 persons were killed on the highways of the State during a comparable 19-month period, because of motor vehicle accidents.
>
> 73 lives were lost in the crash of the Akron off the shores of New Jersey; an average of 98 lives are lost in New Jersey each month because of motor vehicle accidents; and we now have a comparison with the horrible catastrophe caused by the fire on the liner Morro Castle.

Scenes of actual accidents, showing their causes and results, may improve the value of safety movies, not only from the thrilling viewpoint but also from the standpoint of education in actually demonstrating how the highways should not be used.

As an indication of the use which may be made of safety movies in street and highway safety educational activities, I am briefly citing our experience in New Jersey concerning the showing of safety movie, "Public Enemy No. 1." This movie was made available about April 1st, 1934, and from that date to September 1st the movie has been shown at approximately 100 different meetings or locations throughout the state. These include civic clubs, luncheon clubs, industrial groups, schools, theaters, official organizations, safety councils, as well as numerous conventions. During this five-months period, approximately 841,000 persons observed the film, or an average of 168,000 per month.

New Jersey's safety movie, "Public Enemy No. 1," is a sound-on-film type of picture, approximately two reels in length, and includes short talks by the Governor of the State, as well as the Commissioner and Deputy Commissioner of Motor Vehicles. In addition, to make possible an appreciation of the extent of the motor vehicle accident problem in New Jersey, the results of motor vehicle accidents are compared with catastrophes as mentioned above, as well as with fire losses from fires during a comparable period. Besides, some thrilling race-track accident scenes are included in the film, showing a comparison of the results of accidents to expert race-track drivers when they operate vehicles at high speeds. In addition, numerous accident scenes are included showing the causes and results of improper highway practices.

This type of movie may not be the ideal for a safety educational movie, but it illustrates the kind of material that may be employed. The Department is considering the development of another safety movie, probably in the form of short trailers, to be released monthly to various movie houses throughout the state. These trailers may be prepared in such manner that at the end of the year they may be joined together to form a complete safety movie having proper continuity.

Broadcasting Traffic Trials

By JUDGE WILLIAM H. SCHEAFFER

Marion County Municipal Court, Indianapolis, Ind.

The speaker said in part: Like the small boy, who thoughtlessly disobeys his school teacher, a certain percentage of the motoring public must seemingly be called into traffic court, and figuratively "spanked" to impress upon them the simple but necessary rules governing the operation of a motor vehicle. It has been found that the radio broadcast in traffic cases can "spank" more drivers in the shortest space of time than any other known method. The judge does not make friends by broadcasting his court, but the lesson and example set by each decision is multiplied a thousand fold.

Indianapolis is one of the few cities in the country that has used the radio in the education of its motoring public. In February, 1933, certain officials of Station WKBF requested that they be allowed to feature a real court broadcast for one-half hour, as one of their station features. Daily schedules of the broadcasting station were firmly fixed at the time, so the arrangements finally made scheduled the broadcast for 8 o'clock on Thursday evenings, with all traffic cases set down for that night, and with the two regular judges alternating for a month at a time. After two months of night court, the time was changed to afternoon with traffic cases predominating.

To say that the first broadcasts were nightmares is putting it mildly. In fact, the court room and corridors very much resembled the "first night" or premier of a new movie. Curious crowds arrived for a hilarious evening, and these added to the large crowd of offenders, made both the "judging" and the broadcasting most difficult. But the novelty soon wore off. With the seriousness of the court and

severity of the penalties, the audience realized it was not a show and the spectators found that they could hear better at their radios than in the crowded court room.

Radio listeners received the broadcast with a great deal of enthusiasm, as was evidenced by the "fan mail" arriving daily. That the broadcast was having its effect was evident. So popular did it become that the listeners demanded a full hour instead of the half hour, as originally planned. Much of the success of the venture was due to the helpful criticisms of the listeners. Many of their questions were answered in the course of the broadcasts, and there is no doubt in the minds of the officials that the educational side of the broadcast is most helpful. There are evidences of whole parties and families gathering at each broadcast, listening and discussing the decisions made.

We found that the erring motorists dreaded the laughs and taunts of their listening friends—they realized that their excuses sounded mighty "slim" over the ether waves, and this, added to the payment of money for fines, left a vivid impression on their minds. It was surprising how many offenders timidly asked, through attorneys and friends, that their cases might be tried "off the air", and many of them gave all kinds of excuses as to why they couldn't come to trial on Thursday evening, "but any morning would do."

In the course of the hour broadcast, often not more than 30 cases are tried out of the usual hundred. The cases coming under the scope of this one day traffic court are just violations as seen by the traffic officers or motorcycle men, and do not include accident cases in which investigations and arrests are made by squad cars.

We have made the radio broadcast feature more than a drive of short duration on traffic offenders. The broadcast seeks to be a weekly reminder to the public of the necessity for safe and sane driving.

In our city, motorists caught disobeying laws are not taken to jail, which would necessitate a release on bond for appearance, but are simply given a notice and told to appear in court on the date of trial. We have had no end of trouble on account of the large number who fail to appear. Our method is to issue rearrest warrants and to place a bond on the cases to insure appearance at the time of trial, on those who do not show up at the time ordered in. Only a small percentage of those ordered rearrested are ever located or brought into court. Since we have been broadcasting, the names and addresses are read over the radio and the fact stated that the defendant has been ordered rearrested on his failure to appear. The ones who are unfortunate enough to be rearrested are usually caught in the wee small hours of the morning and are, of course, then taken to jail to be either held or released on bond. It gives the absent defendants quite a thrill to hear over the radio that they are to be rearrested. After one very long siege of a night court, a very breathless young man rushed up to the bar and told who he was, and it seems he had heard the broadcast and had received quite a start when he found his case had not been "taken care of" as had been promised. Nearly all of the offenders who have ignored the officers' orders to appear and who either "show up" late, on rearrest plead that they thought the arrest card was merely a sticker which a friend had promised to "fix." Unfortunately the radio broadcast has not fully done away with the fixing of stickers and violation cases.

Since the advent of motor vehicles and the beginning of arrests for traffic violations, the public has conceived the idea that it is impossible to receive a fair trial in a traffic court. All sorts of criticisms have been placed on the shoulders of courts, everywhere. The main criticism is, of course, that the police officer's word is taken for the golden truth, and the poor defendant has lost his case from the start. A lot of the criticism from listeners to our radio broadcast shows that they feel that defendants haven't a chance against the officer's word. Many defendants also feel that they have not had a fair trial when they have had to pay fines while the next man seemingly walks out with no expense, except of course, his time in court. A dissatisfied defendant naturally spreads his case of injustice among his group of friends and associates. By broadcasting the actual trials, however, the public is given a picture of all of the facts which the presiding judge must take into consideration when he makes his finding. Conditions of the family and employment must be considered along with the actual details of the violations and intent of the violators. The same rule cannot apply to all cases in the finding of the

court, and the general public is in a position to understand what is in the court's mind when he makes his finding, if they have listened to the facts as broadcast.

In many cases, where inexperience is shown in driving, and where a defendant has been slated for his second or third expense, something more than a fine is necessary in order that the person may know the rudiments of safe operation of a motor vehicle. In accordance with this need, the Indianapolis Police Department Accident Prevention Bureau sponsored a Traffic School for Violators, and also for others in the community who wished to join in the instruction. Many defendants were glad to have this opportunity to receive the instruction, but of course others were more severely punished by a forced attendance, and especially so, since perhaps their friends might hear over the air, and know they have been sentenced to traffic school for a month. Most of us do pride ourselves on our driving, so no doubt it was a bitter pill for many of them to swallow. Of course, all kinds of excuses are given as reasons why they haven't the time to attend the school.

Incidentally, whether realized or not, the presiding judge, along with the defendants, is affected by the broadcast. The fact that an unseen audience is listening and "judging" the guilt of the offender with him, naturally makes the judge "on his toes" in rendering a fair decision, and in clearly offering words of explanation as to violations, laws, terms of findings, etc. Time is taken during the period to explain types of violations, the meaning of the different aspects of a sentence, and in cases where extreme leniency has been shown, a word of explanation is often given recalling to the listener's mind the facts as brought out by the evidence.

I have noticed in the trial of traffic cases, the large number of boys and young men who have appeared before me. The average speeder is between the ages of 17 and 22. By a speeder, I mean a driver who is exceeding the speed limit, with his car not under control, and driving his car in such a manner as to be endangering the life, limb and property of another. While I doubt very much if our listeners are made up of many of the younger generation, yet undoubtedly parents who have heard the radio broadcasts and instructions and know the seriousness of violations, can in discussions and mealtime conversations in many cases instruct their children.

Although we have had broadcasting in the city of Indianapolis since February, 1933, according to the statistics of the Police Department the number of accidents, property damage, injuries and deaths has shown an increase rather than a decrease over the same period of the previous year. It may be that there are more vehicles being operated this year than last. However, the motorcycle men insist that since the radio broadcast of traffic trials, it is harder to catch traffic violators. I am informed by Captain Johnson, of the Traffic Department, that during the first quarter of 1934, which was the time that trials were broadcasted at night, fatalities were fewer in the city of Indianapolis than in any city of its class in the United States. Also, one of the city's largest milk companies report to us that accidents by their drivers have decreased 50 per cent since the beginning of the broadcast.

Report of Committee on Public Education

By LEWIS E. MacBRAYNE

General Manager, Massachusetts Safety Council, Boston

The speaker said in part: One year ago this committee submitted to you a rather elaborate report based on an analysis of the records in the National Traffic Safety Contest for 1932. The analysis showed a very definite correlation between safety educational work and the accident record; that is, in general the cities that got the highest scores for educational work also had the lowest motor vehicle death rates and the greatest reductions from the death rates of previous years. In short, safety education does bring results in a community.

It seems unnecessary at this time to repeat in any detail the familiar material already presented by this committee in previous reports. We wish, however, to report these definite convictions and recommendations:

1. Safety education must be both inspirational and informational. It is useless to offer information on the detailed technique of safe driving to an individual or a community that is simply not interested. In a community with a bad accident record where no safety work has been done to speak of, the people must first be stirred up —their emotions must be reached by a vivid portrayal of what accidents mean in suffering and in money and how they can only be stopped by greater carefulness on the part of every individual. Several unique plans are being tried out at the present time, such as the broadcasting of interviews with motorists and pedestrians from a street intersection, as carried on by the Police Department in Fort Wayne, Indiana; the traffic court broadcast in Kansas City; and the safety warnings to motorists from loud speakers in police cars on the highways.

If or when this has been done, our educational work must get down to the specific causes and remedies, remembering, however, that the emotional phase must not be entirely neglected. We must tell the people exactly how accidents most commonly happen and exactly what practices make the differences between a safe and an unsafe driver or pedestrian. It is very important to recognize the relationship and the difference between these two types of safety education.

2. Every new driver should receive definite instruction and training before he starts to operate a motor vehicle on the public highway. The great importance of this statement is hard to realize, for those of us who have taught ourselves to drive over a long period of years, starting when traffic was relatively light and speeds relatively low. Today, to expose a beginning driver to modern city traffic with only a few general admonitions is positively suicidal or homicidal and has so proved in countless cases. It seems self-evident that a young man or woman starting to operate a high speed vehicle on highways crowded with other vehicles, with the constant possibility of death to himself or others resulting from the slightest slip, should first receive as much instruction as is given to such relatively harmless people as plumbers, hairdressers, and carpenters before they start to practice their trades. This is in fact done by most commercial fleet operators today.

It is equally important for the state or city to insist on such training for private drivers, and where the state or city does not do it, the parent or the school should. For this reason we are very deeply interested in the present efforts of the Education Division of the Council to promote the definite instruction of high school students, in safe driving. We are equally interested in the work of the Council's Committee *on the Driver, in cooperation* with the State Motor Vehicle Departments and their Association, to raise the standards of drivers' license examinations so that these may come somewhere near realizing their possibilities as an educational force and instrument.

In only a very few states is there even an approach, today, to the sort of examination of new drivers that can and should be given. Of course, this implies that we must first have drivers' license laws in all the states.

3. Your committee is impressed by the fact that safety educational work in a community, to be effective, must be continuous and that to be continuous it must be directed by a permanent body organized for that purpose. As we observe the various cities we find many in which splendid results have been gotten through the permanent leadership of a community safety organization, working of course in the closest cooperation with the public officials. However, we also note that the mere paper existence of a community safety body does not stop accidents if such organization does not carry on actual educational work on an effective scale.

We also note that among the largest cities, over half a million population, the first place in the National Traffic Safety Contests of 1932 and 1933 was won by Pittsburgh and Milwaukee and that in both these cities the safety campaign is headed by an official commission or committee, including representative citizens as well as public officials, authorized by city ordinance and supported by a city appropriation. Such commissions make full use, of course, of the local safety organizations and any other local organizations that are willing to help. We recommend that every large city should recognize its responsibility for the educational as well as the engineering and enforcement parts of the traffic safety job.

4. Recent trends appear to be in the direction of the state providing an appropriation annually to be expended by the registrar of motor vehicles, or some state department, or a state-wide group named as a special committee, to coordinate the work of state administrative departments, and of outside cooperating agencies in a general and continuous campaign of public safety information and education.

WEDNESDAY MORNING SESSION

October 3, 1934

Enforcement Problems

The session was called to order by Harold G. Hoffman, General Chairman, Street & Highway Traffic Section, and State Commissioner of Motor Vehicles, Trenton, N. J., who presided. The chairman briefly stated the purposes of the session, and then introduced the first speaker.

Are We Solving the Speed Problem?

By JOHN P. SMITH

Superintendent of Police, Detroit, Mich.

The speaker said in part: The advent of legal liquor in the last month of 1933 produced a tremendously rising trend in motor vehicle accidents of all kinds. It soon became apparent to the Detroit Police Department that unless quick action were taken, the death rate of 285 in 1933 would be greatly exceeded in 1934. There has been a steady increase in the registration of cars, and today (October, 1934) there are 60,000 more automobiles on the streets of Detroit than there were last year. Between the additional registration of cars and the insane wave of mad, reckless driving which has held not only Detroit, but all the rest of the country, in its grip, there has been an increasingly high accident toll. In Detroit, traffic accidents showed a tremendous increase in the first six months of this year, an increase of 46 per cent in all type traffic accidents over the same period of 1933; fatal accidents showed a 37 per cent increase; injury accidents, 35 per cent; and non-injury accidents increased 53 per cent. Motor vehicle accidents attributable to the influence of liquor increased 138 per cent.

The following table is interesting as a record of accidents attributable to speed, recklessness and carelessness during the first six months of 1934:

Accidents in which skidding was noted	90% increase
Making right turn	82% increase
While vehicle was backing	81% increase
Vehicle hit safety zone	73% increase
Vehicle hit a parked car	53% increase
Exceeding the speed limit	292% increase
Vehicle on wrong side of street	106% increase
Vehicle cutting in	72% increase
Driver failed to give proper signal	296% increase
Driver made improper turn	162% increase
Passing on wrong side of road	59% increase
Driver had been drinking	138% increase
Pedestrian had been drinking	233% increase

As usual, when the traffic death curve takes an abrupt upward turn, the Police Department became the target for a bombardment of criticism. The newspapers assigned special reporters to the Police Department, interviewing the Commissioner, Superintendent and Director of Traffic in regard to the traffic situation. Thus, we were able to obtain the newspapers' cooperation. The Department commenced issuing accident statistics on the front sheet daily, which brought every citizen's attention to the traffic situation. One newspaper gave a reward of $100 for hit-and-run drivers and this had its effect immediately because there was a general reduction in this type of accident.

The Detroit Police Department, in the first four months of 1934, wrote up 30,000 more violation tickets than it did the first four months of 1933. In order to combat this high accident rate, it became necessary to have the entire personnel of the Police Department become active in accident prevention work and we, therefore, inaugurated the Detroit Police Department Inter-Precinct Safety City Contest.

Each precinct is rated according to its activity, under the following headings: Accident Reduction, 25 points; Public Education and Contact, 20 points; Accident Reporting, 15 points; Traffic Law Enforcement, 15 points; Child Safety Activities, 15 points; Traffic Suggestions, 10 points.

Through educational activities in the city schools, an appreciable decrease in accidents involving children of school age has been effected and maintained. We believe that a like reduction of accidents involving adults can be gained by constant application of the same principles that are employed with children.

Previous to the present inter-department contest, it was a common occurrence to receive incomplete and improperly filled out accident report cards. After the start of the contest a decrease in this type of accident report was noted. We have also received some very good suggestions regarding traffic control from Precinct Officers.

The City of Detroit, which covers 140.2 square miles, is divided into 15 police precincts. The Police Inspector in charge of each precinct appoints one or more police officers to take charge of all safety work in his precinct. After these officers have familiarized themselves with the fundamental principles of accident prevention at the training school, they return to their precincts and take complete charge of safety activities.

These activities consist of safety parades, slogan contests, interviewing residents and soliciting their cooperation, addresses at various meetings of clubs and societies, instructing the police officers of their precincts in accident prevention work, and other numerous details. It is amazing how energetically the members of the Police Department have worked in this contest and the results they have accomplished.

Due to the financial condition of our city, we had no funds with which to provide posters, etc. To overcome this, we solicited funds from public-minded citizens. These funds enabled us to erect safety posters on 45 large billboards at strategic locations throughout the city; 1200 safety posters in street cars, and safety posters in all manufacturing plants of the city. Two sound cars were donated to the Department for the purpose of addressing outdoor meetings and also the patrolling of streets in the capacity of a "Voice of Conscience" car. Motion picture safety films for theaters were secured and time was allotted the Department by radio station WWJ for the dramatizing of fatal and injury accidents over the air.

Also, we organized a Safety Club and these funds were used for the purchasing of 50,000 pledge cards and stickers for the Detroit Safety Club (this club now has approximately 50,000 members). The Continental Baking Co. has printed 500,000 leaflets giving a resumé of the speed ordinance on one side and on the other a picture of an auto crashing into a safety zone. The Kennedy Creamery Company printed 500,000 booklets giving a true incident where the children exercised precautionary measures taught them in school while their parents failed to do so. The incident describes how a lapse of memory on the part of parents cost them their lives, while the children were unharmed. These booklets are distributed to each home by police officers with a verbal request that the radio be tuned in on the radio broadcast every Wednesday evening.

In the first six months of this year, there were 1177 violations resulting in accidents from driving on the wrong side of the street. To educate the operators and reduce this type of violation, we painted 65 miles of center lines on the city pavements. We also installed 59,000 metal markers to outline crosswalks at signalized intersections and school crossings.

An example of Public Education activity was illustrated by our Eleventh Precinct when they gave a safety entertainment program in the recreation grounds back of their station house, which was attended by 16,000 people, including city and state officials; safety talks were given by the members of the Department.

We did not obtain definite results from our campaign until the month of July, when the Commissioner of Police issued a strict order to all members to rigidly enforce the speed ordinance of 15 miles an hour in the business section and 20 miles an hour in the residence section, regardless of *prima facie* evidence.

Since 1931, when our Detroit speed laws were amended, the public has misinterpreted the liberty allowed them under this amendment and has increased their speed to 30 miles per hour, or faster, continuously.

The Police Department carried on strict enforcement of the new provision. Many cases were brought to court, but due to the fact that no one was injured, in thousands of these cases the police officer was tried instead of the defendant and the burden of proof rested upon the officer. Accidents due to driving too fast for conditions increased 53 per cent during the first six months of 1934.

Perhaps you may wonder why the Department did not obtain better results before the month of July. However, like any other organization conducting a campaign, we had to lay the foundation. It took time to train the officers in accident prevention work; to contact the citizens, and make them aware of our efforts to curb this unnecessarily high death rate; and most of all, it took the complete cooperation of the newspapers, the Courts, the Police Department and the general public to bring the desired results.

During the first 30 days of our campaign, we had one entire week without a fatality. During July, we had 20 deaths caused by motor vehicle accidents. On August 15th we had the lowest accident rate for a 24-hour period that we have had in a number of years—no fatals, 8 injury and 28 non-injury accidents during this 24-hour period. Also, during this month we had a number of week-ends without a fatality. Moreover, the week ending August 31st, at 7:00 A. M., marked a 13-day period without a fatality, which is an unprecedented record.

Are We Getting Anywhere With Speed Controls?

By E. RAYMOND CATO

Chief, State Highway Patrol, Sacramento, Calif.

The speaker said in part: We might group all traffic accidents into three major classifications: (1) Property damage; (2) injury; and (3) death accidents. By far the largest number are mere property damage accidents in which no one is either killed or injured. Many of these accidents happen to vehicles that are not in motion. The factor of speed could hardly be considered an important influence.

The second class are the injury accidents, of which we have from 40,000 to 45,000 each year in California. The majority of injuries are not serious. Many of them are but cuts and bruises to individuals. The factor of speed may, or may not, enter into the cause af the accident, but usually some speed is involved, although it may not be excessive speed.

The next group of accidents are the fatalities which, although in the aggregate smaller in size than the two groups mentioned, are more serious. It has been found, after an experience of five consecutive years in California, that seldom, if ever, is there a death in a traffic accident that involves a collision of a vehicle traveling 20 miles per hour or less. Roughly speaking, about 35 per cent of the fatalities happen to vehicles involved in collisions traveling up to 45 miles per hour. The great majority of fatalities are known to happen in vehicles colliding at speeds in excess of 45 miles per hour. At moderate speeds, when vehicles collide, perhaps one person in the car is killed and several may be injured, but at high speeds, practically everyone within the car may be killed. It is known that fatalities increase in something like a geometric proportion upward with the speed of the vehicle at the time of the collision.

The statement has been made in the past, and is repeated here, that *"excessive speed is the dominant influence in California motor vehicle fatalities."* No amount of "opinions" or "beliefs" of individuals to the contrary is ever going to change this fact.

To reduce fatalities in California, therefore, one essential thing must be done. Excessive speed must be prohibited and malicious violators severely punished.

That sounds like a simple formula. Many will ask "Why has it not been done?" The answer is, "It can't be done properly under existing conditions."

In the first place, a number of perfectly conscientious people do not "believe" in this policy. Their individual experiences argue against it. They have driven fast for years and never had an accident. They "believe" they, and others, can do so indefinitely. Few of these advocates realize that of the 2,403 persons killed in motor vehicle accidents last year, the majority never had had a previous accident. Many of those dead undoubtedly "believed" they too could drive at high speed safely, but those beliefs have served them to little advantage.

The legal method of making a speed arrest is by chasing the speeder with more speed in a conspicuous vehicle. With a score of highway patrolmen and other traffic officers killed trying to perform this duty, there is but one conclusion possible. This section of law is obsolete for modern conditions.

Another difficulty is the legal restriction to moving traffic officers of the Highway Patrol from one county to another.

The mere arrest of the speeder does not settle the matter. Facts must be impressed upon the judiciary of the State for without the cooperative intent on the part of the judges who hear these cases, a strict enforcement is of little or no avail.

And speaking of the cooperation of the Courts, we cannot overlook the fact that in recent years the majority of the traffic judges have expressed an emphatic desire to do all they can to aid. There has been some advance in this direction. When it is realized that of 10,265 speed cases which went to Court during the month of December, 1933, the judges convicted 99 per cent, we have evidence to indicate that the excessive speeder is certainly not escaping the vigilance of the judge.

On the other hand, when it is further realized that of this group of speeders brought to Court, there was a considerable number whose actions on the highways seriously endangered the lives of many people, it is difficult to realize that only 91, less than 1 per cent, were considered sufficiently serious by the judges to be given a jail or a road camp sentence.

Furthermore, of the December speeders, the Courts administered fines to 6,777 and 812 forfeited bail. Considering these 7,598 violators who paid in all $69,171.25, or an average fine of $9.11 per case, it can hardly be concluded from these facts that the judges were too severe. It should be mentioned also that of 2,271 of the violators, approximately 20 per cent, who were convicted, were given suspended sentences or probation by the courts.

The drunken driving situation is closely associated with excessive speed indulgences. Some of the Courts and district attorneys are prone to reduce drunken driving charges, a felony, to a misdemeanor charge of reckless driving, in exchange for a plea of guilty from the defendant. This practice may be justified in a few instances, but indiscriminate use of it breaks down the strength of the enforcement.

Motor vehicle fatalities in California can be reduced from 10 to 25 per cent within a year, as soon as excessive speed can be effectively checked. We can dig into the various causes of individual accidents from now till dooms day and entertain ourselves with a big variety of interesting phenomena regarding the "psychology of drivers" and many intangible, so-called scientific facts; but these intricate and interesting discoveries will in the end avail us little in furthering the practical and wholesale control of the death situation.

To obtain a control of excessive speed is not impossible. Checks have been made in recent months to bring out the fact that less than 4 per cent of our motorists desire to drive habitually at speeds in excess of 45 miles per hour. Some 96 per cent of the motorists, it has been determined, are satisfied with the 45-mile speed limit and, except upon rare occasions, exceed this limit only for a short time. The speed control problem, therefore, essentially rests upon a control of but 4 per cent of our drivers, a decided minority. It would not be impossible or impractical to develop special records on habitual speed violators and by severely punishing them for a second and third offense, settle the matter effectively.

REPORT ON THE PEDESTRIAN COMMITTEE

(The report, which is too long, unfortunately, for reproduction here, listed all methods which have proved of value in reducing pedestrian accidents, especially mentioning the following as having been of value to those cities which showed decreases: public address cars; newspaper cash awards for apprehension of hit-and-run drivers; enforcement of business and residential district 20 and 30-mile-an-hour speed limits; elimination of parking adjacent to schools; police department bulletins to pupils; daily police broadcasts, and, horn signals by motorists seeing violations or unsafe acts. Certain other activities are listed for the consideration of cities and towns: installation of signals to aid pedestrians in crossing intersections with bad accident experience, using "pedestrians push buttons" for actuation if necessary; signals to tell the pedestrian when it is no longer safe to leave the curb on the green light; special pedestrian crossing periods free of all vehicular movement at places where foot traffic is especially heavy; installation of "Walk Left" signs on rural highways, and use of caution signs on pavements near curbing.)

1. That the National Safety Council immediately undertake a thorough statistical analysis of the pedestrian accidents for the first six months of 1934 as compared with the same period in 1933.

2. That if the increase in pedestrian accidents is as great as indicated by the index of the twenty one cities that "Pedestrian Committees" be established in all cities having a high pedestrian accident rate. This is based on the fact that it is believed that the pedestrian has not had his proportioned share of attention and that the appointment and operation of a special committee on this particular problem will help provide the necessary stimulation.

3. That increased effort be made to educate the pedestrian (in addition to the driver) including newspaper publicity showing illustrations of the principal pedestrian acts which cause accidents.

4. That special efforts be made by police departments to control pedestrians movements by legal and extra legal methods including "jay-walking" campaigns.

5. That further consideration be given to the use of "Mobile Public Address" systems such as "The Voice of Safety" used by such cities as Washington, Detroit, Wichita, etc. which make it possible to talk to the pedestrian "on the field of battle" and while he is actually committing an unsafe act.

6. That some consideration be given to such methods as:

a. Letters painted in cross walks saying "look left" or "look right"—the direction of the hazard.

b. Parking of cars in driveways in residential areas, particularly near schools, a cooperative plan between school boy patrols and car owners.

Respectfully submitted,

MAXWELL HALSEY, Chairman,
Pedestrian Committee.

* Following Mr. Halsey's report, Clifford Davis, Vice-Mayor and Commissioner of Fire and Police, Memphis, Tenn., spoke extemporaneously on "Experiences With Compulsory Vehicle Inspection."

WEDNESDAY LUNCHEON SESSION

October 3, 1934

Business Meeting

The session was called to order by General Chairman Harold G. Hoffman, Commissioner of Motor Vehicles for New Jersey, who presided. Reports of committees were received as follows:

For the "Committee on Annual Congress Program", Chairman Frank C. Berry reported that the committee had made a special effort to arrange for discussions of timely subjects in this year's program, and he pointed out various outstanding features.

For the "Committee on Accident Records", W. Graham Cole, vice-chairman, emphasized the importance of careful accident analysis in each city and state, to determine what kinds of accidents are increasing most rapidly, to discover the most hazardous locations, and to fix responsibility for the accidents wherever possible. Unless accident records are so collected, filed, and summarized as to serve all three purposes—engineering, enforcement, and education—in traffic administration, public officials are failing to make the greatest possible use of accident information.

J. W. A. Hollong, member of the "Committee on National Traffic Safety Contest", reviewed the development of the 1932, 1933, and 1934 contests, pointing out that the number of cities had increased from 443 over 1,000 population enrolled in the first contest to 649 cities above the population limit of 5,000 set for the third contest. Statistical sudies of the results of these contests show clearly that contest cities have better accident records than other cities.

The Nominating Committee recommended the following changes in the By-Laws, which were adopted:

1. Amend Article VI to include in the Section's Executive Committee the last two past general chairmen of the Section.

2. Amend Article VII to omit the election of vice-chairmen of standing committees, and to omit the committees on Uniformity, Membership, and National Traffic Safety Contest from those listed in the article.

The Committee pointed out that the suggestion to omit the election of the vice-chairmen of committees was made to simplify procedure; that the Committee on Uniformity was recommending that it be discontinued because there was no regular job for it to do year after year; and that the committees on Membership and National Traffic Safety Contest were dealing essentially with staff activities.

Report of Nominating Committee

The Nominating Committee recommended the following officers of the Section for the coming year, and it was voted to accept the report and declare the nominees elected:

General Chairman—Honorable Harold G. Hoffman, State Commissioner of Motor Vehicles, Trenton, N. J. (Since chosen Governor of New Jersey.)

First Vice-Chairman—William C. Knoelk, Chairman, Milwaukee Safety Commission, Milwaukee, Wisconsin.

Second Vice-Chairman—Lewis W. McIntyre, City Traffic Engineer, Pittsburgh, Pennsylvania.

Third Vice-Chairman—O. W. Wilson, Chief of Police, Wichita, Kansas.

Fourth Vice-Chairman and Chairman, Committee on Annual Congress Program—Lieutenant Franklin M. Kreml, Director, Accident Prevention Bureau, Police Department, Evanston, Illinois.

Fifth Vice-Chairman—Judge William C. Larson, Municipal Court, Minneapolis, Minn.

Chairman, Committee on Public Education—Frank C. Berry, Manager, Safety Department, Minneapolis Automobile Club, Minneapolis, Minnesota.

Chairman, Committee on Enforcement and Police Activities—John P. Smith, Deputy Commissioner and Superintendent of Police, Detroit, Michigan.

Chairman, Committee on Traffic Engineering—Arnold H. Vey, Traffic Engineer, Division of Traffic Control and Regulation, State Department of Motor Vehicles, Trenton, N. J.

Chairman, Committee on Rural Highway Hazards—W. Sherman Smith, Associate Professor of Civil Engineering, University of Toledo, Toledo, Ohio.

Chairman, Committee on Accident Records—W. W. Matthews, Director of Safety, Bureau of Highway Patrol and Safety, State Department of Revenue, Harrisburg, Pennsylvania.

Chairman, Committee on Pedestrian Problems—E. B. Lefferts, Manager, Public Safety Department, Automobile Club of Southern California, Figuero St. at Adams, Los Angeles, California.

Chairman, Special Committee on Headlighting—R. N. Falge, Research Engineer, Guide Lamp Corporation, Anderson, Indiana.

WEDNESDAY AFTERNOON SESSION

October 3, 1934

Joint Session with Institute of Traffic Engineers

The session was opened by Mr. Lewis M. McIntyre, Vice President, Institute of Traffic Engineers, and Traffic Engineer, Bureau of Traffic Planning, Pittsburgh, Pennsylvania, who presided. After outlining the business of the session briefly, the chairman introduced the first speaker.

Accomplishments and Problems that Arose when the CWA Was Terminated

By SIDNEY J. WILLIAMS

Former Director of Safety, CWA; and Director, Public Safety Division, National Safety Council

The speaker said in part: I will remind you briefly that several cities, of which the largest was perhaps Minneapolis, undertook traffic surveys as CWA projects soon after the CWA started on November 15, 1933, and that in December and January it was decided that the headquarters of the CWA, at Washington, would encourage this type of project and would give as much technical assistance as possible to interested cities. This came under my general supervision as Director of Safety for the Federal Civil Works Administration. Burton Marsh, Maxwell Halsey, and Earl J. Reeder were appointed associate directors of traffic surveys, without salary, and Peter J. Stupka was employed as assistant director, working with me in Washington. Later, six traffic engineers were employed for field work, two of them working under each of the three associate directors, in the northeastern, southeastern, and middle western states, respectively. No field work was done in the far west but assistance was given by correspondence as far as possible.

The federal, state, and local planning boards also took a good deal of interest in traffic surveys and inspired a number of such studies, some of which, though they were local CWA projects, were not supervised by my department at Washington. In numerous other cities a great variety of traffic studies and counts were sponsored by local authorities, with CWA labor.

Such surveys, of either a broad or a limited scope, were relatively simple in cities which had a competent traffic engineering set-up. All a city had to do was to apply to the local CWA for a specified number of men, who were easy to get in November and December. The city traffic engineering department decided what sort of data it wanted, prepared the detailed plans, supervised the actual survey work, and analyzed and interpreted the resulting data. Such projects did not require any help or supervision from Washington.

We knew, however, that many cities needed to get more accurate data on their traffic situations, in fact needed it worse than those just mentioned, but had very little idea of how to go about the job, because they had no city traffic engineer or other official familiar with the engineering side of traffic work. To help such cities was our principal aim.

The easiest plan would have been for every interested city to employ, or for the Federal Civil Works Administration to employ for them, a competent traffic engineer experienced in survey work to help them decide exactly what sort of survey to make, supervise its making, and interpret the results. There were, however, not enough traffic engineers in the country who had had the necessary experience in this work, and even those that were available were not available at salaries which the cities were willing to pay or which could be paid under the CWA schedules.

One of our first undertakings, therefore, was the preparation of a survey manual which would outline in considerable detail just how to carry on each one of six or eight types of traffic study, even down to the various forms to be used in assigning the work, collecting and tabulating the data. With such a manual it was felt that any competent engineer, with some experience in executive work, could direct a local survey in a reasonably satisfactory manner, especially if he had the benefit of occasional visits by one of our field engineers. This manual had the further advantage that data collected on this standard basis would be comparable and could thus be used in nation-wide studies of traffic conditions, such as the extent of observance or non-observance of signs, signals, etc., in different cities.

Our general plan was fine, but the time element prevented its working out as successfully as we had hoped. In the beginning, two weeks were wasted in getting an agreement among the interested parties on the general set-up. Then the preparation of the manual took longer than we had thought, although our engineers worked night and day on it. This manual, I must say in passing, represents a real contribution to the science and art of traffic engineering for which we are all deeply indebted to the engineers I have mentioned and especially to Burton Marsh.

You will remember that toward the end of January it was necessary to put on the brakes over the entire Civil Works Administration—to stop hiring any more men and to begin to cut down. This meant that we never employed even half as many field engineers as we had originally planned (we were going to have fifteen and only had six), and also that it became increasingly harder to have men, especially the right kind of men, assigned by the local administrations. While a large number of cities had indicated their interest in a traffic survey, only 44 project applications were formally submitted; of these, 31 were approved; 12 were actually started before the termination of CWA. I am satisfied that we could have had several times as many if we had been able to start even a month earlier.

When the CWA was formally terminated, during the month of April, the general plan of the Relief Administration was to continue as many as possible of the uncompleted projects, of all varieties, under the work divisions of the various State Relief Administrations. The important differences were, that only men actually in need of relief could be employed; and they could be permitted to earn, each month, only about as much as they would have been given on direct relief, to keep them and their families alive.

This was almost a fatal blow to the surveys because under these new conditions we could not get the high grade men we wanted as local directors and sub-directors, and even if we got them they could not work enough hours per month to do a satisfactory job. At the same time a great deal of the direct federal supervision over local projects was relaxed, most of the responsibility being turned back to the several state administrations. Where a state had considerable state money to put into the relief work, in addition to the federal money, they were able to relax these restrictions and to employ good men on a reasonably satisfactory basis. In such states it was possible to carry on the survey work much better than in others not enjoying those advantages.

Another handicap, perhaps the most serious of all, was that our six field engineers had to be dropped from the federal payroll on May 1. This meant that assistance could be given to the cities only through correspondence with Mr. Stupka or through such visits and correspondence as could be handled voluntarily by the three associates who still retained their official status and their federal traveling allowance.

I am firmly convinced that we all should do everything we can to encourage the carrying on of scientific traffic studies, especially in the larger cities, and in the states. Under the present policy of the Federal Emergency Relief Administration—with which policy I heartily agree—the local Relief Administrations can furnish the labor but the technical supervision must be furnished by the city or the state or by interested unofficial organizations. Even though the conditions on any work relief project are far from ideal, from the standpoint of permanence and efficiency, still I feel that all of us interested in the engineering attack on our traffic problems should make use of this opportunity to obtain without cost an almost unlimited number of payroll hours and thus to carry on work which we could not possibly afford to do otherwise. The engineering staff of the National Safety Council will do everything it possibly can to contribute engineering supervision and assistance to cities desiring to carry on such studies and I hope all the other interested organizations will do the same. There is also a great opportunity, I believe, for state highway departments with a considerable engineering personnel, not only to make certain studies on a state-wide basis, but to assist the municipalities with community surveys.

The Engineer and Highway Safety

By E. W. JAMES

Chief, Division of Highway Transport, U. S. Bureau of Public Roads, Washington, D. C.

The speaker said in part: The engineer has frequently been subjected to criticism. He has not always kept up with the changing standards of the new transportation. He has been accused of lacking vision. But it must be remembered that he has always had to face the practical problem of stretching the highway dollar as far as it will go, to produce a maximum mileage of serviceable road at a reasonable cost. Our highway systems, we must concede, are by no means as safe as proper design might make them. We still have highways—and plenty of them—that are clearly below modern standards; and our standards are continually advancing with experience and experiment.

I submit, however, that in his contributions to safety the highway engineer is actually far ahead of his time. He is building smooth, flowing highways and equipping them with all the safeguards that a scientific age has developed, yet his efforts are to a great degree nullified and wasted by a public that will not or cannot use these facilities safely. I do not mean to imply that the engineer should slacken for a moment in his zeal for better or safer highways. The present demand is all for more and yet more speed and comfort in getting from here to somewhere else. We are much more interested in saving time than in saving life and limb. But I do mean that when, quite properly, we get excited about the rising curves of highway accident statistics, we should not throw the whole problem in the engineer's lap and say, "This is your job. We expect you to give us highways on which accidents will not happen."

It is unfair to lay on the engineer more than his share of the responsibility. Given unlimited funds and a free hand he could, without a single new development in his science, build highways that would be all but fool proof. Much of our accident record must accordingly be charged to a public which is too apathetic toward these accidents to be willing to pay the cost of safer roads. Another great share of the accidents is to be attributed to the aberrant mental functioning of a relatively small proportion of automobile drivers, and of pedestrians. These accidents are no fault of the highway engineer, provided he has made all reasonable allowances for the weakness of human nature.

Most accidents involve collisions of motor vehicles with other vehicles, pedestrians, or fixed objects at the side of the roadway. These can be minimized by the separation of grades at intersections, the separation of directions of travel by means of divided roadways, the provision of pedestrian footpaths, and the widening and improvement of shoulders for emergency turnouts and parking. None of these remedies is new or untried, though our limited experience with their practical applications, together with a general inadequacy in accident reporting, makes it difficult or impossible to demonstrate their actual value as safety measures.

The best evidence I have seen in favor of the divided roadway as a safety measure is an analysis of fatal motor vehicle accidents on Massachusetts highways, made last year by the Traffic Engineer of the State Department of Public Works. The analysis includes only accidents occurring between intersections, does not include pedestrian accidents, and to allow for different lengths and widths of roads studied, the data are expressed in terms of accidents per million vehicle miles. The figures show that two-lane roads and three-lane roads differed little in relative safety. The two-lane roads experienced 1.37 fatal accidents per million vehicle miles, and the three-lane roads 1.40. The four-lane road shows a definite gain, with 0.94 accidents per million vehicle miles, but most striking of all is the showing of the four-lane divided highway, 0.51 accidents. The divided highway actually shows itself to be almost three times as safe as the three-lane road and 46 per cent less dangerous than an undivided four-lane road of the same total pavement width.

Similar analyses obviously could be adduced to demonstrate the benefits of grade separations; and probably of many other major improvements. More such studies are needed to convince the public that we can build safer highways, if only we can pay for them.

It has been our unfortunate experience that many a highway improvement has been followed by such an increase in traffic that the margin of safety has actually not been increased. Sometimes, too, the very appearance of safety creates a false confidence in the vehicle driver that begets recklessness. Nevertheless, I believe adequate statistics will demonstrate that the most modern highways are almost free from the types of accidents that can be charged to faulty design or plan. I believe, too, that this applies in a high degree to the best systems of traffic control.

On the other hand, there are the accidents that can be blamed principally or wholly upon the highway user. Many of these will happen regardless of any improvement we can make in highways, in traffic control, or in the motor vehicles. These can be charged to incompetence, carelessness, or wanton recklessness. Frequently they also involve law violations. With these personally-caused accidents we go outside of the engineer's field and into that of the psychologist, the educator, the lawmaker, and the police.

We cannot say that our traffic control problems are as near solution as are those of highway design. The new code of signs, signals, and markings recently approved by the National Conference on Street and Highway Safety and the American Association of State Highway Officials marks another step toward uniformity and completeness, but much experimenting is still to be done. It is not yet determined how much reliance we can place on the observance of signs and signals. Certainly there is widespread disregard of them, but whether this means only that education and law enforcement have been inadequate, or whether it indicates that signals are not practical when we are dealing with an ordinary cross-section of the population with its normal share of absent-mindedness, recklessness, and physical infirmity, we do not know. I believe, however, that when the engineer has provided these safeguards, it is at least up to someone else to see that they have a fair trial before they are condemned.

Interesting Phases of the Massachusetts Highway Accident Survey

By PROFESSOR ROBERT C. EDDY

Massachusetts Institute of Technology, Boston, Mass.

The speaker said in part: On December 9, 1933, Governor Ely requested the Massachusetts Institute of Technology to supervise a survey of accidents on the highways of the state with a view of determining causes and remedies. On December 11, Mr. Bartlett, State Director of the Civil Works Administration, approved a CWA project which employed approximately 900 engineers and statistical clerks for 10 weeks. Later an extension for an additional 10 weeks was granted.

We approached the problem, as engineers should, without preconceived conclusions. Our purpose was to make a study of the accident problem that should be unbiased and that should, if possible, point decisively toward definite remedies suitable to the actual conditions.

We found that we could take advantage of an unusual opportunity to utilize trained personnel of high grade, then temporarily out of employment and in urgent need of relief, to determine the facts affecting accidents. Engineers are men professionally trained in observing conditions, in analyzing them into their significant factors, and in applying scientific principles to these factors in the solution of the problem at hand. It was necessary to create an organization, but we had an abundant supply from which the right kind of working force could be created.

We started the work of the survey by taking a state-wide one-week traffic count. This prompt beginning of a state-wide operation involving over 500 men was only possible by reason of the fact that the Department of Public Works had a traffic engineer in each of the seven districts of the state who could organize and direct his local group of observers and that they had already had experience in this work and knew exactly how to go about it. These counts have enabled the department to construct complete flow maps of the state to determine the approximate annual traffic volume on any route, thus putting the accident rate into clear relation with the actual traffic volume.

Another large group of engineers and statistical clerks was organized in the office for the purpose of creating a complete file of accidents for the years 1930-33 inclusive arranged by geographical location. Since conditions at the site are often at the very root of the explanation why the accident occurs we needed quantitative data as to where and in the presence of what hazards the toll of accident and damage was being most heavily taken. In the Department of Public Works were records of about 120,000 accidents for these four years, partially classified geographically. This classification was completed and the records transcribed. They were then sent out to the field and additional information supplied from the local police blotters. Thus, for the first time we had a complete file of all available accident data. The records were then returned to the office, sorted and summarized and accident spot-maps were made for the more important towns and cities. In many cases the locations of the multiple accidents were again referred to the field in order that the actual conditions and surroundings might be studied. From this information definite recommendations were made for the correction of accident causing situations.

At the conclusion of the traffic count the district engineers conferred with local authorities and at their request undertook complete traffic surveys in fifteen cities and towns. These surveys included an exhaustive study of local traffic volume, accidents, observance of traffic lights and stop signs, enforcement of traffic regulations, safety education in schools and the preparation of traffic flow maps, accident spot maps and complete accident-by-location files. The reports for these localities were intended to place in the hands of responsible local authorities the best information obtainable as to the traffic facts in their communities, together with suggestion for steps to be taken in the solution of their traffic problems.

For the towns where complete traffic surveys were not made, accident files and spot-maps have been prepared and specific recommendations formulated as to particularly hazardous locations or conditions disclosed by the survey. As a result of all this work, practically every multiple accident location in the state has been studied.

Inasmuch as all of this work was done under the immediate supervision of the traffic engineers of the Department of Public Works in close cooperation with local authorities, it may be expected that continued use will be made of all the data assembled and the records and files will be maintained, with great benefit to the cause of accident prevention.

In analyzing the general subject of highway accidents we found a great variety of factors which might be studied advantageously.

The question of visibility of the pedestrian on the highway at night seemed to be of major importance. Three crews have carried out a program of experiment to determine the distance at which the pedestrian becomes visible to the operator of a motor car under varying conditions of roadway, surface, weather, street lighting and the lights of the opposing cars. We found that under normal conditions the pedestrian frequently does not become visible until the car is within perhaps 100 feet of him. When traveling at a speed of forty miles per hour this means that the operator has only the briefest period of time in which to translate his visual observation into action and avoid hitting the pedestrian. We then found that this distance is considerably increased if the pedestrian takes the precaution of wearing a bit of white clothing or an effective reflecting button. The distance of visibility is adversely affected by the lights of approaching cars, particularly if they are raised above the legal limit. Highway lighting also plays an important part. We found, as might be expected, that inadequate street lighting is a detriment rather than an aid to pedestrian visibility, whereas ample lighting is of material assistance.

We made an extended study of the speed of vehicles on the through routes of the state in order to discover at what speed cars commonly travel over these roads. The studies were made in two parts. In the first part we measured the speed of fifty cars each in about 3,000 locations. The locations were classified and the measured speeds averaged with interesting results.

The average speed on straight stretches free of hazard was 39 miles per hour; the average speed of the slowest 15 per cent of the cars was 28 miles and the fastest 15 per cent was 51 miles per hour. Motorists reduced speed in the presence of hazards by the following percentages: schools and hillcrests 15 per cent; curves, intersections and forks 18 per cent; bridges 21 per cent; underpasses and railroad crossings 28 per cent. The large percentage reduction for railroads may be a tribute to the educational campaign conducted in recent years by the railroad companies, especially when we consider that only 137 accidents out of nearly 25,000 investigated in Massachusetts in the past four years occurred at steam railroad crossings.

The figures I have given are for week days; both speeds and speed reductions on Sunday were somewhat less. The second part of the speed study was made by measuring the speed of as many passing vehicles as possible over a period of four to six hours at about two hundred selected stations. The stations were chosen for the purpose of comparing speeds on straight stretches of road, at hillcrests, sharp curves, and curves of long radius. Over four hundred thousand cars passed the stations during the periods of observation and the speed of about half of these was measured. The periods chosen were week days from 8 a. m. to 2 p. m., 4 to 10 p. m., and 10 p. m. to 2 a. m., and on Sundays 9 a. m. to 3 p. m.

Eighty-five of the stations were on straight stretches of road with no hazards. The maximum speeds observed here in the day time on week-days exceeded 70 miles per hour at seven of the 85 stations, and exceeded 60 miles per hour at 27 stations. The average of the maximum speeds observed was 59 miles per hour.

The distances within which cars may be stopped in case of emergency to avoid an accident is limited first by the effectiveness of the brakes, and second, if the brakes are powerful enough, by the grip of the tires upon the road. Massachusetts has developed non-slip surfaces both for bituminous macadam and for cement con-

crete, at least when it is new, upon which the coefficient of friction under the tires may reach as high as 100 per cent. But we have confined our study of braking to the brakes themselves.

If, in a given car, the air and rolling resistance were zero, the maximum pedal pressure were fixed, and the coefficient of friction of the brake lining constant, the stopping distance would vary as the square of the speed.

In the tests which we made we found that stopping distances were not proportional to the square of the speed, that higher speeds required longer distances. Air resistance and rolling friction will not account for the longer distances required for stopping at higher speed. It can apparently be accounted for only by a variable coefficient of friction in the brake linings, a reduced coefficient for higher speeds. Information from certain brake manufacturers corroborates this view. The result of this is that the stopping distance, air resistance taken into account, varies more nearly as some power of the speed between the square and the cube.

There is in some cases marked reduction of friction when the lining gets very hot as it does after braking from extremely high speed. This quality may prove a source of danger, because although a driver can and should allow in his manner of operation for the quality in his brakes of which he is aware, any unexpected reduction in his braking power would threaten disaster.

A factor of great importance in the analysis of accidents is the so-called reaction time of the driver. By this term is meant the time which elapses between the moment when an operator sees a need for slowing down and the moment he is able to respond with physical action. Motorists may think that they can stop immediately upon seeing the stop light of an automobile ahead, but a substantial interval of time must elapse before one is able to get the brake on his own car into operation.

We tested a large number of operators in cars equipped with a timing device developed in the Massachusetts Institute of Technology. In general, we found that when they know they are being tested their reaction time averages about six-tenths of a second. On long runs this average was quite likely to run up to eight-tenths of a second. If the stop light on the preceding car was not working, it often required 1.5 seconds for the following operator to observe that the preceding car was slowing down and to apply his own brakes. The importance of this reaction time will be recognized when you realize that at 50 miles per hour each second delay in applying brakes means that the car has traveled 73 feet additional distance.

As another project of this investigation we undertook to get some expression of opinion from the motorists themselves regarding accident hazards and the factors relating thereto in which they were most interested. The experience of a million drivers in the state ought to be worth a great deal if they could be collected and tabulated. We were able to submit a questionnaire to about 12,000 motorists, thus obtaining better than 1 per cent sample opinion. We made every effort to select this 12,000 in such a way that they fairly represented the entire body of motor operators.

It is, of course, impossible to give more than a general idea of the interesting things brought out by this questionnaire. Touching upon just a few points, we find that the majority favor increasing the age limit for licensed drivers to 18 years. The majority also believe that car inspections should take place every six months and opinion is about equally divided on the question whether operators should be reexamined. The vote was almost overwhelmingly in favor of the compulsory use of hand signals for vehicles stopping or turning on the road, although our road studies showed that practically no drivers now give signals on the state roads where it is already compulsory.

An important factor in highway accidents is the personality of the driver. The question to what extent the forty thousand accidents a year are due to a few careless or indifferent drivers, who repeat their accident record year after year, is one which has long interested students of highway traffic and a wide range of opinion has been expressed. We made a careful study of the records in the Registry of 10,000 licensed drivers. To make sure that this 1 per cent sample of the million licenses drivers in the Commonwealth was thoroughly representative, great care was taken in the method for selecting the ten thousand names for study.

There is a wide variation in the tendency among drivers to have accidents. Some drive with a wider margin of safety than others and are much less prone to have

accidents. Some such number as 1500 of the 40,000 accidents recorded yearly in Massachusetts will be distributed among her 10,000 worst drivers, the rate being 15 per hundred drivers. Some 6,000 accidents will be distributed among 90,000 drivers intermediate in quality, or 7 per hundred. The remaining 32,500 accidents will happen to the other 900,000 drivers, about 3.5 per hundred. The margin of safety observed by each driver in his operation of a motor vehicle will determine the group in which he will be classified, the ratio of probability that he will have an accident, the number of accidents that will happen to each thousand drivers in his class. Chance will determine who in each group or class will have the accidents in any year. It is impossible in advance to point out any particular driver who is going to have an accident in any year. It is impracticable, therefore, to rule off the road any driver on the ground that he is going to have an accident.

It must not be inferred from this, however, that the recording of accidents and other evidence of dangerous driving is useless, that highway accidents cannot be reduced or that the accident-prone driver should not be unremittingly sought out and dealt with.

On the contrary he must be sought and found, not, however, with the thought of putting him off the road and thus ridding ourselves of accidents, for that method is ineffective, but for the purpose of teaching him that his own safety and well being, as well as that of society, require him to drive more circumspectly than has been his wont. The accident-prone driver most needs that teaching. Drivers must be brought to realize that the Registry is informed and takes cognizance of infractions of safe driving, that no accident or complaint escapes attention, and that each case is treated with courtesy and understanding, with the purpose of being helpful, but whenever required, with the force necessary to compel attention on the part of heedless drivers. For, since the distribution of accidents is largely by chance, the only hope of effecting a substantial reduction is to persuade all drivers, and particularly those prone to accidents, to provide a larger margin of safety in their habitual manner of driving. They must be convinced that the driving urgency of the moment, whether it be a real need for rapid transportation or an unconscious urge to demonstrate one's smartness, must be subordinated to the chance that something unexpected and untoward may happen at any blind intersection, around a curve or even merely in the presence of another driver.

At least 80 per cent of all accidents happen to good drivers who are put under suspicion thereby of being not quite as good as they had supposed. The accident itself is a potent force in the education of the driver involved. One experience is enough to teach most drivers how to escape the accident that chance is constantly throwing in their paths. The beneficent effect should be fostered and spread by the Registry with all the skill known to educational psychology. Those drivers who have capacity to profit by the experience of others should somehow have the opportunity placed before them.

Fatal accidents in Massachusetts are all carefully investigated. In order to discover if any particular quality characterizes the drivers as a class who are involved in fatal accidents, the fatal drivers, so-called, of 1933 were examined as to their records in that and the previous three years. We found, as we expected, that fatal accidents, as a class, are attended by all the earmarks of speed. A disproportionate number of drivers under 25 years of age were involved in the fatal accidents, just as in all accidents where speed was a factor.

Speed was definitely reported as being a factor in a very large proportion of the fatal accidents. Aside from this, a fatal accident, so far as the driver is concerned, is merely an accident with an unusual admixture of hard luck. That is to say, a fatal accident, though more frequently visited upon fast drivers, is no more an indication of vicious character or reckless disregard of the rights and welfare of others than a non-fatal accident. It is less an indication of these qualities than conviction in the courts of reckless driving, driving under the influence of liquor, or other ascertainable facts.

In the light of these considerations, the inflexible imposition of penalties upon drivers involved in fatal accidents which is practiced in Massachusetts and perhaps in other states appears unnecessarily arbitrary and oppressive. Suspension of license to drive should at least await presumptive evidence of fault and more severe penal-

ties a finding of serious fault. And the procedure might well be applied to all personal injury accidents, whether fatal or non-fatal.

An accident by itself is evidence but not proof of accident proneness in the drivers involved. More is needed even than a fatal accident to substantiate habitual poor driving quality. But every accident is a rich opportunity to show every driver involved, notwithstanding where lay the fault, that he could probably have avoided the accident had he been willing to take sufficient care.

The largest primary factor in highway accidents is the mental attitude of the driver. A certain small number of accidents occur through untoward circumstances which the driver could not possibly foresee. Sometimes brakes or steering mechanisms will fail suddenly, rocks or trees fall into the roadway, hazards are mismarked or unmarked in unexpected places; another car suddenly and unavoidably brings disaster to the most skillful and cautious driver. Except for accidents of this type, however, which are comparatively few, the driver can, if he is willing, avoid all accidents. No matter how bad the road, how sharp the curve, how blind the intersection, no matter how poor his brakes, how smooth his tires, how slippery the paving, he can, if he will, proceed safely. All these other factors in accidents are secondary in that they cause accidents through their effect on the driver. They are hazards only because they impose upon the driver delay which he finds irksome and to avoid delay he will take chances that result in accidents when luck fails him.

All drivers maintain a margin of safety in their driving, some a wider margin than others. Those who drive with less margin of safety are the accident-prone drivers. The margin of safety betokens a willingness to incur delay in the presence of a hazard in order surely to avoid an accident. Thus the mental attitude of drivers is the primary factor in accidents. It should be possible through education in which law enforcement may take a prominent part, to instill in all drivers a greater willingness to preserve a wider margin of safety and thus to reduce the number of accidents. This is the direct and most important approach to highway safety.

National Studies of Survey Data on Law Observance

By EARL J. REEDER

Traffic Engineer, National Safety Council, Chicago

The speaker said in part: The entire traffic survey plan of the Federal Civil Works and Federal Emergency Relief Administration was so laid out as to provide data for national research at the same time that data were provided for local studies. Each city that conducted a survey was asked to submit duplicate copies of the summaries of certain data gathered, to the offices of Associate Directors of Traffic Surveys, for this purpose. As soon, therefore, as the Emergency Relief Surveys got well under way in the different cities data of the following classes began to come in:

Collision diagrams of high accident locations, condition diagrams of high accident locations and others where observations on law observance were taken, observations on vehicle observance of stop and go signals, observations on pedestrian observance of stop and go signals, observations on vehicle observance of stop signs, observations on hand signalling and vehicle turns, traffic volume counts at locations where other observations were taken, and observations on speeds at locations where other observations were taken.

So far, data have been received from nine cities. Collision and condition diagrams have been sent in for 336 intersections. Observations on vehicle obedience of stop-and-go signals and condition diagrams have been received for 56 intersections. Observations of pedestrian observance of stop-and-go signals and condition diagrams have been received for 77 intersections. Observations on vehicle obedience of stop signs and condition diagrams have been received for 146 intersections. Observations of hand signalling and vehicle turn practices have been received for 103 intersections.

Unfortunately, quite a number of observations of various kinds have been sent in without the corresponding condition diagrams or other necessary data for adequate studies. An effort is being made to obtain as many additional reports for completing these combinations as possible. However, a small staff of competent workers has been engaged in making various compilations and comparative studies for some time. Now, what are these studies and what are they intended to determine?

1. Characteristics of High Accident Locations.

Frequently I have been asked, "When are you going to start preventing accidents without waiting for an accumulation of accident experience at a dangerous location?" My reply has always been, "When a sufficient amount of data about accidents and other conditions at high accident locations have been accumulated to enable us to predict accident experience by the examination of such locations." We know that some intersections that have appeared hazardous have been relatively free from accidents, while others that did not appear hazardous have had a bad accident experience. We hope from these studies to discover at least some of the specifications of a location that will actually have accidents and not merely look dangerous.

The procedure in this study will be to group the collision diagrams of many intersections according to similarity of accident experience and then to divide the corresponding condition diagrams into similar groups. After computations of critical approach speeds have been made, data as to traffic volumes and speeds have been entered on the condition diagrams, and any information concerning the general obedience of traffic regulations has been similarly entered, the condition diagrams in each group will be studied to see what the various locations have in common.

2. Obedience of Stop-and-Go Signals by Drivers.

A few years ago considerable publicity was given to the similarity of the results obtained from three different studies concerning the effect of traffic signals on accidents. One was conducted by the Division of Traffic Regulation and Control of the New Jersey State Motor Vehicle Department, another by the Traffic Planning Bureau of the City of Philadelphia, and a third by the National Safety Council, the latter covering about 25 cities in various parts of the country. These studies showed that between 50 and 60 per cent of the signal installations that were studied had been followed by reductions in accidents, between 30 and 40 per cent had been followed by increases, and approximately 10 per cent had been followed by no change. The general conclusion was that the signals that resulted in no reduction of accidents or in actual increases had not been needed or were improperly installed or operated.

Now, it is proposed to make a study to reveal, if possible, a little more information about the kinds of locations at which traffic signals may be expected to be quite completely obeyed and those at which obedience is likely to be quite low. The percentage of obedience will be computed for each location studied. Then the locations will be separated into groups of similar degrees of obedience and the corresponding condition diagrams will be separated into similar groups and studied for similarity of characteristics. Traffic volume, signal locations, lengths of cycles, and physical conditions of the streets will be considered.

3. Pedestrian Observance of Stop-and-Go Signals.

Pedestrian control by stop and go signals has long been a controversial subject. Some cities have claimed marked success in requiring pedestrians to obey the signals, while others have confessed failure.

The same general type of study outlined for vehicle obedience of stop-and-go signals will be used in this study. The intersections will be grouped according to the degree of observance and the corresponding condition diagrams will be similarly grouped for inspection as to similarity of characteristics. The purpose will be to find out under what conditions pedestrian observance of stop-and-go signals may be expected because it is reasonable, and under what conditions it may not be expected with any practical efforts of enforcement because it is unreasonable.

4. Vehicle Observance of Stop Signs.

Disobedience of stop signs in many locations is notorious. Yet, in other locations in the same city they are well obeyed. What is the reason for this difference when the signs that are used may be identical?

One study, now as far along as the data that have been submitted will permit, is being made by computing the degree of obedience of stop signs, computing the critical approach speeds in terms of the observations of view across corners, and then constructing a scatter diagram showing critical approach speeds plotted against percentage of obedience.

Vehicles that approach at an estimated speed of three miles per hour or less were classified as obeying the stop signs, while those that approached at higher speeds were considered as disobeying and the percentage of obedience was based on this classification. The general arrangement of the spots on the diagram, so far, seem to indicate that the higher the critical speeds, the lower is the degree of obedience. If other observations substantiate this trend, it will be evident that stop signs are not likely to be effective where the view of traffic approaching on the main thoroughfare is quite unobstructed.

Another study will be made from these same data, quite similar to the studies of stop and go signals. The intersection approaches will be grouped by degrees of observance and the corresponding diagrams will be similarly grouped and a study will be made to determine what characteristics the approaches in the same groups have in common. It is hoped to discover the various kinds of conditions that affect the obedience of stop signs, in addition to the degree of obstruction of view.

5. Hand Signalling and Vehicle Turning.

The need for hand signalling has been a subject of long controversy. The data that are being gathered on this subject will show for a large number of vehicles at each location, the number that turn from the proper lane and the direction in which they turn, the number that give proper arm signals and whether or not vehicles were following within 200 feet in the same direction.

If we find that drivers commonly give hand signals when traffic is following reasonably close, and are making turns from the proper lane, the situation may not be nearly as bad as it is claimed to be. If, on the contrary, there seems to be no consistency in the giving of hand signals, it will be evident that something ought to be done to obtain better obedience of this legal requirement.

It is proposed to pursue these studies as far as the available data will permit and as long as the required personnel are available. There has recently been some more evidence of increased interest in these surveys and if they materialize more data will be available. The prospects are good now for nine more cities to send in data from surveys that are now being conducted or are being proposed.

REPORT OF COMMITTEE ON TRAFFIC ENGINEERING

BY LEWIS W. McINTYRE

City Traffic Engineer, Pittsburgh, Pa.

The speaker said that the Committee had selected as the subject for study, "The Proper Treatment at Intersections Where Obstructions Prevent Adequate Visibility." A detailed research was undertaken in Pittsburgh with Relief Work Division Men, to show the comparative effectiveness of stop signs and stated speed slow signs at street corners with obstructed view. The conclusions and recommendations of the Committee were based on this investigation.

At a number of locations where stated speed slow signs and stop signs had already been erected, as well as at a number of locations where no sign at all had been erected, the critical speed, the main street speed, and the cross street speed were determined, the critical speed being in each case that speed at or below which vehicles may approach an intersection able to make any additional change of speed or to stop as may be required to avoid collision with vehicles on the main street, but above which there can be no assurance of safety.

In every case signs were permitted to remain erected for at least one week, and usually from two or three weeks, before observations were taken so that motorists might become familiar with them. Some of the signs were mounted 7 feet 6 inches from the curb to the center of the sign and some 3 feet 6 inches. All signs were located at the property line, although some who advocate the use of stated speed slow signs recommend that they be placed some distance from the intersection so that drivers may see them in time to slow down to the critical speed well in advance of the intersection.

The speed observations were taken by means of timing vehicles through a 66-foot course terminating at the property line. This caused vehicles which came to a full stop at the stop sign to be recorded as having some considerable speed instead of a zero speed and placed the stop signs at a considerable disadvantage in the comparisons.

The following are brief statements of the conclusions drawn from the speed observations taken successively on stop signs and stated speed slow signs at the same intersections:

1. High mounted signs of neither type appeared to decrease the speeds of drivers appreciably as compared to no sign at all. Low mounting of either type of sign appeared to decrease speeds about two miles per hour as compared to no sign at all.
2. At locations with critical speeds of fifteen miles per hour, the "fifteen mile" slow sign located at the intersection was obeyed by 75 per cent of the drivers when the sign was mounted low. A similarly mounted stop sign reduced the average speed about two miles per hour below the critical speed.
3. At locations with critical speeds of fifteen miles per hour, the reaction to the slow signs located at the intersections was not appreciably different for drivers approaching at different speeds. The observations on the stated speed signs located at the intersections indicated that where the view was not completely obstructed, the high speed drivers were not affected appreciably by the speed signs.
4. For signs mounted at the property line, it did not seem to make any difference what the speed indicated on the sign was, whether ten or fifteen miles per hour. The low mounting was more effective than the high mounting, but the message, except that of stop, was not effective.
5. For locations with critical speeds of ten miles per hour, high mounted stop signs were about two and one-half miles per hour more effective than high mounted ten mile stated speed signs located at the property line. Low mounted signs of both kinds at these locations were equally effective in speed reduction.
6. For locations with critical speeds below seven miles per hour, drivers drove at about the same speeds regardless of the type of sign at the intersection or whether any sign was present.
7. Along through highways the difference in visibility at various intersections had no effect on driver speed on the cross streets.

Public Safety as Affected by Street Lighting

By R. E. SIMPSON

Illuminating Engineer, National Bureau of Casualty & Surety Underwriters, Hartford, Conn.

The speaker said in part: Partly from necessity and partly from choice, we are rapidly becoming an 18-hour nation. The tempo and magnitude of our affairs—the time required for work and play—require 18 hours for their accomplishment. This means that our streets and highways are points of activity during three-fourths of the day. Unfortunately, nature does not permit us to employ and enjoy the benefits of daylight during the entire 18 hours, and again, unfortunately, good visibility is of prime importance for the efficient and safe conduct of human affairs.

When we consider the present age with that of 50 years ago, man has apparently acquitted himself very well in producing the means of artificial illumination. It is no longer a question of whether man can but rather whether he will provide artificial illumination to a degree compatable with his needs and safety. Seemingly, the item of cost looms exceptionally high whenever the question of producing artificial illumination is considered, and this notwithstanding the repeated demonstrations that the benefits of good illumination far outweigh its cost.

The average cost of an accident due to inadequate illumination is usually several times higher than the cost of providing for several years' sufficient illumination to have prevented the accident.

Since costs enter into the question, it is interesting and instructive to view the results of three years' survey on street lighting costs and automobile fatalities in a number of American cities. The object of these surveys was to find out what effect, if any, the varying levels of street illumination as reflected by the costs had on the automobile fatality rate.

The three-hour period from 5 P. M. to 8 P. M., in the four summer months of May, June, July and August, and the four winter months of January, October, November, and December, were chosen because the variables, other than visibility, which might affect the comparison are reduced to a minimum. Throughout the three years the returns are consistent in showing that cities with the lowest per capita costs for street lighting have the highest night automobile fatality rate per hundred thousand population, while the cities with the highest per capita costs for street lighting have the lowest night automobile fatality rate.

A Comparison of

Three Years' Street Lighting Costs and Street Safety.

	1931 46 cities	1932 227 cities	1933 60 cities
Population	25,355,000	40,669,000	31,745,000
Cost of Street Lighting	$27,199,000.00	$44,718,776.00	$28,700,000.00*
Cost per Capita	1.07	1.09	.94*
Automobile fatalities 5 P. M. to 8 P. M., Summer months	366	505	287
Add 10 per cent due to winter weather and road surface conditions	36	50	28
(a) Number to be expected in winter	402	555	315
(b) Number actually observed in winter	794	1,025	735
Number due to insufficient light (b-a)	392	470	420
Increase winter over summer	117%	102%	156%
Non-fatal automobile accidents 5 P. M. to 8 P. M., summer months	9,516	13,130	7,462
Add 10 per cent due to winter weather and road-surface conditions	951	1,313	746
(a) Number to be expected in winter	10,467	14,443	8,208
(b) Number actually observed in winter	20,644	26,650	19,110
Number due to insufficient light (b-a)	10,177	12,207	10,902
Excess economic loss, winter over summer	$31,707,000.00	$38,031,000.00	$33,966,000.00
Excess economic loss, winter over summer per capita	1.25	.93	1.07

* Estimated on incomplete returns.

It will be noted from the accompanying tables that in 1932 there was a slight increase in the per capita street lighting costs and also a slight decrease in the per-

centage of winter months fatalities over the summer months fatalities. One of the characteristics of the 1933 returns is the large number of cities showing a rather drastic reduction in their street lighting budgets over former years. The other characteristic is the uniform increase in automobile fatalities during the four winter months—more than 50 per cent higher than 1932 and 156 per cent higher than the four summer months of 1933. It is also interesting to know that with a per capita street lighting cost of $1.09 the excess economic loss per capita was $.93 in 1932. These figures are almost exactly reversed in 1933, the per capita street lighting cost being $.94 and the excess economic loss $1.07. The conclusion to be drawn from all this is that the community pays for good street lighting whether it gets it or not.

Admittedly, the three-hour period from 5 P. M. to 8 P. M. is the busiest of the day and for this reason the comparison between summer and winter may not be considered equitable. The police records permitted a comparison of the periods from 5 A. M. to 7 A. M. for both winter and summer. This two-hour period is one of darkness in winter and daylight in summer is one of light traffic the whole year. Out of a total of 203 fatalities during this two-hour morning period, 64 occurred during the summer months and 139 during the winter months, and once more the winter or night fatality rate is more than double the day rate. Mr. G. D. Newton of the Travelers Insurance Company made an investigation on a nation-wide basis of the number of fatalities occurring during the four evening rush hours of 5 P. M. to 9 P. M. with the number of fatalities during the four morning rush hours of 6 A. M. to 10 A. M., and found that the fatalities in the evening rush hours exceeded the record of the morning hours by 281 per cent.

Considerable support is given to our interesting figures by a comparison of two groups of cities, one of which increased its street lighting budgets 11 per cent, or 9 cents per capita, and experienced a 25 per cent reduction in night fatalities and an economic saving of $2.07 per capita. The other group reduced its street lighting budget by 14 per cent, or 19 cents per capita, and suffered a 7.6 per cent increase in night fatalities at an economic cost of 69 cents per capita.

There are many variables which enter into the cost of street lighting, such as density of population, rates for electric current and servicing, capital investment on street lighting equipment, etc., so that costs alone do not constitute an accurate gauge by which to measure and compare the efficacy of street lighting in different cities. However, when we deal with a large number of cities ranging from one hundred thousand to several million inhabitants, these variables tend to equalize.

Even so, it was thought desirable to eliminate some of these variables by trying to correlate the automobile fatalities with traffic flow and street illumination levels. To do this, it was first necessary to know the total number of automobile fatalities, the hour of occurrence and the location. With this information at hand, it was merely a matter of analyzing it to determine those streets on which fatalities were most frequent both by day and night. These streets, as might be expected, almost invariably proved to be main thoroughfares and embraced both business and residential sections. It was then necessary to get traffic counts to determine the automobile traffic flow and the number of pedestrians crossing the street, and finally to obtain the street lighting level through the medium of a lumen value per lineal foot.

The police department offer the most fruitful and authoritative source of information on automobile fatalities in cities and through their cooperation we were able to secure the total number of fatalities by hour and location in 60 American cities. There were 5,527 automobile fatalities in these cities in 1933 and of this number 2,295, or 41 per cent, occurred during the day, and 3,232, or 59 per cent, during the night. From this it will be seen that the night fatalities were 44 per cent greater than the day fatalities and this curiously enough is within one-half of one per cent of the corresponding figure for the country as a whole.

Again through the cooperation of the police departments, the electric light and power companies, National Safety Council, local councils and the opportune aid of Federal authorities in CWA activities, traffic counts and street lighting data were

available from 30 cities with definite promise of more to follow. From these data we were able to correlate the three factors, shown in the accompanying Table II.

TABLE II.

Traffic	Lighting	M.V.M. Day	M.V.M. Night	Fatalities Day	Fatalities Night	Fatality Rate Per M.V.M. Day	Fatality Rate Per M.V.M. Night
A	A	94.4	27.4	25	48	.26	1.75
A	B	222.0	62.4	57	138	.25	2.21
A	C	29.5	6.5	6	22	.20	3.34
A	D	57.1	12.2	11	44	.19	3.66
B	A	8.5	3.0	4	5	.47	1.66
B	B	54.1	15.0	28	54	.51	3.60
B	D	39.9	10.2	10	51	.25	5.00
C	B	4.5	1.1	2	7	.44	6.24
C	C	4.6	.6	2	5	.43	8.19
C	D	9.9	3.1	5	19	.50	6.11
Composite		524.5	141.5	150	393	.28	2.77

The Street Lighting Committee of the Illuminating Engineering Society has published a Code on Street Lighting in which streets are classified according to the traffic they bear. Heavy traffic thoroughfares usually carry a maximum of more than 1,500 vehicles per hour in both directions during the lighting period, medium traffic thoroughfares a maximum of 800 to 1,200 vehicles per hour, and light traffic thoroughfares not more than 500 vehicles per hour. In Table II, these thoroughfares are denoted in the traffic column by the letters A, B and C, respectively. The code also prescribes the size and general type of street lighting equipment necessary to provide the minimum amount of illumination acceptable for each class of street. It seems desirable, therefore, to follow the code specifications as nearly as possible, but to reduce these specifications to a common unit of lumens per lineal foot. We have, therefore, classified the street lighting as Grade A, when the equipment provides 80 or more lumens, Grade B, 40 to 80 lumens, Grade C, 25 to 40 lumens and Grade D less than 25 lumens per lineal foot. Similarly, traffic conditions have been reduced to the common unit of million vehicle miles (M.V.M.) per year.

Some of the outstanding features of this tabulation are: The bulk of the experience comes from streets in the heavy traffic class; the average day fatality rate per M.V.M. in this class is .25 while the night fatality rate increases as the grade of street lighting goes down. Specifically, the night fatality rate per M.V.M. on these heavy traffic streets with Grade A lighting is 7 times higher, with Grade B lighting 9 times higher, with Grade C lighting 13 times higher, and with Grade D lighting 16 times higher than the day fatality rate. Again, as in the case where costs alone were considered, the fatality rate increases as the level of street illumination decreases, but here we have taken into account part of the traffic exposure—the pedestrian exposure not yet included.

A somewhat surprising feature is that on Class B and C streets the day fatality rate is almost double the day rate on Class A streets—just contrary to what might be expected. This may be accounted for in part by the fact that these streets are consistently narrower by from 8 to 20 feet than Grade A streets. With parking on one or both sides, there is less space and time for maneuvering in emergencies and there is the further probability that the speed does not conform to the conditions. This and the limited experience available to date may also account for the consistently higher night rate. The one bright feature is the showing of Grade A lighting on Class B streets wherein the night fatality rate is the lowest of all. Finally, there is the total traffic exposure of more than 660 M.V.M. in which the night fatality rate is almost ten times higher than the day rate. All of which may give justification for the cynical observation that anyone mindful of his own safety should not place too much confidence in our street lighting.

Another interesting point comes to light by segregating the fatalities occurring between midnight and dawn (dawn is here considered as beginning one-half hour before sunrise) and comparing this with the total number occurring during the hours of darkness. As already stated, there were 3,232 night fatalities and of this number 747, or 23 per cent, occurred between midnight and dawn. Approximately 4 per cent of the total 24-hour traffic occurs during this period, from which we may deduce that from midnight to dawn 6 per cent of the night fatalities occur with 1 per cent traffic flow. From personal observation, we would say that the uniformly higher speed and the prevalence of trucks on the streets at this time are important factors in making this record.

Many of the police department records not only give the hour and location of the fatalities, but also the manner of occurrence—that is, whether the fatality was due to collision of automobile with a pedestrian, a trolley, a railway train, a fixed object, etc. Since approximately 40 per cent of the returns gave this information, the results may be taken as fairly representative. Pedestrians hit by automobiles account for 69 per cent of all the fatalities, while all other types of accidents account for the remaining 31 per cent. Of the pedestrian fatalities, 66 per cent occurred at night and 34 per cent during the day. All of this leads up to a consideration of another factor which has a bearing on public safety, namely, the pedestrian exposure in the streets.

THURSDAY MORNING SESSION

October 4, 1934

A. B. C. TRAFFIC SESSION

This session was opened by Lewis W. McIntyre, Vice-Chairman, Street and Highway Traffic Section, and City Traffic Engineer, Pittsburgh, Pa., who presided.

ACCIDENT CLINIC

Conducted by Lewis W. McIntyre, City Traffic Engineer, Pittsburgh, Pa.

This clinic was conducted as a demonstration of methods of studying and treating high accident street locations. The accident records of high accident locations were submitted in collision diagram form by delegates, showing graphically by arrows on diagrams of the street locations, the directions from which vehicles or pedestrians approached the accident locations.

Each diagram was drawn on the blackboard and possible solutions were discussed by the leader and the delegates. Space does not permit reproduction of the diagrams here and, without them, the presentation of the discussion of each of the problems is not feasible. The clinic did, however, demonstrate the value of the collision diagram method of studying high accident locations.

TRAFFIC VIOLATIONS CLINIC

Conducted by Capt. Ray Ashworth, Police Department, Wichita, Kansas

This clinic was conducted to demonstrate methods of solving traffic law enforcement problems. The following questions, submitted by delegates, were discussed and solutions were developed as described:

1. "The law in our state makes it a violation for a motorist to pass a school bus from either direction on a public highway while children are alighting from the bus or embarking thereon. Much difficulty is encountered in enforcing this law because the violations commonly occur when officers are not present. What can we do to enforce this act and obtain a higher degree of observance? There are 7,500 school bus drivers in our state. These drivers are loath to file affidavits against offenders for various reasons: The violator may be a

neighbor or friend of the driver. Drivers hesitate to appear in court and so forth. What plan or general agreement should be offered to induce drivers to assist in enforcing the law as stated above?" Submitted by Loran W. Warner, Bureau of Accident Prevention, Department of Safety, Indianapolis, Indiana.

Conclusions: It was the general opinion of delegates from Indiana that there were very few accidents involving children getting on or off these buses and that the law probably is one that would be impossible to enforce because drivers would not naturally slow down unless children were actually crossing the roadway at the time they were passing the bus. It was suggested that some organization similar to the Junior Traffic Patrols be used in connection with the loading and unloading of the bus, and that the law be changed to make it an offense to pass these buses only when such patrol indicated that children were crossing the roadway.

2. "What do you do with drivers who insist on hugging the center of the street at slow speed?" Submitted by Commissioner Clifford Davis, Memphis, Tennessee.

Conclusions: It might be possible to institute a "honking" campaign on the part of the general public against such violators, this being merely to have any car drivers seeing such a violation honk at the violator, calling his attention and the attention of everyone in the vicinity to the violation, thus putting him in the "spotlight."

3. "Do you favor turning right on the Red Light?" submitted by Commissioner Davis.

Conclusions: It was the overwhelming opinion of the majority of the members present that right turns on a red light should not be permitted.

4. "During the last twelve months, approximately twelve per cent of our pedestrian accidents involved hit-and-run drivers. We were able to apprehend only about eight per cent of these drivers and to convict about five per cent of those apprehended. What can we do to increase the percentage of apprehensions and convictions in hit-and-run cases? From my observations, I am convinced that the use of liquor has been a contributing cause in quite a high percentage of our traffic accidents in St. Paul. However, our accident reports indicate that drivers have been drinking in only 6 per cent of the cases reported. Likewise, complaints involving drinking are made in less than 2 per cent of our traffic arrests. We find it difficult to get convictions in such cases. How can we improve our handling of such cases?" Submitted by Harry N. Wettergren, Superintendent of Traffic of the St. Paul Police Department.

Conclusions: It was ponted out, based on the experiments of Dr. H. A. Heise of Milwaukee that most hit-and-run drivers are actually drunken drivers. An increase in the percentage of apprehensions and convictions in hit-and-run cases could probably be had by organizing and training an accident investigation squad, whose purpose would be to investigate such accidents as thoroughly as any crime is investigated. It was also pointed out that the paying of rewards by some organization for the apprehension and conviction of the hit-and-run driver has produced excellent results in some places. The use of scientific tests to determine the amount of alcohol in the blood stream as explained by Dr. Heise was recommended as a method of helping to secure convictions in drunken driving cases. It was pointed out, however, that this method must be wisely used and used only to prove that certain observed actions on the part of the person accused of drunken driving were caused by liquor which he had consumed rather than attempting to prove that a man was drunk or under the influence of liquor simply because he had consumed a certain amount of alcohol. Another device which has just come into use is that of taking moving pictures of the person accused at the scene of the accident or at the Police Station or at both such places. These pictures to be used in court to prove the condition of the accused.

THURSDAY MORNING SESSION

October 4, 1934

The Statewide Traffic Problem

The session was called to order by Frank C. Berry, Vice-Chairman, Street and Highway Traffic Section, and Manager, Safety Department, Minneapolis Automobile Club. Chairman Berry stated the purposes of the session and introduced the first speaker.

Where Should the Jurisdiction of State Traffic Department End in Municipalities?

By JOHN P. ARNOLDY

Chief Highway Patrol Officer, State Highway Department, St. Paul, Minn.

The speaker said in part: One of the great things the National Safety Council has accomplished, with the cooperation of its members and other bodies is setting up standards, or a uniform plan or system, for the various state units to follow. But before this plan can be completely successful, a proven or recommended policy *must be adopted and applied by every state, county, city and village if their local* conditions require it.

The nature of the various features requiring consideration should determine not only the method but the agency of the treatment. Purely local conditions within the community may well be controlled by the local agency having jurisdiction. Conditions of a more general nature, prevailing over a wider area, should be treated or controlled by an agency having sufficient jurisdiction and having the advantages of a broader scope and greater experience.

Only a few short years ago the motor vehicle was used entirely within the community. The automobile owner of that day was not willing to venture far from home in his slow-moving vehicle, upon his not dependable tires and behind his poorly behaved motor over rough and muddy roads. Today, however, such progress has been made in the manufacture of motor vehicles and in the building of highways that the automobile owner may undertake a trip of almost any distance and feel reasonably sure of reaching his destination in comfort and without tire or motor trouble.

The result is that traffic on our highways today is no longer local, but is transient, and the vehicles we may meet on our highways come from all parts of the country. For this reason I believe the motorists are entitled to expect the same regulation and the same conditions under which the vehicle may be operated throughout the trip. Any lack of this standard or uniform regulation would not only cause inconvenience, but would actually create a traffic hazard.

Let us assume, for example, a man undertaking to make an automobile trip across the state of Ohio. Coming to the first village, he reads a sign erected at the city limits stating that the speed limit through that village is 35 miles an hour. He proceeds at this rate, but immediately beyond the limits of this village is another small town, and here he is arrested because he is exceeding the speed limit of this town, which has been placed at 20 miles per hour. In the next town he finds that traffic is controlled by mechanical devices erected in the center of the intersection.

This is fine, but in the next village he is arrested by an officer for going through a stop-and-go sign which he finds, to his amazement, has been suspended in mid-air over the street intersection on a cable attached to poles on each side of the street. Going on to the next town, he is prepared for anything, but regardless of extreme care in operating his vehicle, he becomes involved in an accident with a local resident who is driving down the left side of the street at a high rate of speed. He finds that in this village funds are not available to employ traffic officers and the automobiles proceed on the street without any regulation or control.

Although this is a somewhat exaggerated experience, we can easily realize the inconvenience to the vehicle operator who travels across our country without the protection of a standard or uniform regulation or method of control for all vehicles.

Aside from this inconvenience to the operator, it must be admitted that local control of traffic movement is both inefficient and inadequate. Local conditions will frequently appear which might affect or influence the body in charge of the control of traffic to such an extent that they might specialize in one department and entirely overlook other equally dangerous features.

I say that local control is inefficient, because the local body lacks the broad experience and the wide scope of a state body. For instance, a municipality may be sold upon the use of a mechanical device for directing traffic which has proved to be inadequate or dangerous when used under the same conditions in other parts of the state. Only a state organization handling such conditions generally would have the advantage of this experience. I say that local control of traffic is inadequate because the local community, generally speaking, cannot afford to hire officers who specialize in this work, and the many other duties of local officers may prevent their spending sufficient time on this work to have a good understanding of the problems.

I believe that very few municipalities would be willing to spend the money or would realize the necessity for special training of officers or other men for traffic work or traffic control. Further than this, the municipality would not have or *could not afford the proper equipment to permit its men assigned to such duties to* properly carry on the work, and the local officers, working under such handicaps and influenced by local conditions, might be absurd or unreasonable in their work. I know from past experience that many communities which have enforced their local traffic ordinances have been branded as speed-traps and have lost considerably through the bad reputation it gave throughout the state. Even though their activities may have been justified or necessary, the public as a whole is quite willing and anxious to criticize, and we often hear remarks that certain cities or municipalities are short of money and are therefore putting on a drive to increase their treasury. This may or may not be true, but if such activities were carried on by a well-controlled state-wide organization, there would be no opportunity for such criticism and the local community might be saved much embarrassment.

Generally speaking, the traveling public is acquainted with, and has much respect for, enforcement of the law by state police organization. When state control of traffic has been applied, it has been proven that the methods used are reasonable and that penalties resulting from this enforcement are justified. There should, of course, be an understanding as to where the jurisdiction of the state will end. To this end, I believe the state should control all arteries of travel providing means of transportation between communities. I believe a municipality may well control the movement of vehicles over streets or roads constructed for purely intra-city travel.

There may be some doubt as to the propriety of the state controlling such matters as parking even on the main highways through municipalities. I do not say that this feature should be prohibited, but I am convinced that it should at least be controlled and that arrangements or provisions be made to assure the safety of the users of the highway before such practice is permitted.

The system of standardized signs and markings, as developed by the Bureau of Public Roads of the United States Department of Agriculture, generally speaking, has been adopted and applied by the American Association of State Highway officials, and sets a shining example of the benefits derived through state control and standardization of this feature. The result of this standardization of markers has eliminated much confusion and has been a means by which the traveling public may learn to recognize the meaning of every sign from its shape. Under this system all signs are erected in the same position and cross road signs or through stop signs, so far as possible, are erected the same distance from the intersection. This standardization of signs has made for a definite, efficient system of signs and markers and is in itself evidence that a general standardization of methods to control and regulate traffic would bring about very favorable results.

It is true that the larger cities have had much experience, and generally speaking, follow the approved lines of handling and regulating traffic over their streets. I do not contend that the state should completely take over the regulation of traffic through the larger cities where capable and efficient police forces are maintained and are instructed in traffic work, and where modern devices for the direction of traffic are maintained.

It would, of course, be ideal if the state could handle such activities even through the larger cities, but in many cases such a method might entail much unnecessary expense, inasmuch as the larger cities have the means of carrying on such activities. I do believe, however, that the state might well carry on the regulation of traffic, even through the larger cities, on the streets or arteries over which the main highways of the state are routed. In either case, I believe the state should work and control the method the larger cities shall follow in their traffic management.

It is very surprising to find, even in many of the larger cities, that the traffic ordinances are unreasonable because they were enacted years ago and have not been amended to accommodate the movement of vehicles today. Such ordinances, of course, do not follow the approved lines, and strict enforcement of them would cause many accidents and would be worse than no enforcement at all. This condition cannot be corrected until this matter is turned over to some central group with statewide jurisdiction.

I firmly believe that all traffic directional devices, such as stop and go signs, should be approved by the state, and that their direction and use should be supervised by the state. If such a method were possible, a uniform type and method for using such devices could be brought about which would greatly eliminate the confusion and misunderstanding which the use of the many types of such devices causes today. Many cases have been called to my attention where the smaller villages or communities have been influenced by salesmen to use certain types of devices which have proved very unsatisfactory in other villages or communities under similar conditions.

I am, therefore, convinced that state regulation of traffic, through the state in general, would promote the safe movement of vehicles, would set up a uniform method of regulation which could easily be understood by all, would standardize traffic directional devices so as to avoid congestion, would give complete, efficient and impartial service and enforcement to all communities, would eliminate confusion with respect to the operation of vehicles now existing in many states, and would be a great step toward uniformity of methods and regulation of the handling of traffic in all states to the ultimate end that the traveling public would find the same regulations and the same law enforcement methods and the same conditions governing the operation of their vehicles throughout our country as a whole.

Finding and Disciplining High Accident Drivers

By CHARLES A. HARNETT

State Commissioner of Motor Vehicles, Albany, N. Y.

The speaker said in part: Two methods have been adopted in New York State to keep unfit persons from operating motor vehicles on our highways. First, we attempt to prevent individuals who fail to prove their ability from securing a driver's license. Second, if a person has been granted a license and then indicates by *his driving that he is unfit to possess a license, his privilege* to operate is suspended or revoked. The power of suspension and revocation is similar to locking the barn door after the horse has been stolen. The first plan, which refuses to grant a license, while far more effective, is likewise far more difficult of accomplishment. There are, however, certain tests which are applied to determine the fitness of an individual before granting him a driving license.

While we are utilizing both systems in New York State, our greatest efforts at the present time are being directed toward weeding out unfit applicants for drivers' licenses, before each applicant secures his permit. Before granting the license, every applicant is required to fill out an application, pass an eye test indicating that his vision is proper, and then demonstrate his ability to operate a motor vehicle before an inspector specially trained in conducting examinations.

We have found many individuals who have defective vision and yet are unaware of this fact. In some instances, the applicant was totally blind in one eye, but until he presented himself for his road test, he failed to realize that his eyesight was defective. If an applicant for a driving license cannot pass the eye test, he is not permitted to take the road test. If his vision is defective, he is informed of this fact and advised that until his vision is corrected a driving license cannot be issued.

If an applicant has other physical defects, such as a short arm, an amputated leg, or fingers which are missing, he is required to pass a rigid road test before *two different inspectors at two different times. Unless he is successful in passing* both of these examinations, his application is rejected.

In conducting the examination to determine the ability of the applicant to operate a motor vehicle, the inspector requires the applicant to drive through all types of traffic. The test includes right turns, left turns, operating the motor vehicle down a hill and up a hill, and turning on a steep grade. The course of the road test passes intersections where traffic signals are located. The streets over which the test is conducted, include narrow streets and those upon which vehicles are parked. An applicant is required to back into a parking space, indicating his ability to properly handle the car in close quarters.

From the number of applicants who fail in this road test, it is apparent that it is a vital necessity. If there were no tests, our highways would be filled with incompetent drivers.

For those persons who desire to learn to drive, a learner's permit is issued for a fee of ten cents. This permit is valid for a period of three months, and the applicant is permitted to operate a motor vehicle if accompanied by a licensed driver. In some of our more progressive cities, certain streets have been designated by the police authorities as those for learners to carry on their course of instruction.

In addition to the tests which are at present being given to applicants, many new suggestions have been submitted to the Bureau of Motor Vehicles by persons interested in safety. The American Academy of Medicine, which is vitally interested in the accident problem, has suggested a physical examination of all applications for driver's license, so that their physical fitness may be determined before scheduling the applicant for a road test. The theory back of this suggestion is that many persons have physical disabilities which are not apparent to a layman, and can only be determined by a physician carefully examining the applicant. Another plan suggests that inspectors be supplied with certain questions which should be asked the applicant, and from the reply, it may be determined if the applicant should be required to submit to a medical examination. The difficulty with this plan has been to devise a proper set of questions which could be handled by an inspector who has no medical training.

In addition to preventing unfit persons from obtaining licenses, we are protecting the highways of New York State against unfit persons by suspending or revoking the licenses of those operators who are involved in serious accidents. The power of suspension and revocation is necessary in the operation of a license law. It is effective, not only to the driver who is being disciplined, but also to the general public who read in the newspapers the names of those persons whose privilege of operating has been taken away.

The Vehicle and Traffic Law requires the operator of every motor vehicle involved in an accident which results in personal injury or death, to report such accident to the Commissioner of Motor Vehicles within 24 hours. In addition, every police officer to whom an accident is reported must file a report with the Bureau, setting forth all facts in connection with the accident. In those cases which result in a fatality, the coroner is required also to file a report, giving his conclusions as to the facts and circumstances surrounding the happening.

The operator of every vehicle involved in an accident which results in a death or serious injury is called by the Bureau for a hearing before an official referee who questions the driver and all witnesses to the accident to determine whether the operator was guilty of careless or reckless driving. If the hearing indicates that the accident resulted from negligence on the part of the operator, his license is suspended or revoked for a period in accordance with the seriousness of the violation committed. Under this system many negligent and incompetent drivers

are removed from the highways. If the power of suspension and revocation were removed, these undesirable drivers would continue to operate without any deterring force being exercised against them.

Many highway accidents do not result in serious injury or death. While the operators of these motor vehicles are not requested to appear for a hearing, the accident is recorded against their individual records. A complete file is maintained of every operator or chauffeur license in the state. On this record are entered all accidents, complaints concerning the operator's driving, court convictions, and violations of the Vehicle and Traffic Law, which are reported to the Bureau. Minor complaints are classified as 1 point; accidents which are not serious or do not result fatally are classified as 2 points; court convictions vary from 1 to 3 points; and in those cases where the statute provides for mandatory suspension or revocation, the violation is classified at 6 points. When an operator's record totals 6 points, he is summoned to the Bureau of Motor Vehicles where his complete record is reviewed by a hearing referee. If the facts indicate that such operator has been guilty of careless or negligent operation of a motor vehicle, the hearing referee determines whether a temporary suspension of the operator's driving license should be issued.

In many cases the hearing indicates that a driver has certain tendencies which cause accidents. These faults are called to his attention and he is instructed to correct them so that future accidents will not occur. It has been found that in many cases we have been able to correct conditions which previously were causing accidents.

Reports are also received from railroad officials and safety councils notifying the Bureau of those operators who fail to observe warning signals and drive over a railroad intersection against the warning signal of a flagman on duty. The operators of these motor vehicles are written a warning letter and the violation is recorded against them. Violations recorded against such operators also include complaints of reckless driving from police officials, the court convictions dealing with offenses against the Vehicle and Traffic Law. An additional penalty in the nature of financial responsibility is imposed against operators convicted of a certain violations. This has had a decidedly beneficial effect, as a driver cannot have his license restored in certain cases unless he submits evidence of financial stability.

Report of Committee on Rural Highway Hazards

By E. J. O'MEARA

Secretary, Pro-tem, Rural Highway Hazards Committee.

Your Committee on Rural Highway Hazards is definitely convinced that accident records must be made available far beyond those that are now gathered. This also applies to the accident reporting. This agency must be organized and trained in the accident reporting methods, so that the reports can be studied and accurate conclusions drawn from them.

We present herewith a program of study for the Committee for the ensuing year, as follows:

1. Reflectorization of Highway Signs. During the early construction of high type highway systems certain hazards were created inherent to the roadway itself which no one could anticipate would be of such a serious nature. With steadily increasing speeds the demand for proper sign protection becomes more urgent. Adequate sign protection has in most instances been furnished for daylight driving, however, it has been apparent for some time that night traffic requires adequate protection. The economics of reflectorization will permit in many cases only the treatment of signs in the slow or caution groups. The Committee feels that the reflectorization of highway signs should be expanded as rapidly as funds are available, giving priority to the most hazardous places.

2. Sponsorship by State and County Authorities of School Boy Patrols. Heretofore, this service has been carried on almost entirely by civic clubs, local and national safety organizations, automobile associations, and similar groups. The

Committee recommends that jurisdictions having charge of construction and maintenance of highways should also assist in furthering this work. Much beneficial work can be accomplished through the medium of the traffic engineering groups responsible for the protection of highway traffic.

3. Construction of Sidewalks in Suburban Areas to eliminate walking on the roadway. Accidents to pedestrians largely are due to lack of adequate sidewalk facilities in the suburban areas. Schools, factories and business houses located just outside the corporate limits of cities where speeds are ordinarily high create a real hazard due to school children and employees walking along the pavement.

4. Studies of Safe Control of Motor Vehicles in Towns and Villages. Urgent demands are being made on highway authorities by municipalities for curtailment of high speeds through the residential and business districts. Realizing the potential hazards existing and that the design of highways as well as the improvement in motor car design has been conducive to higher speeds, it is the opinion of this committee that studies should be carried on tending toward an appreciable reduction of excessive speeds in these areas.

If time is available, we recommend that some study be devoted to the following phases of rural traffic control.

1. Studies of critical approach speeds at intersections; 2. Studies of critical approach speeds at varying degrees of curvature; 3. Elimination of unwarranted traffic signals; 4. Installation of traffic signals at intersections where necessary; 5. Restriction of parking; 6. Pavement and intersection laning; 7. Coordination of effort between the bureau responsible for design of highways and the traffic engineering section.

Report of Committee on Headlighting

By R. N. FALGE

Guide Lamp Corporation, Anderson, Indiana

The speaker said in part: The Headlighting Committee, in its initial report last year, made certain recommendations which were approved, with relation to the multiple-beam practice being recognized by the National Safety Council as providing the type of automobile headlighting required for safety, that the Council advocate the adoption of the multiple-beam practice in the Uniform Vehicle Code and in the laws of all states, and that the Council conduct an intensive educational campaign to impress upon motorists the need for maintaining headlamps in correct adjustment and for using the meeting beam when passing other vehicles.

The National Safety Council's sponsorship of the multiple-beam headlighting practice was most helpful in bringing about the substitution of that practice for the fixed-beam practice in this revised Code.

Sections 142 to 145, inclusive, provide in general that all motor vehicles manufactured and sold after the act has been in effect one year, except motor vehicles which travel at a speed not to exceed 20 miles per hour, shall be equipped with road lighting facilities capable of providing at least two beams, one aimed high enough and of sufficient intensity to reveal obstacles at a distance of at least 350 feet ahead, another aimed low enough to avoid glare under all ordinary conditions of meeting, all beams aimed high enough to be capable of causing dangerous glare to be marked with added indicator lights to notify oncoming drivers and the driver behind the light when such beam is in use, the driver behind the lights to be responsible for using a beam which does not glare when within 500 feet of an oncoming driver.

The note which follows Section 145 recommends that the Commissioner in each state adopt current standard specifications developed by recognized engineering societies as a means for determining whether a given device complies with the performance requirements in the Act, but discourages the inclusion of such specific test requirements in statute laws as likely to interfere with progress.

Sections 148 to 150, inclusive, provide for the approval, sale and use of lighting equipment.

Sections 160 to 165, inclusive, provide for periodical inspection of lighting equipment and enforcement of the provisions included in the Act.

From this it appears that Item 2 in the recommendations in the previous report has been complete insofar as the Uniform Vehicle Code is concerned. The Council now is in a position to advocate the adoption of the Lighting Provision in this Code in the laws in the various states during the coming Legislative Sessions. In this connection it is recommended that this report and the appended Uniform Vehicle Code Lighting Provisions be made available in printed form and broadcast to all interested individuals and agencies including, state motor vehicle administrators, police chiefs, chief engineers of car companies, automotive dealers and service stations, gasoline filling stations, legislative associations, safety organizations, interested engineering societies such as The Society of Automotive Engineers and The Illuminating Engineering Society, Conference of Mayors, and Conference of Governors.

The final recommendation of the Headlighting Committee in its previous report was that the Council institute an intensive educational campaign designed to encourage motorists to maintain their headlamps in the adjustment now specified in the Uniform Vehicle Code and to use a beam aimed low enough to avoid glare when meeting other vehicles.

The logical procedure in developing the program adopted by the Council, now that the Uniform Vehicle Code matter has been settled, might be that of concentrating next on the legislative changes needed to bring all state laws in line and following later with the educational program. Obviously, it would be much more desirable and hasten the time when we might look forward to substantially improved night driving conditions, if it were possible to get this educational campaign under way immediately.

The difficulty in instituting a nation-wide educational program before the legislative job is completed is that it necessarily involves the full cooperation of the automotive industry to be reasonably effective. The Council would hardly be justified in soliciting that cooperation without some assurance that its efforts would not lead to serious criticism from enforcement officials in states where the practice advocated by the Council are contrary to the interpretation of present laws.

In an effort to overcome this difficulty and get the educational program started, it is suggested that the Council refer this report to The American Association of Motor Vehicle Administrators at its annual meeting in Chicago and request that organization to contact its members and get their approval in all states where the practices advocated are now contrary to the interpretation of present laws.

Assuming that such approval may be obtained, the educational program might then be developed around the basic principles of aiming the upper beam high enough to show up obstacles at a safe distance ahead and using a lower beam aimed low enough to avoid glare whenever within 500 feet of an oncoming vehicle.

A major advantage in getting this educational program under way at an early date is that it would encourage service stations throughout the country to provide adequate service facilities, a distinct need in many parts of the country. Once service stations generally are in a position to provide headlamp service on a profitable basis, it is reasonable to expect that they will do much to interest motorists in adjustment and to instruct them on usage. Service organizations should be contacted with this in mind and with the understanding that they have much to gain by entering actively into the educational program sponsored by the Council.

Your Committee makes the following recommendations:

1. That the Council actively promote the adoption of the Uniform Vehicle Code Lighting Provisions by Legislatures in all states at the coming sessions by broadcasting, in printed form, the Headlighting Committee Report and the appended material, so that it will reach all interested individuals and groups.

2. That the Council refer this Headlighting Committee Report to The American Association of Motor Vehicle Commissioners at its next annual meeting and request it to secure the approval of enforcement officials in all states to the lighting practices specified in the Uniform Vehicle Code to clear the way for the educational program previously approved.

3. That the Council contact the various motor vehicle service organizations throughout the country in an effort to interest them in providing adequate service facilities.

By formal vote the delegates assembled in this session of the Congress approved these recommendations made by the Headlighting Committee.

Organizing a State Highway Patrol

By COL. LYNN BLACK

Superintendent, State Highway Patrol, Columbus, Ohio

Speaking extemporaneously, the speaker presented in substance the following ideas: The Ohio Patrol on November 15, 1933, began to organize and operate their Patrol under the new law. The patrol force comprises 60 men plus "students." They have had three training schools for these men. They have 24 sub-stations throughout the state. The men start at a remuneration of $100 per month plus board and clothing. They are promoted on ability as recommended by the immediate superior. The sergeants get $113 per month, the lieutenants $124, and the captains $154 per month. Efforts are being made to increase these compensation rates.

The duties of the Patrol relate to moving traffic only—that is, the enforcement of the motor vehicle laws. This includes the recovery of stolen cars, this being the only criminal offense with which the patrol is concerned.

Ohio badly needs a drivers' license law. At present, a driver in Ohio need not carry any sort of identification. The state also needs a strengthening of the laws on drunken driving.

The Highway Patrol Department uses three radio broadcasting stations through which they are in touch with five or six neighboring states.

Only the officers, commissioned and non-commissioned, have automobiles at their service; the other members of the patrol use motorcycles exclusively.

The Patrol Department operates on the basis of courtesy and cooperation. At the beginning they made a special effort to make contacts with all the local police. While the State Department has powers everywhere in the state, they do not exercise these in incorporated places, but if they pick up a violator in an incorporated community they take him to the local officials and let them prosecute. There are also one or two counties in the state where there is good enforcement by the county and the state department practically stays out of these counties.

One of the things the Highway Patrol has attempted to do is to break up so-called "speed traps" and "fining traps" established by constables and justices of the peace in local communities for revenue purposes. The patrol has been frequently blamed for these arrests, and the operation of a so-called "fining mill" as a source of revenue is harmful to the entire plan of traffic handling. When the patrol has found the constables engaged in this reprehensible practice, officers have been assigned to the particular part of the read in question in an attempt to break up the practice.

FRIDAY MORNING SESSION

October 5, 1934

The session was called to order by Frank C. Berry, Vice-Chairman, Street & Highway Traffic Section, and Manager, Safety Department, Minneapolis Automobile Club. Chairman Berry introduced the first speaker.

What the National Conference on Street and Highway Safety Did

By ARNOLD H. VEY

Traffic Engineer, Division of Traffic Control & Regulation, State Department of Motor Vehicles, Trenton, N. J.

REPORT OF COMMITTEE ON UNIFORMITY

Following the recommendations of the former Committee on Uniformity, approved at the last meeting of the Street and Highway Traffic Section, your Committee not only cooperated with the National Conference on Street and Highway Safety at the Washington meeting last May, and the American Association of Motor Vehicle Administrators in the development of changes in the Uniform Code and Model Municipal Ordinance, but also requested suggestions for possible changes in these documents. All of the suggested changes and additions so received were presented before the Committee on Uniform Traffic Laws and Ordinances of the Conference.

The principal changes in and additions to the code and ordinance approved by the Fourth National Conference on Street and Highway Safety are outlined as follows:

Changes in Form

The various acts promulgated in 1926 and revised in 1930 have been brought together in logical order in a single pamphlet which may be regarded as a complete motor vehicle and traffic code and also in individual acts which are available, separately, for the convenience of States having some, if not all, of the acts in effect. In order to confine each section of the code more closely to a single subject and make it more readable and understandable, many of the sections have been broken up, necessitating a complete re-numbering. Also many new sections have been added. Briefly, these changes are as follows:

Act I—Uniform Motor Vehicle Administration, Registration, Certificate of Title, and Anti-Theft Act—As expressed in the title, Act I relates to motor vehicles, trailers and semi-trailers, the registration thereof, the issuance of certificates of title and the collection of certain fees through the registration of such vehicles and drivers. Also to license persons in business or dealing in such vehicles and parts thereof. This revised act is a consolidation of former Acts I and II and, in addition, contains many amplified provisions.

Act II—Uniform Motor Vehicle Operators and Chauffeurs License Act—Act II, as the title implies, relates to the licensing of persons operating motor vehicles upon highways. As former Act II has been consolidated with Act I, this uniform motor vehicle operators and chauffeurs license act, formerly numbered Act III, is now re-numbered Act II. In addition, the text has been revised and amplified in certain respects.

Act III—Uniform Motor Vehicle Civil Liability Act—As the title implies, Act III relates to civil liability of owners and operators of motor vehicles, service of process on non-residents, and requirement that owners of "for rent" vehicles give proof of financial responsibility. This act contains provisions, in part, from former Acts I and III and certain new material relative to motor vehicle civil liabilty.

Act IV—Uniform Motor Vehicle Safety Responsibility Act—As the title implies, Act IV relates to the giving of proof of financial responsibility by owners and operators of motor vehicles. It represents a new act not heretofore included in the code.

Act V—Uniform Act Regulating Traffic on Highways—As the title implies, Act V relates to the regulation of traffic on highways, defining certain crimes in the use and operation of motor vehicles, providing for regulatory devices, defining powers of local authorities and providing for the enforcement of the provisions of this act. It represents a redraft of former Act IV, containing numerous new sections as well as sections taken from the former model municipal traffic ordinance.

Model Municipal Traffic Regulations—Model municipal traffic regulations is a redraft of the former model municipal traffic ordinance, divided into three parts: The Model Municipal Traffic Ordinance; the Model Traffic Administrative Ordinance; and State Law Provisions Which Might Be Included in the Traffic Ordinance.

Manual On Uniform Traffic Control Devices for Street and Highways—The Manual on Uniform Traffic Control Devices for Streets and Highways is a revision and consolidation of the two previous manuals; that is, the manual promulgated by the American Association of State Highway Officials for rural highways and the one prepared by the American Engineering Council for the National Conference on Street and Highway Safety to apply to city streets.

The Joint Committee on Uniform Traffic Control Devices was created primarily to bring all of the standards for traffic control devices into a single document. Recognizing the needs for both rural highways and urban streets, as well as the rapid developments in the art of traffic control during the past few years, considerable new material has been added dividing the manual into four parts. Part I deals with Signs, Part II with Markings, Part III with Signals, and Part IV with Islands. As soon as approval by a majority vote is given to the manual by the member State Highway Departments of the Association, the same will be printed and made available for distribution.

Changes and Additions in Substance

In addition to the changes in form briefly explained above, there have been changes in substance because of revised and amplified sections as well as additional sections. Briefly, these changes in substance are as follows:

Act I—Uniform Motor Vehicle Administration, Registration, Certificate of Title, and Anti-Theft Act—As previously explained, Act I is a consolidation of former Acts I and II. The present Act I further amplifies the duties and powers of an up-to-date Motor Vehicle Department as a separate Statement. It also provides for a more up-to-date Certificate of Title Law, with provisions adequate to enable a complete chain of title of the ownership of motor vehicles.

Act II—Uniform Motor Vehicle Operators and Chauffeurs License Act—Greater flexibility has been written into the Operators License Act to meet objections raised in states not yet having the license system. The changes approved do not necessarily lessen the effectiveness of the system nor do they prevent those experienced in the administration of the licensing system from utilizing that experience. However, it is felt by the Conference that by permitting greater flexibility, the objections raised by states not having such an act would be met, enabling more favorable attitude to the adoption of such an act. For example, the right of the Department to issue a restricted license to any person who is at least 14 years of age.

Act III—Uniform Motor Vehicle Civil Liability Act—This act primarily contains the same substance concerning civil liability as provided in former Acts I and III. It represents a consolidation of the provisions, in part, from these two former acts.

Act IV—Uniform Motor Vehicle Safety Responsibility Act—This represents a new act not heretofore included as a part of the code. It has been based upon the Safety Responsibility Bill sponsored by the American Automobile Association.

Act V—Uniform Act Regulating Traffic on Highways—As explained above, Act V represents a re-draft of former Act IV and contains many new provisions, as well as sections taken from the former Model Municipal Traffic Ordinance. Some of the major changes are as follows:

Negligent Homicide—A new section has been added to this act defining negligent homicide as an act of a driver causing the death of any person within one year as a proximate result of injuries received by the driving of a vehicle in a reckless disregard of the safety of others. This section also provides a mandatory penalty by imprisonment for not less than one year or by a fine of not less than $100, in addition to the mandatory revocation of the license of any person so convicted.

Speed Restrictions—The system of speed regulations in the 1930 code has not been clearly understood and is recognized by many traffic and enforcement authorities as improper for present-day adoption. The legislative trend during the past four years has been toward simple prima facie limits. This section of the 1930 code was therefore re-drafted in a manner re-stating the basic rule in simple form and designating prima facie limits more or less consistent with present-day safe practices. The prima facie limits are as follows:

20 miles per hour in any business district;
25 miles per hour in any residential district;
45 miles per hour under other conditions.

A provision is also made for scientifically determining and posting lower limits where special hazards exist or higher limits on other highways.

Equipment—Several changes have been made in the article of this act dealing with equipment of motor vehicles in substance as follows:

Driving Lights—In all new automobiles the single beam headlamp on which present lighting legislation is based has been replaced by dual or multiple beam lamps. These are necessary to provide proper illumination at prevailing speeds for night driving where highways are not adequately lighted. Their use, however, must be controlled to prevent dangerous glare.

Brakes—In place of the provision in the former act which stated that motor vehicles shall be equipped with brakes adequate to control the movement of and to stop and to hold such vehicles, the present act provides a stopping distance for service brakes of 30' upon dirt, asphalt or concrete pavement, free from loose material, where the grade does not exceed 1% when traveling at a speed of 20 miles per hour. Under like conditions, a hand brake shall be adequate to stop such vehicles within a distance of 55' and to hold such vehicles stationary upon any grade upon which operated.

Safety Glass in Motor Vehicles— The present act includes a new provision making it mandatory that on and after (suggested one year) the date of the passage of the act, all motor vehicles used for the purpose of transporting passengers for compensation or as school buses, be completely equipped with safety glass.

Trucks to Carry Flares, Lanterns or Similar Devices—A new section of this article of this act makes it mandatory that all motor trucks carry not less than three flares or electric lanterns or other signals capable of continuously producing a warning light visible from a distance of at least 500', for a period of eight hours, when traveling upon any highway outside of a business or residential district. Whenever such motor truck is disabled and cannot be removed from the main travelable portion of such a highway, such flares, lantern or other devices shall be lighted and placed upon the highway, one 100' in advance of the truck, one 100' to the rear, and one on the roadway side of the vehicle. In the case of vehicles carrying inflammable liquids or explosives, the act makes it permissible that such vehicles only use approved reflector devices in place of open flame devices.

Periodic Inspection of Vehicles—This article provides for a further new section making it mandatory that at least once a year the Commissioner of Motor Vehicles require complete inspection of motor vehicles.

Size, Weight and Load—The two major changes over the former act in the provisions of this article are changes in length of vehicles and specific provisions limiting weights for different classes of vehicles. In the case of the former, the length of a single vehicle has been slightly increased from 33' to 35', but the length of a combination of vehicles, coupled together, has been decreased from 85' to 45' and provides that the combination shall not consist of more than two units.

In the case of gross weights of vehicles and loads, a new section was added establishing maximum allowable wheel and axle loads and permitting the insertion of maximum gross weights by the several states, depending upon the conditions existing in those states. Because of varying traffic conditions, as well as the lack of uniformity in highway construction, the Conference felt that it could not justly recommend uniform maximum gross weights for general adoption throughout the country. However, the Conference does suggest consideration of the recommendation of the American Association of State Highway Officials by the various States when considering the adoption of maximum gross weights.

In addition, the section provides that every motor vehicle when operated outside of a business and residential district shall have motor power adequate to propel such a vehicle at a reasonable speed, with any load thereon or drawn thereby.

Model Municipal Traffic Regulations

As previously explained under the heading "Changes in Form", the former Model Municipal Traffic Ordinance has been re-approved, dividing it into three parts. In addition to the principal changes in form and substance in the code and ordinance herein briefly described, there are minor revisions in several of the sections, more clearly defining the laws pertaining to the use, registration and operation of motor vehicles upon highways, as well as revisions in the so-called rules of the road all of which have been based upon experience during the past four years.

Your Committee not alone endorses the code and ordinance as now revised but recommends that the National Safety Council use the machinery now available in publicizing not only the need for and advantages of uniform traffic regulations but also the more up-to-date provisions now made a part of these documents.

Respectfully submitted,

ARNOLD H. VEY, Chairman,
Committee on Uniformity.

Traffic School

October 2, 3, 4 and 5, 1934

Four sessions of the Traffic School were held on succeeding mornings of the Congress, led by Mr. Earl J. Reeder, Traffic Engineer, National Safety Council, Chicago. The sessions were developed along the "conference" plan of discussion and were attended by large and interested groups of delegates. The general subject considered was "Elements of Traffic Administration", four separate points of view being presented. In the following pages Mr. Reeder has consolidated and condensed the discussions for these TRANSACTIONS into four brief articles, or summaries.

I—Some Basic Conceptions of the Traffic Problem

The purpose of the Traffic School this year is to bring out those elementary principles that serve as the foundation for handling the whole traffic problem. The discussion will be divided into four parts, a separate phase of the subject for each day. This first part will be devoted to a discussion of the importance of the problem and the general divisions into which traffic administration naturally falls.

One of the very important things about street and highway traffic that is so easily overlooked is that it is one of the essentials in our social and economic life. When we consider the vast cities, the great industrial institutions, the popular vacation centers, and many other factors of equal interest and value, we must recognize that they are possible only because we have mechanical means of transportation capable of speeds many times those that the average person can make on foot. Transportation, and to a very large extent street and highway transportation, has not only made these things possible but is sustaining them.

If traffic is such a fundamental part of our social and economic scheme, why is it that we consider it such a problem? The great difficulty is that in a short period of forty years we have entirely revolutionized the character of transportation by introducing the motor vehicle, that has been so popular and has grown so rapidly in use that as individual drivers we do not yet fully understand it and as traffic officials we do not yet understand all of the problems that its use in great numbers produces.

The total production of automobiles in this country in 1894 was only four

machines. Since that time we have produced more than four millions in a single year, and the total number in use has grown to some twenty-four millions. The users include persons of all kinds—young and old, laborers and capitalists, illiterates and the most highly educated—all with varying degrees of ability for understanding and using mechanical equipment.

The toll taken by this situation is more than 30,000 lives a year, in addition to a million or more personal injuries and a large but indeterminate number of accidents resulting in property damage only. In addition, there is the toll of untold economic loss and inconvenience through serious delays in congestion and confusion due to the fear of accident. If it were not for accidents and the fear of accidents, traffic could move much more freely than it does. It is the fear of accident, taught by the actual occurrence of some four or five million accidents each year, that slows down traffic at intersections, causes you to keep a safe distance between you and the car ahead, and makes it necessary to demand that drivers shall stop for "STOP signs" and "STOP lights" and obey other restrictions for safety.

I am anxious that you shall see that traffic is one of the most serious administrative problems in cities and states because it has provided one of the foundations on which they have grown to their present size and state of complexity. The problem is bound to become greater rather than smaller and the sooner officials recognize its real importance and citizens accept the necessity for adequate regulation and control, the sooner will we make the modern modes of travel the safe and convenient utilities that they ought to be instead of instruments of death, injury, damage, and delay that so many of them now are.

The pioneering that has been done in this field of traffic administration falls into three important divisions. I shall name and describe them briefly in this session and, then, in subsequent sessions take them up one by one for more detailed discussion.

The first of these fields is that of traffic planning. It deals with finding out how drivers use the streets and highways and the extent of this use, and designing and promulgating the physical aids and legal restrictions that will help the great variety of drivers to use the highways and streets with safety and convenience. Years of experimentation and observation have been necessary to find out how drivers and vehicles perform under different circumstances. Along with these it has been necessary to determine the characteristics of different highway locations and to learn how to restrict and safeguard traffic in accordance with the needs at those locations. Some rules and methods for doing this traffic planning have been developed.

The day is past when mere guesswork can be tolerated in the regulation and control of traffic. With increasing volumes of traffic on the streets and highways, the chance of tying it in a knot by poorly selected restrictions or equipment is so great that accurate planning must take the place of mere guesses and of political expedience in applying restrictions and installing aids and safeguards. Economic conditions now require a large measure of traffic safety and convenience for every dollar expended in equipment and regulation.

What has been said here concerning the planning of restrictions and aids to traffic movement applies as well to the planning of educational and enforcement programs. Hence, much that will be said under the discussion of traffic planning in the next session will apply equally well to all of these phases of traffic administration.

The next important field of activity in traffic handling deals with the informing of the general public about the traffic problem, what is being done about it, and what the individual driver or pedestrian must do to conform with the plan that is evolved or must do to safeguard himself voluntarily. It matters little how good an installation of traffic control equipment may be or how well adapted a regulation or restriction may be to the condition that it is intended to correct, either is doomed to failure unless the drivers and pedestrians who use the streets and highways understand it and know how to comply with it.

More than a century and a half of representative government in this country has demonstrated that what the public does not understand it will not accept and support voluntarily and will not accept under compulsion. In an activity so new and so

controversial as traffic regulation and control, the clarification of public opinion and the enlistment of public support are necessary for success. Public education is for the purpose of enlisting the support and cooperation of the law abiding citizen through the press, organizations, radio, schools, and every other available means, so that compliance can be required by compulsion of those who will not voluntarily conform.

This brings us to the third division of traffic administration, the enforcement of traffic restrictions and regulations. Some drivers and pedestrians will not voluntarily obey regulations. If the regulations are appropriate and the job of public education has been well done those who must be forced to obey under compulsion should be a relatively small part of the users of the highway and streets. In fact, if it is a very large part, efforts at enforcement are certain not to be very successful.

A well done enforcement job makes effective good traffic planning and good public education. The effects of poor enforcement grow and grow rapidly. Law abiding citizens expect essential laws to be enforced and non-essential ones to be repealed. Hence, they consider that any rule or regulation that is enforced is necessary and that any that is not enforced is unnecessary. Vigorous and impartial enforcement of traffic regulations is an essential of traffic administration.

To summarize, traffic is one of the most important and most difficult problems confronting city and state administrations, and the regulations and restrictions that are imposed upon it must be wisely planned, adequately publicized, and consistently enforced. Everyone who is interested in improving traffic conditions in his city or state, whether his interest is official or unofficial, should do his part to see that the proper balance exists between these essentials and that none of them is stressed to the exclusion of the others.

There is need for pioneering work in each of the three fields. Conspicuous work has been done by those who have pioneered in these fields so far, but the toll of death, injury, property damage, and traffic delays that is still being taken is a challenge to the spirit of research, invention, promotion, and administration among those who either officially or unofficially carry or feel the responsibility for improving and safeguarding our use of the streets and highways.

II—Planning Traffic Regulation and Control

Traffic planning is the solution of problems of traffic accidents and congestion. It may deal with the road or street itself, the restriction or regulation of traffic movement on the road, the control of traffic by equipment, the safeguarding of traffic by physical protection, or the improvement of traffic administration.

The first essential that I would emphasize for good traffic planning, regardless of who does it, is a continuous program. Equally important, traffic planning should be an aggressive program. By these I mean that the official responsible for traffic planning should be ever on the lookout for the first symptoms of traffic problems. That is not only a good way of keeping the public satisfied, but it is also a good way of keeping out of the emergencies that always are difficult to handle. The best way to describe more fully what I mean by a continuous and aggressive program is to describe how the traffic planner should proceed in handling typical situations.

The best single indication of what is wrong with traffic is the accidents that occur in the use of the streets and highways. Hence, the traffic planner should constantly have before him a graphic picture of the accident problem, an accident spot map. On this map should be shown, by pins or spots, the locations of all traffic accidents. Each pin or spot should represent one accident rather than one person killed, one person injured, or one vehicle damaged.

When the spots begin to accumulate at a point on the map, it is evident that a study is necessary to find out what is wrong. An accumulation of four accidents at a street intersection or along a couple of blocks, in a few months is apt to be significant and, to find out whether it is or not, a collision diagram should be prepared showing how the accidents occurred. It is a diagram showing, by arrows on a rough sketch of the intersection or street, the directions traveled by the vehicles or pedestrians, or the positions of other objects involved in individual accidents. Dates, times of day, and any particularly significant information are shown on one of the arrows representing each accident.

If the accidents are similar in character, detailed observations should be made of what happens at the offending location. Traffic movements should be watched. Obstructions of view across corners should be located. Common parking practices that affect the safety of moving vehicles should be noted. Pedestrian movements should be observed. If the problem is at all complex a condition diagram should be prepared, showing the street layout to scale, the directions and amounts of grades, the locations of physical obstructions of view across corners or on curves, the locations and character of traffic equipment, and any other conditions that may affect the accident experience of the location.

Traffic counts may be necessary to find out how much traffic moves in the different directions. It may be necessary to observe speeds for use in computing traffic signal timing, critical approach speeds, or street capacity. Observations of the spacings of vehicles as they enter or leave the intersection, may be needed to compute signal timing.

When all of this information has been gathered, or as much as may be needed for the required study, the traffic planner will determine what regulations or control measures are necessary to correct the difficulties, or what modifications of the street layout may be required. His conclusion will go to the proper city department or the city council for approval of installation or for enactment. If the action is favorable and the regulation becomes effective or the equipment is installed, he must check up periodically to determine whether it is producing the anticipated results and whether any changes may be necessary as new conditions arise. If the action is not favorable he will simply have to watch for more indications of the problem and what should be done about it as a basis for a new recommendation at the appropriate time, unless conditions change.

Now, suppose that the preparation of the collision diagram shows no significant grouping of accidents. It will be necessary to wait for more accident experience, and he will make a note to follow up on that location a couple of months later.

Suppose, now, that the traffic planner receives a complaint from a local resident, about congestion, accidents, or near accidents at a street intersection. Such complaints may be valid clues to developing traffic problems although the requests or suggestions that are given for correction may be entirely wrong. The traffic planner may be able to prove that a complaint is illogical or unfounded, but he cannot afford to disregard it. He must either solve the problem or prove that it does not exist.

Many of such complaints claim accidents as their justification. Those who request traffic improvements know that there is no better argument for their cause than that accidents are occurring. For the same reason, if the traffic planner can prove that accidents are resulting from a condition that he knows should be corrected, that information is bound to be a powerful argument for him. When a traffic problem comes to the planner's attention through a complaint or through his own observation, he goes through very much the same procedure as when it is revealed by the accident record. He consults his spot map, prepares a collision diagram if there is enough accident experience, makes observation at the offending location and completes his study as before, unless at some step in the process he finds that no problem exists.

This is what I mean by a continuous and aggressive program of traffic planning. It is a matter of watching for the developing problems and solving them just as soon as the planner has adequate information, and never waiting for public pressure to force him to take some emergency step that may prove to be unwise.

I have strongly emphasized the importance of accident records in studying traffic problems. Now, what are good accident records? How should reports be obtained and how filed for reference?

First of all, a good accident reporting law or ordinance is necessary. A state law is the better but in its absence a city ordinance is necessary. This law or ordinance should require all accidents involving deaths, personal injury, or property damage above a specified total amount, to be reported, so that the records will be

available to the traffic planner. I recommend the fixing of the lower limit of property damage at a total of $25, for the greater the percentage of all accidents reported, the more useful will be the resulting data for the traffic planner.

A good accident report form that will give all of the information required for traffic planning, should be adopted. The Standard Accident Report Card recommended by the National Safety Council and endorsed by the International Association of Chiefs of Police and other organizations, should be used. Officers who make the reports themselves or receive them from others, should be instructed to obtain complete information as requested by the forms.

The reports should be kept in a location file so that the traffic planner can have immediate access to the accident experience at any location. He may use cross references on small cards giving names of injured persons, dates of accidents, or any other information that he may desire to obtain concerning individual accidents, but the original reports—the master reports—should be filed by locations. The most important use which can be made of accident records is the prevention of other accidents of the same kinds.

Time will not permit of a detailed discussion of the various traffic planning methods, particularly the methods of gathering information about traffic volume, speed, spacings, and observance of traffic regulation. However, there are certain fundamental points that I want to bring out, points with which every traffic planner should be familiar.

I have briefly mentioned collision and condition diagrams and further discussion of these will not be necessary. However, some points about the gathering of information in the field are important.

One important question in making observations at a street intersection is, "How far back from the intersection should obstructions of view be considered?" At city street intersections an adequate test is made by placing poles approximately 90 feet along the curb from the intersection of curb lines and sighting across the property between these two points. Any obstructions of view within the resulting triangle should ordinarily be shown on the map. The observers should watch for actual obstructions that may not be readily apparent to drivers and should locate the points at which these obstructions start. Typical ones are combinations of trees, low shrubbery between two adjacent approaches to the intersection, fences, hedges, and various other combinations of conditions, none of which alone might be an actual obstruction of view. Such very evident obstructions as buildings, walls, and hill-boards should be shown if they come within the "visibility triangle."

Traffic volume counts are taken in various ways and I shall not go into the detail of these methods. At best a traffic volume count is a sample rather than a completely detailed story of the traffic volume. For almost any use that is made of traffic volume counts the maximum traffic flow, at least, is required. Hence, traffic counts must, first of all, show the maximum normal conditions. The periods when these exist are easily determined and the counts should be taken at those times. If counts are taken at certain key locations in a city every time that they are taken elsewhere, counts taken at a certain period at one intersection may be compared with those taken at another period at another intersection. This enables a relatively small force to obtain comparable data at a large number of intersections with the counts scattered over a considerable period of time.

Traffic speed observations and spacing checks are somewhat more technical in the uses to which they are applied and it will not be necessary to go into description of the methods here. Observations of driver practices, particularly obedience of various kinds of regulations, furnish valuable information for the traffic planner. They are of various kinds, including obedience of STOP signs, obedience of STOP and GO signals, parking regulations and various driving restrictions.

This discussion should include some mention of the various types of possible treatment of street intersections, stated somewhat in the order of ultimate costs. The following may be named as the outstanding ones:

1. Removal of obstructions of view.
2. Prohibition of parking to keep an intersection "open."
3. Installation of stated speed SLOW signs or STOP signs.
4. Installation of stop and go signals.
5. Alteration of alignment or grade, or widening of street.
6. Separation of grade.

In general, that measure should be adopted which involves the least restriction of traffic movement and gives the greatest aid to vehicles and pedestrians with the least expenditure for construction or installation and maintenance.

To summarize, traffic planning is finding out what is wrong with traffic and devising practical and economical means for correcting the condition. Sporadic efforts in traffic planning often result in inadequate or partially effective measures. It usually allows problems to assume emergency proportions and to receive emergency treatment. Though, in small cities, traffic planning may not be a job requiring full time of even one person, it should be done with regularity and with the same care as in a larger city. Carefully planned traffic based on the principle of minimum restriction with safe and expeditious movement, is the kind of traffic that makes transportation agreeable.

III—Informing the Public About Traffic

One of the things often forgotten about traffic administration is that the public must use traffic control equipment and must be governed by traffic regulations and restrictions. The public is made up of all kinds of people. There are many subjects about which the general public is relatively uninformed, but this lack of information may not be particularly vital to their living together safely and successfully in families, communities, states, or nations. However, with a large part of the public in high powered motor vehicles capable of express train speed, and practically all of the remainder on foot, all intermingled on the streets and highways, ignorance of the essentials of safe traffic is bound to result in casualties and damage, of calamitous proportions.

The attitude of the public determines to a large extent the success or failure of any given measure for traffic regulation or control. Human beings have freedom of action and are bound to exercise it in the use of the streets and highways. Properly informed, that freedom of action is much more likely to be uniform as between individuals, than if it is uninformed. That is why public education concerning traffic is so important.

Now, what are some of the things that the general public must know about traffic to go safely and expeditiously from place to place? These are a few of them:

1. How to start, propel, and stop a motor vehicle.
2. How to handle the vehicle in certain important emergency situations.
3. How quickly a stop can be made under different conditions.
4. What conditions along the highway constitute hazards and how to avoid accidents therefrom.
5. The common rules of the road that apply generally to all traffic.
6. Special traffic regulations that apply to individual states or cities.
7. The meanings of signs, signals, and other equipment used in traffic regulation and control.
8. The rights and duties of pedestrians.
9. What must be done in the event of accident.
10. The restrictions concerning stopping, standing, and parking of vehicles.

Informing the public on these matters is no small job, even if the matters remain unchanged. But, consider the fact that changes are made from time to time—some to bring local conditions into conformance with nationwide standards or practices and others being experimental excursions into new fields—and you see what a complex thing this job of informing the public about traffic really is. That is why it is so important.

Many of the things that are new to us now in traffic will some day become as definitely a part of our community standards as are laws against crime, and violations of these things will be considered as unsocial as crime is today. That will be after a great deal of continuous public educational work has been done and after our traffic rules and regulations, our control equipment, and our administrative procedure have approached much nearer to uniformity than they are now.

Who is to do this public educational work, this informing of the public about traffic? Is it the responsibility of the traffic planner? It certainly is, because the success of his plans will depend to a very large extent on a clear understanding of them by the general public. Is it the responsibility of the organizations interested in civic activities? It certainly is, because the hazards of traffic menace every community. Is it the responsibility of the school? It certainly is, because there is no more universal problem to which future citizens will be subjected than that of the safe use of the streets and highways. Is it the responsibility of enforcement officials? It certainly is, because the success of their enforcement depends to a large extent on voluntary obedience of traffic regulation by the vast majority of the users of the highway. It is, in fact, the responsibility of every agency in the community that is concerned with keeping the community a safe place in which to live and a convenient place in which to transact business.

Considering any individual community, where should this public educational work start? Does any organization, official department, or commercial interest have a corner on the right to promote the educational program? My answer to these questions is that it should be inaugurated by that agency that has vision enough to see what ought to be done and courage enough to start it.

Of course, the educational program should be inaugurated with full consideration for all of the different groups and departments that should be interested or should be responsible for it and with a view to making it community-wide and all inclusive. If possible, it ought to start that way, but as in every other pioneering job, it must be started by the most forward looking interests and expanded to include the others as rapidly as possible. To fail to recognize this is but to allow accidents to continue to maim and destroy and to allow congestion and confusion to stifle the commercial life of the community.

For purposes of general education of the public about traffic, the population of any community falls into four general groups:

1. Children and young people, representing present and future pedestrians and future drivers.
2. Adult pedestrians.
3. Adult drivers of private passenger vehicles.
4. Drivers of commercial vehicles.

Each of these groups has its own particular avenues of approach. The first group is to be reached mainly through the schools and to a limited extent through radio, the press, and organizations. All adult pedestrians and the drivers of private passenger vehicles are to be reached through the organizations with which they are affiliated, the public press, radio, pamphlets, and various activities. Commercial drivers are to be reached through their employers, in addition to those activities that apply to adult pedestrians and private drivers.

It is not necessary to go into detail in this discussion about different kinds of activities, because they will be discussed in other sessions at this convention and it is not the purpose of this Traffic School to repeat what is given there. The purpose here is to deal with the kinds of information that the public should receive.

One thing that I am particularly anxious to get across is that public education should be very specific. The public is quite aroused about traffic accidents and congestion. Ask any public official who has been besieged by citizens for all kinds of traffic restrictions and equipment and he will tell you that the public is interested but he wishes there was some uniformity in that interest. One of the important functions of this traffic educational program is to bring about a more nearly uniform interest in and understanding of the local traffic problems.

What could be more effective in starting a community-wide educational program, than a series of daily or weekly newspaper items or radiograms, each taking up a separate phase of the local traffic ordinance, describing what it means, and telling how to obey it? Such a series might be extended to a dozen or fifteen items. They most certainly would be read or listened to because the vast majority of drivers would like to know just what these legal sounding restrictions mean in plain newspaper or radio English.

When a new ordinance is adopted, a general revision of the old one is made, or even a few new features or amendments are added, the public will be vitally interested in knowing what they mean and how they are to be interpreted in terms of daily driving.

A new type of traffic control equipment is always a puzzle to drivers and pedestrians until they become accustomed to it and know just exactly what it means. Contrary to the views of some who have become quite discouraged about the public interest in such matters, I am convinced that the public is vitally interested in the new things in traffic if they are properly told.

I have in mind a middle western city in which some of the earliest installations of stated speed slow signs were made in accordance with the instructions of the National Safety Council for computing critical speeds and installing such signs at dangerous intersections. News items in the local papers and addresses before organizations described just what the signs were intended to accomplish. It was explained that these were to be used where some restriction of speed was necessary and where full stops, as would be required by stop signs, were not always needed for safety. It was pointed out that the speeds stated on these signs were carefully computed in terms of the obstructions of view on the corners and the common speeds of traffic on the major streets. It was explained that they were "critical speeds" of approach to the intersection, above which the average driver of the average vehicle had no assurance of safety, but at or below which he would be able to see what was coming on the cross street in time to make a decision and stop, slow down, or go across without change of speed, as the conditions might warrant. The results were most satisfactory because some intersections that had been serious accident menaces became free of accidents or experienced large reductions and observations of speeds indicated that the signs were being well obeyed.

The public is always interested in the character and extent of the accident problem, if it is properly visualized for them. A list of the most dangerous intersections in the city with a little information about the kinds of accidents that occur at each, will help drivers to avoid similar accidents. A reproduction of the accident spot map from time to time is welcome news. It shows how the accidents group along certain streets and at certain intersections. Such a map reproduced in a newspaper or displayed in a store window or in the city hall for a few days always attracts much attention.

Then there is much to be taught about the safe operation of motor vehicles and about safe practices in the use of the streets and highways, that have never been written into law. It might be called the "unwritten law" of traffic safety. A part of it is definite training in the handling of the vehicle under various conditions. Another part is the matter of moulding the driver's attitude concerning traffic. Some of these are jobs for the school. Others must be done by agencies that deal with adults.

Of outstanding importance are two things about the traffic educational program that I would emphasize by repetition here in closing. First of all, every public department and unofficial agency that is at all interested in maintaining a community that is a safe place in which to live and a conveniently accessible center of commercial activity, should be interested in crystallizing public knowledge and understanding of the rules, regulations, restrictions, and equipment that have been enacted or installed for accomplishing this end should conduct activities for this purpose on an impartial, community-wide basis. Then, the educational program should be specific, helping the individual to receive specific information which he recognizes to be important in his daily use of the streets and highways. When these two fundamental requirements of public educational programs are fulfilled, the public will be carried a long way toward well organized and safe traffic.

IV—Enforcing Traffic Regulations

Enforcement provides the teeth of traffic administration. It is the means of requiring those who will not voluntarily obey the traffic regulations and restrictions, to accept them under compulsion so that the safety and convenience of other users of the streets and highways may not be improperly menaced.

One of the most serious obstacles in enforcement is the tendency to consider violations of traffic rules and regulations as mere mistakes—offenses which were not committed with any intention of injuring anyone or damaging any property. Of course, some traffic law violations are committed without the violator even knowing that he has committed an offense, and there is an obligation on the part of public officials to provide reasonable regulations and restrictions and to make every reasonable effort to inform the driving public about them. But the thing that I am condemning here is the public and official attitude that would strip traffic law violations of all criminal aspects.

The shooting of guns in a city is commonly prohibited except in the enforcement of law. It is not a question of whether the person who does the shooting is an expert who could fire a hundred shots in a busy street without injuring anyone or doing any damage or is the most reckless and inexperienced amateur. The act is prohibited as a menace to society because previous experience has shown that accidents do occur.

Violations of traffic regulations should be considered in the same light. An expert driver might be able actually to violate a traffic signal a hundred times without accident because he would not think of driving into the intersection until he knew that no traffic was coming on the cross street. But, how can the enforcement official distinguish between the expert driver and the inexperienced learner who does not yet know the hazards of such an act? The only safe way is to prohibit every such violation and treat all of such violators alike unless some condition over which one of them had no control caused him to violate.

An enormous dam breaks, allowing a great wall of water to surge down a valley taking buildings, livestock, and human beings along with it. An investigation follows, arrests are made on the grounds of criminal negligence, and convictions result.

This is not because the dam had been built to impound water for the purpose of destroying property and wiping out human lives. Rather, the owners and operators of the dam which had furnished light and power for industrial plants to manufacture necessities of life or had furnished water for irrigating arid lands and making them produce food stuffs, had failed to take proper precautions when those threatening leaks began to appear. It was failure to do what should be done that brought this conviction, and not any act of criminal violence.

This situation is quite similar in character to that of the driver who passes a stop sign without stopping and collides with another vehicle out in the main thoroughfare and then pleads that he was thinking about something else and didn't see the stop sign. Why was he thinking about something else? Why did he fail to see the stop sign? It was simply because he had never taken traffic restrictions so seriously as to make stop signs important to him.

Another type of violator with whom I have very little sympathy is represented by the man who parks his car between a street corner and a sign reading "No Parking Here to Corner", and then pleads he did not know he was violating because the sign faced the other direction. Is there no obligation for such a man to find out what the sign says? Does he not know that signs along streets, particularly in cities, are intended to give the driver information which he may not otherwise know and to warn him of restrictions which he might not otherwise be expected to recognize? Must the city greatly increase its administrative expenses to place a policeman at every place where there is a restriction, to individually warn every driver of the existence of the restrictions?

I am no more anxious that our street traffic law enforcement should become persecution of the driving public than is the most frequent violator of traffic regulations. However, I am alarmed by the chaotic traffic conditions that result when public and official leniency allows dangerous violations to go unpunished because there is no evidence that the violator intended to injure or destroy.

Consistency among enforcement officials is one of the essentials of public support for official traffic activities. Seeing a police vehicle parked in front of a stop sign which I am expected to obey, does not increase my respect for the officers who did it, particularly if I know that no emergency is involved. Nor did my opinion of the quality of the enforcement in a certain city appreciate when I, as a visitor,

was driven in the wrong direction along a one-way street in a police vehicle with the officer in charge of the traffic division present. Of course, there are times in emergencies when police vehicles must violate regulations, but no police department can afford to allow that to become a habit that will cause officers to interpret all driving of official vehicles as emergencies.

I have devoted all of this time to this particular phase of my subject because traffic violations are so serious and I am anxious that enforcement officials shall cease to condone such acts on the part of either citizens or officials. We must hasten to the time when public and official opinion will consider traffic violations just as unsocial as those acts that are now considered to be major crimes. They may not be considered individually as serious, but I look forward to the time when they will be considered as opposed to the general welfare of society.

Traffic law enforcement is very closely tied in with the prevention of traffic accidents. In fact, I consider that the primary purpose of traffic law enforcement is to prevent traffic accidents. It is to discourage the commission of those offenses that cause or are likely to cause injury to persons or damage to property, in the use of motor vehicles.

If that is the case there ought to be some kind of relation between the extent of the traffic accident problem and the character and extent of the enforcement program that is carried on. The National Traffic Law Enforcement demonstration conducted by the Enforcement Committee of the Street and Highway Traffic Section during September, 1932, demonstrated the existence of such a relation. A considerable number of cities participated in this demonstration and reported the results of their increased enforcement, in accidents reduced. It was found that, in general, increased enforcement, represented by more arrests and convictions for hazardous driving offenses were accompanied by decreases in traffic accidents.

As a means of relating enforcement efforts to the extent of the problem, an enforcement index was devised. It was the ratio of the number of convictions for driving offenses to the number of accidents involving personal injuries. Convictions for parking offenses and other violations that have been shown to have little or no relation to the accident experience, were not included in the computation of this index. Furthermore, accidents resulting in property damage only were not included because there is such a great variety of reporting in different cities. Hence, it was decided to confine the enforcement index to the number of convictions for driving offenses per personal injury accident.

Some cities that had high enforcement indexes did not show very large reductions in accidents in spite of marked increases in arrests and convictions during the demonstration. Cities with indexes of more than ten convictions per personal injury accident seemed to accomplish little more by increasing their enforcement and, hence, their enforcement index beyond that point. On that basis it was concluded that an index of approximately ten should be the aim of all cities, but that an index of more than ten will probably not accomplish much in reducing accidents. The reason is that excessive enforcement will not take the place of necessary improvements in traffic planning or public education. Vigorous enforcement of unreasonable regulations can get results for a time, but reaction will soon set in if definite steps are not taken to bring the regulations up to a proper and reasonable standard and to inform the public that that is being done.

One of the first questions which a traffic law enforcement official may properly ask about improvement of enforcement is "how should it be started?" It is not my purpose to go into detail concerning specific enforcement measures and, thus, repeat much that has already been said in other sessions about enforcement activities. However, I shall call attention to a few essentials of a successful approach to the improvement of traffic law enforcement in any community.

Enforcement is always relative. There is no such thing as absolutely complete enforcement because there are not enough officers in any city to be sure that an arrest is made and a conviction obtained for every violation. In fact, traffic law enforcement is at present a sampling process in which the police department devotes all of the time that it can with its available staff and equipment to making arrests and getting convictions for traffic violations. However, it is possible in

most cases to improve the enforcement by making better application of the available personnel and facilities—that is, by doing better sampling.

First of all, enforcement can be made selective by placing the greatest emphasis on those violations that are most commonly involved in accidents and applying the greatest police activity in those areas where accidents are most common. In that way the increased activity can be amply justified if publicity is given to the fact that emphasis is being placed on those violations and areas. I repeat again, "there is no more effective justification for any proposed traffic improvement than the fact that it is needed to reduce accidents."

Another sound basis for increasing traffic law enforcement is the investigation of accidents for the conviction of violators involved in them. The use of accident investigation squads is quite generally understood among enforcement officials over the country, but I doubt that their advantage in improving enforcement is adequately understood and appreciated by many.

In starting the improvement of enforcement by the inauguration of an accident investigation squad, the emphasis is being placed on the treatment of accidents that have already happened. No one can deny the hazardous practices, because they resulted in accidents. There is little defense for the violator whose offense has resulted in an accident. Gradually, as the information about the violations that are most commonly involved in accidents, accumulates, the justification for arresting and convicting violators of the same regulations that have not been involved in accidents, is established. Such a program is bound to be popular with the right thinking citizens of the community and is bound to improve the general obedience of the traffic regulations throughout the city.

Enforcement of traffic regulations can be as scientific an activity as the planning of traffic regulation and control. Enforcement must be planned on the basis of facts concerning accidents, the extent of disobedience of different regulations, and the distribution of violations and accidents over the city. The investigation of accidents, the determination of whether a driver has been drinking, and various other problems are activities on which considerable development is yet to be done.

* * *

By way of general conclusion for this course and to summarize it briefly, I would emphasize that traffic administration consists of three important groups of activities, none of which can be stressed to the exclusion of the others. Traffic planning must furnish the groundwork of proper regulations, restrictions, and control for the guidance and protection of traffic. The public must be informed about the traffic problem and what is to be done about it, as well as the general practices that are necessary for safe and expeditious movement of traffic, so that individual drivers can and will cooperate with the officials in a very high measure of obedience of the imposed regulations and restrictions. Then, to require those unsocial beings who are not willing voluntarily to obey the traffic regulations, to do so for the safety and convenience of the entire driving public and of pedestrians, vigorous and impartial enforcement is necessary. There is no successful substitute for this three-fold program.

TWENTY-THIRD ANNUAL SAFETY CONGRESS
NATIONAL SAFETY COUNCIL

Child Education Section

Officers 1933-34

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Secondary Chairman—FRANCIS L. BACON, Evanston Township High School, Evanston, Ill.

General Meeting

Chairman—Albert W. Whitney, associated general manager, National Bureau of Casualty and Surety Underwriters, New York City; vice-president in Charge of Education, National Safety Council.

For some years those in charge of the sessions of the Child Education Section held during the Annual Safety Congresses have been giving careful thought to the fundamental purpose of these meetings. During the past year this consideration has been intensified, and the sessions scheduled for this congress were planned after lengthy discussion with the Section's officers, the Council Executive Committee, the staff and others. Experience has clearly shown that two types of meetings are possible, one for the industrial delegate in attendance at the Congress, the other for the teachers and administrators who may have come from other cities or from the schools of the city in which the Congress is held. The 1934 program of the Child Education Section was planned with a desire to interest both groups. Consequently the opening meeting was devoted to the industrialist and his place in the child safety movement, the following sessions to teaching and school administrative problems. On the whole the plans seemed satisfactory with the possible exception of the opening session which seemed to fail in its fundamental aim of bringing the industrial safety men into a meeting of the Child Education Section.

In planning for th. essions, a definite effort was made to provide ample time during each session f. cussion by delegates in attendance.

Not only by right of his position as superintendent of Schools in Cleveland but also because the Cleveland schools have for years held an enviable position as leaders in safety education, the first speaker of the first meeting on child safety was Dr. Charles Lake. He extended a warm welcome to the delegates and outlined in convincing detail the safety instruction and activities which are carried on in the Cleveland schools.

PANEL DISCUSSION

Topic: Why Should Industrial Management Be Interested in Saving Children's Lives?

Participants:

Mr. Whitney, Chairman.
Mrs. Hugh Bradford, Sacramento, California, past president, National Congress of Parents and Teachers.
H. A. Bathrick, Cleveland, associate superintendent of schools in charge of high schools.
Dr. Thomas W. Gosling, Washington, Director, Junior Red Cross, General Chairman, Child Education Section.
Harry Guilbert, Chicago, Safety Director, Pullman Company.
F. C. Lynch, Kansas City, Manager, Kansas City Safety Council.
George McClain.
Lewis MacBrayne, Boston, Manager, Massachusetts Safety Council.
Henry Lester Smith, Bloomington, Indiana; Dean, College of Education, University of Indiana; president, National Educational Association.
Marian Telford, New York, secretary, Child Education Section.

Summary of Discussion:

Mr. Whitney: (After explaining that a panel was an informal conference under the direction of a chairman and that the audience would be urged to join the discussion before its close.)

Year after year many interested in safety education in schools feel that their problems ought to be significant to people in industry but have been unable to get industrial safety people into meetings where child safety education is being discussed.

Mr. Lynch: Why should industrial people be interested in saving children's lives? That's such an obvious topic. A stranger out on the street would give his life to save that of a child. The question should be changed to "Why should industrial people be more interested than the banker in the promotion of child safety?"

Dr. Smith: I should say that industrial management should be more interested than the banker or any other form of profession or industry.

Mr. Bathrick: And the public should also be concerned in this question and discussion.

Mr. MacBrayne: Miss Frances Perkins says that we have reduced accidents by taking children out of industry.

Mr. McClain: I can't see that entirely.

Dr. Smith: Every child is a potential industrialist. A safety consciousness should be created during the period of his growth. Industrialists could enter the educational picture by aiding in the development of a practical program of industrial education for teen age children.

Mr. Guilbert: There's no easier way for a corporation to establish a fine relationship with its employees than by letting them know that the management is interested in their families.

M. Lynch: Do people who go into industry after having had the advantage of safety education in the schools prove to be safer workers than older employees who have never had this advantage? Do children retain safety education?

Dr. Smith: That depends upon the kind of education. Students can sometimes answer questions correctly but still fail to apply their fundamental knowledge to life.

Mr. Guilbert: The whole problem could be solved easier if the home taught safety, too. The home has some responsibility for it.

Mr. Bathrick: There's no organization in the home.

Mr. MacBrayne: Suppose you trained all the potential mothers. In ten years there would be organized safety in the homes.

Mrs. Bradford: We seem to be separating education into school, home, public and industrial. I think we ought to work together more so that there is better understanding and more complete programs.

Mr. Whitney: How can we do this, and very specifically how can we get industrialists at these meetings?

Miss Telford: Can it be that industrial safety men have unfortunate experiences with their own schools at home between Congresses that make them feel that there isn't anything they can do for their schools. I heard today of a situation where a school administrator said in effect to outside groups interested in safety education, "All you can do for us is pay the bill. We need money, that's all?"

From audience: Our coal company finances a school safety program. "Very interesting" is all our superintendent has time to say about it.

Dr. Smith: The schools need the help of all agencies.

Mr. Lynch: To answer Mr. Whitney's question, I would say that the problem of the Education Division was to sell itself to industry and to the rest of this Congress. The Education Division must teach industrial safety men that they should cooperate in local child safety programs and activities.

From audience: Industrial men are not here because they are interested in other meetings. There isn't any lack of interest; there is only a division of interest.

Gordon Graham (from the floor): I think we should go to the industrial people. We ask them to come to us.

Mr. Whitney: Industry is represented here today and its representatives have indicated their interest in child safety, and safety education. It seems that there is required some correlating influence to bring the industrial safety men and those primarily interested in safety education together.

(From the floor): Just what do we need to bring to the industrialists? That point is important.

Mr. Whitney: There are several questions here: What do we need to do? Who is going to do it? How is it to be done?

(From the floor): I move that we place a resolution before the Executive Committee of the National Safety Council asking permission to carry on a discussion similar to this one before a general session of the next Annual Safety Congress.

The motion was seconded, put by the chairman, and carried unanimously. Following this action the meeting adjourned.

Luncheon Meeting—Tuesday, October 2, 1934

Chairman—Dr. Thomas W. Gosling, Director, Junior Red Cross, Washington, D. C., General Chairman, Child Education Section, National Safety Council.

A very important meeting of the Section was held in the Red Room of the Hotel Cleveland on Tuesday, October 2, when a large audience gathered to welcome Dr. Henry Lester Smith. This was the first time a president of the National Education Association had addressed the Annual Safety Congress. He was graciously introduced by Dr. Thomas W. Gosling as chairman of the meeting and warmly received by the audience.

A New School and a New Teacher for a New Age

By DR. HENRY LESTER SMITH

Dean, School of Education, University of Indiana, Bloomington

After mention of the methods of education in earlier ages the speaker said in part:

The twentieth century needs and is adopting a radically different type of educational system from that which apparently met the needs of our European ancestors, of our colonial forefathers in America, or even of the citizenry of half a century ago. Some of the many factors influencing this change in needs are the improved methods in communication and transportation, the growth of industry, changes in the form and purpose of our governmental organization, the breaking down of family life, the decline in the influence of the church, the growth of scientific discoveries, changes in our philosophy and psychology of education, and, with these, changes in the very nature of our school population.

Our own population has become more urban than rural, thus breaking down the old community life and bringing about a greater interdependence of communities. The employer and employee no longer come into close contact. This breach of relationship considerably lessens a community of purpose, and contributes toward a lack of understanding of the interdependence of all men connected with a particular industry—their mutual responsibility for the success of that industry—and a lack of understanding of their proper interrelationship with those engaged in other productive activities. This lack of understanding has resulted in considerable strife and social injustice inflicted both by industrialists and by laborers.

It is evident that an educational system which provides chiefly for the transmission of a race heritage characteristic of a century or centuries ago—for the transmission of the tools of knowledge and of the classics—cannot fit the child for an understanding of his proper place in the world of today. The numerous problems resulting from our complex industrial and commercial organization must be given greater attention in our school curriculum, if our citizens of the present and future are to contribute intelligently toward a harmonious and peaceful relationship between individuals, communities, industrial divisions, states, and nations of the world.

The more numerous our industrial and commercial problems become, and the more dense our population becomes, the more numerous become the responsibilities of the state and federal governments. Any democratic form of government is utterly helpless in extending its activities and in enforcing its regulations unless at least the majority of its citizens are informed adequately regarding the added number of problems and duties of the government, and unless the majority of its citizens are indoctrinated sufficiently with democratic ideals and principles which will guide them in performing their governmental functions intelligently. Our present educational system in America instead of imparting a mere knowledge of facts directed at the youth, as has too often been the custom in the past, must assist the citizens of the future to grow, to develop guiding principles which will enable them and inwardly compel them to become useful citizens of this democracy of ours, both today and tomorrow.

Along with the changes in our commercial and industrial life have come changes in family life; in fact family disintegration is stealthily creeping upon us. Many factors have decreased the potential influence of the home as an agency for the dissemination of moral, religious, political, economic, social, and vocational training. A loss of these types of training strikes at the very roots of our civilization, and retrogression can be averted only if these functions are assumed by some other institution or institutions of society.

Another factor which has demanded a change in our educational system, especially in the school curriculum, has been the rapid development of scientific investigation and the rapidly increasing store of knowledge produced by it. Discoveries in the causes and prevention of disease have been instrumental in considerably prolonging the expectancy of life. Discoveries in the fields of physical and biological science have done much toward enabling man to adjust himself to his environment.

Our whole philosophy of education also has changed. We have ceased to look upon the mere accumulation of knowledge as power, and we have ceased to believe in formal discipline and general transfer of training with their accompanying logical organization of subject-matter. We have ceased even to look upon education as a mere development. We are beginning to recognize quite generally the value of pupil purpose in all learning activities, and to value most highly that learning which produces a change in human behavior, enabling the individual and the group to make adjustments and adaptations that will improve both individual and social welfare. Such a philosophy has developed essentially as a result of our numerous psychological and sociological investigations and discoveries.

One other factor that has contributed toward a need for modification of our educational program has been the change in the very nature of our school population. Compulsory education and child labor laws have forced into school many individuals who otherwise would not have attended school for any long period of time. Many of these individuals are expecting to follow only skilled and unskilled labor for a livelihood. The majority of them are not interested intrinsically in

academic subjects, aside from the elementary tools of learning. It then becomes necessary for the school to modify its curriculum to fit the needs and demands of these individuals. Their school program must be built around immediate life problems and vocational interests if they are to derive benefits commensurate with the expenditures for education.

The curriculum of the future must follow the lead of the more progressive schools of today. We can no longer educate the individual merely for adjustment to the needs of the present. In earlier years if the child was educated for adjustment to the age of his youth, such training essentially sufficed to meet his needs throughout his entire span of life. Changes in the social, political, moral, and economic order took place very slowly, so that few occurred within any one generation. Quite the opposite is true of changes in our economic and social order today. During the twentieth century discoveries and inventions have taken place very rapidly, often completely revolutionizing our way of thinking within little more than a decade. Within the past three decades we have witnessed specific changes that could never have been anticipated with any reasonable degree of accuracy during the periods in which the youth of that time were receiving their elementary and secondary school training.

In the new age it is impossible to anticipate and offer specific training that will enable the individual to make adjustment to each type of problem which he will meet in his environment. Our educational system has a much greater function to perform; it must train not only for present adjustment but also for adaptation to the changing needs, and for leadership in improving the existing individual and social welfare. The curriculum of the new school, both its materials and methods, must be selected with a view toward performing these new functions. Materials which no longer satisfactorily meet the needs of the present and future generations must be deleted from the curriculum. New experiences must be added which will serve in giving the new type of training. Continuous pupil growth will become the aim of the new school. Much of the old materials and methods do not stimulate pupil growth effectively.

The materials and methods which form the curriculum of the new school should be taken from life as it exists about us. They should be determined to a large extent by an analysis of pupil and adult activities and of needs in the present age. Such materials will have greater intrinsic interest for the child, and the activities which he performs in relation to these materials will have a greater significance to him and contribute more toward his general growth. Creative activity should receive greater emphasis in the curriculum of the new school. Such creative activity should not be limited to the manual arts, but it should be extended to thinking and to all other phases of human activity.

This new type of curriculum designed to meet the needs of the new age cannot be constructed most satisfactorily by mere addition to and subtraction from the curriculum of the past and immediate present. The curriculum-makers for the school of the new age must begin with experiences which exercise the greatest direct influence in improving man's individual and social welfare. These experiences should be organized into teaching units, and later the units may be assigned to definite groups. Many of the new activities and experiences which should constitute the curriculum of the school for the new age may be organized easily under conventional subject-headings. It is quite likely, however, that some of these new activities will not find place under conventional titles; consequently, a partially new nomenclature may need to be introduced into our program of studies. The new program of studies necessarily must be introduced into the schools of any local unit rather slowly. It will be necessary to begin in an experimental way and gradually acquaint the community and train the teaching staff if the new program is to be assured any adequate degree of success.

We have spoken of the new experiences and activities which are to form the curriculum of the new school. It might be well to suggest a few of the new items which perhaps should be included in the new curriculum. An analysis of the activities, experiences, and problems of the present age indicates that our youth need special training in problems of child care; feeding; causes, prevention, and

treatment of diseases; mental hygiene; safety; politics; and charity. Pupils need to be taught to appreciate art, music, and literature of a much higher level; they should learn how to listen, and how to conduct intelligent conversation; they should have a greater knowledge of that portion of scientific knowledge which is useful in everyday life; they should learn how to secure the most benefit and pleasure from travel; and above all they should have a better understanding of their function and relation to other members of the industrial and social order of which they find themselves members. These are only a few of the many activities and experiences which should receive ever greater emphasis in the curriculum of the new age.

Let us examine a little more in detail the need for giving greater attention to safety education in our public schools. In our thickly populated urban districts the danger of the destruction of property by fire is materially increased. In buildings of many stories, unless a great amount of precaution is exercised, the fire hazard to human life is far greater than in small buildings. Our rapid means of transportation have increased considerably the danger to the lives both of the occupants of the vehicles and to those pedestrians who may accidently come within their paths. Likewise, unless greater precaution and more extensive preventive measures are exercised, the dangers of sickness and disease resulting from unsanitary housing and close association are much greater in the city than in the rural areas. The greater use of machinery in industry also has increased considerably the danger to human life. The inhabitants of many cities have recognized these rapidly increasing hazards and have organized City Safety Councils. These agencies along with several others have been influential in getting the school systems of some of the cities to make provisions for safety education. In some places safety education has been incorporated directly into the curriculum as units under traditional subject heads while in others it has been introduced into the school system as extra-curricular activity.

The new school also must have a new type of teacher. The old type of teacher who compelled rote memory largely by external pressure, the more recent text-book teacher, or the teacher who has been interested primarily in subject-matter achievement should and will have no place in the school of the future. The teacher of the future must be interested first in the development and growth of boys and girls. The teacher's chief aim must be to train the individual so that he may be able to adjust himself to the world of the present, and that he may be able to make adaptation to the rapidly changing world of the future. He must aim also to train the youth for leadership in improving the world of the future, for correcting maladjustments in our economic and social order—maladjustments which result from a lack of harmonious development among our social and industrial institutions. Such aims can be accomplished only through a curriculum that provides for a great amount of pupil activity which has its beginning in the pupil's own purposes and which is taken directly out of the experiences of present day life.

The Nominating Committee for Officers placed the following in nomination for general chairman, Frederick Archer, superintendent of schools, Louisville; vice-chairman, Agnes Samuelson, Iowa state superintendent of schools, Des Moines; secretary, Marian Telford, National Safety Council, New York. These were unanimously elected.

The audience then broke into two sections for conferences on "Safety Education in the Elementary School" and "Safety Education in the Secondary School." Their programs may be summarized as follows:

TUESDAY AFTERNOON SESSION

October 2, 1934

Safety Education in the Elementary Schools

Chairman—Dr. H. M. Buckley, Assistant Superintendent in Charge of Elementary Schools, Cleveland.

Dr. Buckley called the meeting to order at 2:15 and introduced Miss H. Louise Cottrell, vice-principal, Stockton School, East Orange, New Jersey, whose topic was "Opportunities for Teaching Safety in the Elementary Schools."

Miss Cottrell pointed out that most teachers have turned from slogans, jingles, statistics and morbid details of accidents as a method of teaching safety. Instead they now make use of every possible accident situation as an opportunity to teach self-preservation and safety for others. This teaching of safety has enriched the regular subjects of the curriculum.

Miss Cottrell gave as an example the recent Morro Castle disaster which occurred near the city in which her school is situated. The children of this school were very much interested in this disaster and anxious to talk about it. The teachers' problem was to direct this interest away from horrors and into worth while channels. A two-weeks' unit of work based on the activities of the Coast Guard was the solution of the problem. In addition to introducing a type of safety which was not familiar to the children it provided an opportunity to review water safety and artificial respiration. Language, art and spelling periods were motivated. The motto of the Coast Guard, "Always Ready," was adopted by the class as their motto for the year. So much interest was created by this unit that practically the entire school has now adopted "Always Ready" as their motto.

Miss Cottrell presented an exhibit of children's work to show the opportunities which arise in various classrooms for the development of valuable safety habits, knowledge and attitudes. These illustrations proved beyond question that it is possible for the teacher to conduct a safety program in a limited amount of time.

It was emphasized that safety should be taught *whenever an opportunity arises.* Perhaps a fire drill or an excursion to some point of interest furnishes the necessary approach. Often a safety lesson arises unexpectedly from some phase of the regular work. For example: A second grade pupil was reading "Red Feather." The child read, "Red Feather knelt in the bow of the canoe. Big Eagle knelt in the stern." Immediately the question arose, "Why did they kneel?" A lesson in the safe way to handle a canoe followed and, with this as a beginning, a unit of work on water safety developed. The unit closed with an assembly program which included a dramatization. The children made a large canoe from cardboard and gave a demonstration of the proper way to handle it.

In closing, Miss Cottrell emphasized the important point that the teacher's responsibility for the child's safety never stops, and that she should be constantly on the alert for opportunities to emphasize these principles.

Following Miss Cottrell's talk Dr. Buckley discussed the need for teaching safety and quoted statistics to show the seriousness of the accident situation—those relating to the Morro Castle disaster, national traffic fatalities, and also the local problem. The death of a local boy that day in a traffic accident was used as an example. Dr. Buckley also summarized some of the important points which were brought out in Monday afternoon's meeting.

Dr. Sherrard, Associate Superintendent of Schools, Pittsburgh, spoke of the value of the accident reporting system and encouraged all teachers to make use of SAFETY EDUCATION Magazine and the lesson outlines.

There was also some discussion of the question of liability when a member of a school boy patrol is injured or when a child who has been directed by a patrol boy is injured. No definite information was offered on these questions.

Another problem discussed was: How far down in the grades is a pupil capable of acting as a member of the patrol or as a member of the junior safety council? Cleveland teachers felt that sixth grade and sometimes fifth grade boys are capable of directing the activities of child pedestrians. Grades two to eight send representatives to junior safety council meetings.

The meeting closed about 4:15. The attendance was approximately 200.

Safety Education in the Secondary School

Chairman—Dr. H. A. Bathrick, Associate Superintendent in Charge of Secondary Schools, Cleveland.

Dr. Bathrick called the meeting to order at 2:15 and introduced Dr. Herbert J. Stack, Safety Supervisor, National Bureau of Casualty and Surety Underwriters, New York City, who spoke on "Recent Developments in Safety Education in the Secondary Schools," as follows:

Why teach Good Driving in High chool? Whitney and Bacon in their admirable introduction to the new publication of the Education Division, National Safety Council, "Good Driving, a Manual for the High Schools," have answered this question for us.

1. A large percentage of high school students already drive cars.
2. An even larger percentage will wish to drive soon after their graduation from high school.
3. The accident record for the younger driver is not good; in fact it is considerably worse than that of their parents.

What should we teach?

I would choose rather to go into a discussion of this, to refer you to the best analysis of subject matter that has yet appeared. J. S. Baker in the subject matter presented in Good Driving has done an excellent piece of work. No person interested in the promotion of this work should be without this publication. I also might refer to the new courses prepared for the Dept. of Public Instruction in New Jersey and the forthcoming publication of the Dept. of Public instruction in New Hampshire and Pennsylvania, which are now ready for print. Likewise the forthcoming publication of the Dept. of Motor Vehicles in Virginia. These states have moved definitely ahead.

How shall this teaching be organized? How can we get these courses organized? This is by far the most important work for without this we can get nowhere.

Experimental courses and other activities in many localities such as Evanston, Providence, Kansas City and New Jersey have shown that the high schools are definitely ready for this work. Yet while there is a state of readiness or mind set on the part of principals there is much that we can do to get the work under way. There is much inertia on the part of schools and the principals are always very busy.

Marion Telford has presented an analysis of the methods by which the work may be organized in "Good Driving." This includes the Integrated Subject Matter, the Home Room Program, the Credit Course, The Motor Traffic Club Program, the Drivers School. All of these have their value but several may be only transitional steps through which we are passing to reach a more permanent form such as the Credit Course or the Drivers School.

Whatever method is employed in introducing the work it is most important that it have permanence. Activities which are here today and disappear in a year are hardly worth while.

I would like to speak briefly about one type of course in which I am especially interested. This is the Credit Course which has appeared in New Jersey and is ready for publication in Pennsylvania and New Hampshire. The Credit Course has its value in that it is given in school time, the student receives graduation credit for it, it is interwoven into the fabric of the school, it is taught largely by school people.

These courses are organized jointly by the State Depts. of Public Instruction, School Principals and State Dept. of Motor Vehicles. They have established subject matter and tests and on the completion of the course the Dept. of Motor Vehicles sends inspectors to each building to give the regular drivers' examinations, licensing students who are prepared and are old enough and giving certificates to others.

Commissioner Pringle of New Hampshire, in connection with this said that he looked forward to the day when it would be taught in all high schools and evening schools to adults, so that in a four-year period we might reach the point

where all applicants for drivers licenses would have to show a certificate of having completed a course. But this is the millennium. Yet New Hampshire, within a few weeks, will send out 5,000 copies of its new course to High Schools in the state.

Assuredly we are moving ahead. The schools were never so ready as they are today. We need only to keep aware of several criteria that should make these courses or lessons most effective.

1st. Whatever we set up should have some permanence—the school itself should take over the responsibility for a major part of the work.

2nd. The activities should be complete. Not alone the study of state and local regulations but also the full rounded course of what makes a good driver.

3rd. The work should be practical—and interesting, not all lectures and outside speakers. At least half the course can have definite practical implications requiring real activities on the part of students. Learning by doing rather than listening to lectures on what to do.

Practically every member of the audience participated in the discussion following Dr. Stack's address. Mr. Whitney opened it by distributing and commending upon "Good Driving: a Manual for the High Schools" recently published by the National Safety Council, Education Division. Dr. Gosling discussed "First things first in Education." The safety activities of high schools in Oregon, Michigan and Ohio were explained. Those in Oregon were found to be very similar to those described as being developed in Pennsylvania. In several secondary schools in Michigan the principles of good driving are being integrated with civics. This organization of material is interesting because it provides for instruction of all ninth grade students. Since the Michigan driving age is 14 years, it seems necessary to emphasize the importance of good driving at a relatively early date. The value of motor traffic clubs in the high schools of Pittsburgh was explained. Announcement was made of the distribution of 60,000 copies of a manual on driving and an abstract of the state traffic code among Minnesota high schools by the Minnesota Emergency Relief Administration, Safety Division.

After a full informal discussion the conference closed shortly after four o'clock Approximately 40 had been in attendance.

Luncheon for School Principals and Presidents of Parent Teacher Associations—Wednesday, October 3, 1934

Honorary Chairman—Mrs. W. C. Wulff, president, Cleveland Council of Parent Teachers Associations.

Chairman—Mrs. E. C. Stopher, president, Ohio Congress of Parents and Teachers, Kent, Ohio.

After introducing the guests at the speakers table Mrs. Stopher presented the first speaker of the meeting, Mrs. Hugh Bradford of Sacramento, California, past president of the National Congress of Parents and Teachers, who made a short appeal for cooperation between parents and teachers for the good of children. She emphasized the importance of cooperation in safety work and said:

"A safety program that involves the child must of necessity be one that is cooperative since all the elements which enter into the hazards of modern life affect children and are very largely beyond their control. These hazards are those of an adult world which is responsible for its young and too frequently does not provide adequate protection for childhood. It must be a program which technicians, expert safety advisors, and adults generally plan with intelligence and a sense of mutual responsibility. The program must be a continuous and persistent effort in providing safeguards and education so that the child may not only protect himself but also desire to protect others. Safety education is of a type that must carry through one's entire existence. It must be a part of all that a child experiences.

"The safety program of a community may well be considered as an index of the standards of that community. Where human life is held cheap and where no joint efforts are made to protect it, there is a community that stamps itself as

inferior; one of retrogression and of reprehensible negligence. To secure the best cooperation, experts and lay people must understand the necessary procedures, both technical and psychological, that will be valuable in interesting the public in assuming its responsibility. It must be one that is a bit dramatic, that is practical, that interests all types of adults and children. It must be presented to parents that homes may be made more safe; to teachers that it may be a part of each school curriculum; to citizens that it may become a part of the thinking and doing of all adults.

"It is incongruous for us to continue to build educational programs for children and adults in which we seek to train human beings to live happily and wisely, if we do not educate them primarily to safeguard life itself. That education should come from the wisdom of scientific studies, from the dynamic power of human ingenuity, from the overwhelming desire of a civilized world to conserve life. Each state, city and village is a nucleus for service in this direction. We who represent safety councils, parent teachers associations and other groups whose paramount interest is to move forward in this field, should act as messengers to carry from this fine convention, to our respective communities, the enthusiasm, information and zeal that has characterized these meetings."

The discussion of parent-teacher cooperation for child safety was continued by the next speaker, Mr. H. Ray Wagner, Columbus, Ohio, Safety Chairman of the Ohio Congress of Parents and Teachers. Mr. Wagner said:

"One of the major factors of this complete education of the child in this complex age is that of educating a child so as to live safely. This problem ties in closely with the home and school. Each have a definite responsibility and neither must fail. It isn't necessary to give you facts here today to prove that your children and mine are growing up in a dangerous age. As I analyze the situation, the human mind has developed a complex civilization which is far advanced from his own ability to keep pace with it. We are almost like the spoiled child who gets what he cries for and then doesn't know what to do with it. This fact has been proven many times—that our automobiles are capable of going faster than the average man, not mentioning women, has the ability to handle safety. We should have governors in our automobiles until we catch up with them.

"This subject is of vast importance. I believe we are in an age where parents and teachers are working together for the best interests of the children. I believe parents are living more for their children than ever before. We parents have reason to be proud of our children and to appreciate them. One of our biggest jobs is to *keep* them safe and train them to keep themselves safe. Safety must be accomplished by education and this must begin at home and continue through school and even longer. Safety depends largely upon acquiring of certain habits and these must be cultivated early in life and correctly. Habits determine what and how we act in an emergency and means life, death or injury."

The meeting was adjourned at approximately two o'clock and the audience urged to return to the Cleveland Hotel for the meeting on Home Safety. The attendance at the luncheon was approximately 185.

THURSDAY MORNING SESSION

October 4, 1934

The session was devoted to the problems of Vocational Schools. Gordon C. Graham, safety engineer, Detroit Public Schools, called the session to order and presided during the morning. He first gave a brief resumé of the year's activities and then called upon the first speaker.

Safety in School Shops

By FRANK C. MOORE

Supvr. of Industrial Arts, Cleveland, Ohio, Public Schools

The speaker said in part:

I feel that in approaching the subject of safety in connection with shopwork it is probably better for me to spend some little time on the philosophy and analyzation of teaching rather than on the detail of instructional aids.

Teaching to me is the "occasioning of those activities in the mind of the learner that results in knowledge, power and skill." In analyzing the definition we realize that the job of teaching requires the creation of mental activity on the part of the learner. Realizing that mental activity in itself does not assure definite results we must control this activity so that it will result in definite, desirable knowledge. Certainly, safety education is a basic requirement for life. And we positively know that it is effective in the industrial arts program only insofar as it results in safe habits, attitudes and procedures on the part of the pupil.

Knowledge can be superfluous if we do not gain power to use it towards desired ends.

Even with a fund of information and the power to use it, we shall fail if we have not developed the skill necessary to make us efficient users of the knowledge we possess. The man who never develops power to use his fundamental knowledge and never requires skill in its proper use has not become properly educated.

Industry today has become highly automatic and mechanical safeguards are common; yet we are amazed at the number of accidents occurring in industry. This must be the result of improper training.

The Cleveland Public Schools have 32,000 boys enrolled in industrial art works. During the past year there were no serious accidents—no accidents resulting in the loss of a member of the body. Thus our accident ratio was very low. Yet we know that industry has a *high* accident ratio. It makes us realize more and more that our problem in the public schools is not only the prevention of accidents there but the inculcation of habits of safety which will carry-over when our boys enter industry.

One of the reasons why safety education has become a major part of our program is that new equipment added during the last fifteen years has made shopwork more hazardous. In order to eliminate the hazards we have followed all the recommended guarding procedures even insisting on guards when they retard production. In addition we have given thought to shop layout, illumination, ventilation, noise, machine design, electrical outlets and switches and their location, shop maintenance, stock and tool storage, project storage, material storage and all other physical details which bear on safety.

We have realized that safety is a matter of right attitudes and right habits rather than mechanical perfection. So we teach safety. I shall describe the procedure which is followed in teaching the use of any motor driven machine.

First we teach the student about the power used to drive the machine; where it comes from; how it is fed into the machine; and how it is turned on and off. This is valuable whether the student goes into industry or not. It is important for anybody to know where the power comes into his home, where the main switch is and how to find it, where the fuse boxes are, how to turn off the main switch without danger. In other words, when we teach safety from the analytical standpoint, we have begun to start real safety education.

After this lesson we must teach the boy those parts of the machine over which he has control. In other words, he must know what parts are for him to adjust; what parts are to be inspected before operation, and what parts are automatic and *not* under his control. This is important because the student soon realizes that there are certain parts of machine for which he is responsible and that there are other parts that no amateur should attempt to adjust. If the machine does not operate correctly after he has made the adjustments, he should call in expert advice.

The next thing a boy should know is exactly what a machine is supposed to do. Every machine has its purpose and its limitations and these must be understood.

After the boy has learned where the power comes in; what he is responsible for and what the machine can do, he is ready to be taught how to operate the machine. These operations are definitely outlined in written form with visual aids. These are taught to him through demonstration, lectures, slides, movies and the actual operation of the machine under supervision.

All machines must be lubricated. Instructions on this are provided by the manufacturer, and these should be carefully followed in order to gain maximum results from the use of the machine. Boys should be taught to understand where

the machine is to be lubricated, the kind of lubricant to use and the periods of lubrication before they operate any machine. Attending to lubricating should become a habit with him so that no matter what kind of machine he operates he will think of its care.

Most machines used in school shops have cutters of various types. These cutters, in order to perform their job efficiently, must be kept in good condition. Boys should understand how to care for cutters. Anyone who has been taught to take care of tools usually becomes an efficient user of these tools. This is another means of developing right attitudes and habits in relation to machine operation.

Thus I have outlined a procedure to be followed in teaching a pupil to become an efficient, careful workman. We feel that if this procedure is followed and if the boy is required to go through these steps in analyzing the use of any machine, he will be trained in safe attitudes and safe habits which are bound to carry over into his future life regardless of the type of work he may enter.

Job Training in the School Shop

By F. H. ACHARD

Personnel Department, New York Edison Company, New York

The speaker said in part: Last summer at a conference on Plant Training, the leader expressed his opinion that there are four measures of a foreman—the way he handles ideas, materials, people, and himself. These are also measures of any person and also of the training program to which he has been exposed. I should like to examine them and to point out how they are affected by job training activities.

How Well Does He Handle Ideas?

No matter how simple a machine, even the skilled operator must exercise judgment and initiative in using it. Following a rule blindly may defeat its purpose. Economy of effort reflects the way a person handles ideas. As the old carpenter advised: "Measure twice and cut once."

To handle ideas effectively one must think scientifically and this implies paying attention to conditions, recognizing problems as they arise, obtaining and analyzing essential data, and drawing valid conclusions. The final test is action based upon these conclusions.

Job training, whether in school shop or in industry, should develop a person's ability to think scientifically. If the school can train its students to avoid jumping to conclusions, to be willing to admit ignorance, to plan work, and to forecast the results of each course of action, and if, in addition, it will give him a sound training in the subjects of communication and interpretation, it will have given the student the foundation for handling ideas effectively.

How Well Does He Handle Materials?

Handling materials might well be considered first. By this is meant the selection and use of all shop tools and equipment, operating materials, and supplies. This is, perhaps, the most commonplace of our activities, and yet millions of dollars are wasted annually through misuse and abuse of materials.

A friend recently told me of a college classmate who borrowed from him a pair of light pliers—and broke them while trying to cut a *tenpenny* nail.

Whenever a man is given a job, he should ask himself four questions:

1. What am I expected to accomplish?
2. Have I all of the necessary knowledge and information?
3. Are the material means at hand?
4. Do I understand the purpose and the information and have I the necessary skill?

The efficient use of materials involves a coordination of brain and hand. For example, industry has found that while a man may learn how to make a passable splice by following a prescribed procedure, he can make a better splice if he knows the "reason why" of the various operations.

Should not the school shop train its students not only in specific vocational skills and related knowledge, but also in habits of "good housekeeping," neatness and thoroughness, attention to details, the care of tools and equipment, in the practice of prescribed procedures?

How Does He Handle People?

A lineman had performed a job using all the necessary tools and protective devices and had descended the pole. The foreman was present. After the lineman had taken off his protective equipment he noticed that he had overlooked a small detail of the job. Therefore he again climbed the pole but omitted to put on one of his rubber sleeves. He came in contact with a high-tension wire and was killed. Did the foreman display good foremanship in this situation?

Good leadership is one of the elements in handling people effectively; another is cooperation; a third is good "followship."

Courtesy is the foundation of successful human contact. Perhaps less obvious is the fact that teaching and learning are the primary activities involved in human contacts. To illustrate: If a supervisor orders a certain job to be performed he must instruct the employee as to what he is to do and, frequently, as to method; and the employee must correspondingly learn. If two people are cooperating on a job they must study each other's point of view and come to an agreement.

While working in a manhole, a man cut into a live cable with a saw and caused a short circuit. An investigation showed that the foreman had failed to give specific instructions and had failed to ascertain whether the man knew which cable he was to cut.

Fundamentally, does not the school shop train learners and teachers just as truly as it trains craftsmen? Granted that the student must leave the school shop with a reasonable complement of material skill and knowledge, is not his equipment in the way of ability to learn and to teach even more important?

How Does He Handle Himself?

Handling oneself involves self respect, ambition, habits, attitudes. "To thine own self be true—." Perhaps the gist of the phrase is contained in *intelligent self-discipline*.

Willingness to follow orders, habits of cleanliness and neatness, attitudes of cooperation and team play, and, above all, intellectual honesty, are all evidences of intelligent self-discipline. Industry finds it necessary to devote a great deal of training to the development of these habits and attitudes. Are they not equally responsibilities of the school?

Without entering into an extended discussion of school shop techniques, I should like to point out what appear to me to be certain sound principles underlying them. I know that they apply to job training in industry, and I suspect that the difference between the industrial shop and the school shop is fundamentally one of emphasis.

A. Function

As a part of its function, the school should set the pace for industry in training, accident prevention, and similar matters.

B. Equipment

School shop equipment should be in a good state of repair, properly housed, and carefully maintained, but need not be of the latest model or design. The students should be trained to use and care for equipment intelligently. The room in which the equipment stands should be lighted in accordance with the best illuminating engineering practice.

C. Subject Matter

The school should not attempt to train students for specific vocational skills except when it is known that the students are to be absorbed into a special industry and that such trade practices are common to all employees in that industry.

The school should see to it that each student, according to his intelligence, is developed in the practices of scientific thinking. He should be given a thorough training in the applications of the fundamental subjects—the three R's—so that he can use them to advantage, and an adequate foundation in the subjects related to the basic skills he may be studying.

The art and practice of teaching and learning should receive major emphasis.

D. Students

Students should be as carefully selected for the school shop as they are for other departments of the school system. It is unfortunate that there has been a trend toward sending academic failures into vocational work on the basis of their failure alone. A competent craftsman requires just as much native intelligence as his academically inclined brother.

E. Teaching

The teacher should in fact guide and direct the teaching activities of pupils and should not let them flounder through by the trial and error method.

Safe practices and cooperation can best be taught by example and the inculcation of correct work habits.

Since intelligent discipline is of such great importance in life, the teacher should promote it in the school, both by his own practice in self-discipline and by exerting a common-sense discipline upon the students.

A Statewide Safety Program for School Shops

By CHARLES D. DAWSON

Assistant Sup't. of Schools, Grand Rapids, Mich.

Shop safety today consists in much more than saying, "Always whittle from yourself and you'll never cut yourself." Boys must be taught to keep their fingers out of cogs; their shirt sleeves and neckties out of fast revolving machinery; their hands away from buzz-saws and cutters; their heads below moving cranes; their feet from under heavy loads; and their bodies free from molten metal and electric sparks. The problem of school safety is now recognized as a difficult one and must be dealt with as an important phase of school work. Its solution will depend on the type of organization behind it and the degree with which suggestions and plans are executed.

Any organization for controlling shop accidents should be part of a broad state program.

The organization to conduct the program should include representatives of the office of state superintendent of public instruction; state supervisor of vocational education and home economics; state supervisor of the physically handicapped; an industrial safety supervisor; a leading superintendent of schools; a shop instructor who is familiar with the hazards of shop machinery and the technique of machine operation; representatives of the state police and highway departments; and a safety council manager.

From this general committee sub-committees should be appointed made up of those who are familiar with the hazards of the various phases of the work. A shop safety committee should be one of these sub-committees.

One of the first and most important jobs of each committee is that of fact finding. No problem in safety can be approached intelligently without knowing the extent and causes of accidents; without this information it would be mere conjecture to suggest remedies.

Only by careful analysis of accident records can intelligent remedies be applied. If, for example, we find that a large percentage of serious accidents happen in school shops because boys disobey instructions, then we know that our instructors are ineffective in presenting the problem of safety to their students. We can not overestimate the value of shop safety to students. It is more important for boys to learn safety in the shop than to learn the techniques of the trade which the shop purports to teach. Big employers will tell you that they prefer to hire boys who; first, can get along with their fellow men; second, have the right attitude toward work; third, practice sound safety principles; and, fourth, possess some small amount of training for their particular jobs. Safety is one of the most important attributes of any worker. Only by securing accident reports from shop teachers can we know conditions and wisely suggest plans for betterment.

A second important job for any committee is to energize teacher training institutions to give more attention to safety. Life itself is too precious to be sacrificed on the altar of carelessness for the mere want of proper training. I believe it was John Dewey who said that school is not a preparation for life, school is life itself. Today our educational philosophers are saying, "Be practical." Is there anything more practical than to teach children safe habits? I think not. Safety ought to be a part of every curriculum of every normal college and every teacher training institution throughout the land.

One of the important functions of a shop committee on safety is to present to instructors and pupils definite rules and regulations for the school shops. These instructions should consist of "do's," not "don'ts," because "don'ts" are always suggestive of the wrong way. Pupils must be so impressed with safety that they will be found doing things for safety that they have not been told or taught to do. This is an index of safety mindedness, which is of far greater value than guards or mechanical devices.

The plan which I have just outlined is practically the type of a statewide organization which has recently been inaugurated in Michigan by Doctor Voelker, superintendent of public instruction. Your chairman, Mr. Graham, is chairman of the state committee. The members of the committee have been organized into sub-committees and each sub-committee charged with specific duties. Shop safety constitutes the work of one of these. We have had three meetings so far and are soon to have a fourth. Each sub-committee submits its program to the general committee for criticism.

The committee hopes to interest every village, hamlet, and crossroad in the problem of safety. The cities of Michigan have for years wrestled with the problems of safety for its school children and have spent considerable sums of money, but the smaller places have done very little due primarily to lack of safety materials or definite programs.

Home Safety

WEDNESDAY AFTERNOON SESSION

October 3, 1934

The session devoted to a discussion of Home Safety problems was called to order by Dr. R. M. Little, former Chairman of the Home Safety Committee of the National Safety Council, who introduced Miss Rosamond Losh, Director, The Kansas City Childrens' Bureau, Kansas City, Mo., and new Chairman of the Committee, who presided. Miss Losh welcomed the delegates, outlined briefly the purposes of the session, and introduced the first speaker.

How Safe Is Home?

By HOWARD WHIPPLE GREEN

Secretary, Cleveland Health Council, Cleveland, O.

The speaker said in part: Many fatal accidents occur in the home. People are burned to death, they fall, are asphyxiated, suffocated, poisoned, strangulated, shot, run over or crushed by automobiles, electrocuted and even drowned at home. A total of 1,094 men and women, boys and girls, and babies died in Greater Cleveland from fatal accidents right at home, during the five-and-one-half year period, January, 1929, to June, 1934.

When this number is compared with the 1,495 automobile accidents occurring in the Cleveland streets during the same period, it may be concluded that perhaps it is nearly as safe to brave the buzzing highways as to stay peacefully at home.

Entirely too many accidents occurring in the home are fatal. In Greater Cleveland, including Lakewood, Cleveland Heights, East Cleveland, and Shaker Heights, in the five-and-one-half year period, January 1, 1929, through to June 30, 1934, 1,094 such accidents occurred. By far the largest proportion of these accidents were caused by falls—569, or 52 per cent. The next largest number, 263, or 24 per cent, were caused by burns. Carbon monoxide caused 119, or 11 per cent; mechanical suffocation caused 26, or 2 per cent; poisoning of various kinds caused 52, or 5 per cent; and other accidental causes of death accounted for 65, or 6 per cent.

It is notable that more than one-half, 56 per cent, of the deaths in home accidents of those under 15 years of age, were due to burns and 13 per cent to falls; while of those 75 years of age and over only 5 per cent were due to burns, and 92 per cent were due to falls.

Of the 569 fatal falls, 208, or 36 per cent, occurred at 75 years of age and over; and 152 or 27 per cent, at 60-74 years of age. Thus 360, or 63 per cent of the deaths due to falls were of persons 60 years of age and over. Twenty per cent, or 112 of the fatal falls, were among those 45-59 years of age; 10 per cent, or 56, among those 30-44 years of age; and 7 per cent occurred among those under 30 years of age. 28 under 15 years of age, and 13 between 15-29 years of age.

Of the falls, 36 per cent were in the age-group 75 years and over; 28 per cent in the age-group 60-74 years, and 20 per cent in the age-group 45-59 years; while 17 per cent were in the age-group under 45 years.

The persons who died from carbon monoxide poisoning were largely in the group 30-59 years of age, with a few in the early years and a few in the later years of life. Mechanical suffocation occurred among the very young—81 per cent of all such deaths occurring in the age-group under 15 years. Poisoning also occurred among the young—40 per cent in the age-group under 15 years.

The largest number of fatal burns occurred at the youngest ages and in the poorest sections of the city. For example, with 26 per cent of the Cleveland five-city area under 15 years of age, as many as 46 per cent of the fatal burns occurred at these ages. And with the area divided into four economic quarters, each including one-fourth of the total number of families, the lowest economic quarter is seen to have experienced 48 per cent of all fatal burns; the next higher, 28 per cent, while the third economic quarter had 16 per cent, and the highest economic quarter only 8 per cent of all fatal burns.

The deaths due to mechanical suffocation divided themselves into two classes, the first including 20 of the 26 deaths. They were largely babies under one year of age.

These children died from being smothered under bedclothes, blankets, pillows, etc. In most cases they were asleep. Young children were involved, 18 under one year and two at the age of two years. Most of the group under one year were under 3 months of age. One baby, three months of age, was suffocated between mother and father. Another baby, two months of age, was suffocated while asleep on his face on a davenport. A child, two years of age, was dead in her baby buggy with her head buried in a pillow. One child, four months of age, suffocated while vomiting.

The second class included five adults between 36 and 59 years of age. These people were suffocated by smoke from the burning of their homes. Sixty per cent, or three of the five lived in the two lowest economic quarters.

A total of 52 persons accidentally poisoned themselves. Twenty-one were under nine years of age, six were 15-29 years of age, 11 were 30-44 years of age, nine were 45-59 years, and five were 60 years of age and over. Among these, six died from eating mushrooms.

Nineteen persons died from scratches, cuts, and crushings. All of these but one were adults. One was a two-year-old child whose eye was injured by broken glass when a ball from outside was thrown through a window pane.

Thirteen persons died from strangulation. Six of them died while eating, four from swallowing foreign objects, two while playing with a rope, and one while sleeping.

Nine persons were accidentally shot. Their ages ranged from a three-year-old girl shot by her brother, a six-year-old by a boy friend who found a gun in a mattress, a 14-year-old shot by a rifle, a 17-year-old girl shot by her brother, to a boy 18 years of age who was shot while playing with a gun. A man, 21 years of age, was shot while cleaning a revolver. A girl, 23 years of age, was shot in a scuffle. A man, 26 years of age, was shot while examining a pistol. A man, 38 years of age, was shot in his yard by a stray bullet.

Eight persons died at home from automobiles. Three of them were only one, two and three years of age. The other five were 18 to 91 years of age. The one-year-old child was struck by an automobile. The two-year-old was backed over. The three-year-old was crushed between the garage door and a truck. The 18-year old was crushed against the garage door when a jack let go. The 22-year-old was crushed between two automobiles. The 28-year-old man's skull was crushed while under an automobile when a jack let go. The 42-year-old man was run over when cranking an automobile. The aged man was struck by a coal truck in his yard.

Seven deaths were due to drowning at home. Two of them were at birth. The others were 32 to 56 years of age and were drowned in bath tubs.

Nine other persons met deaths from home accidents. Five of these were electrocuted. There was one 14-year-old boy electrocuted by an electric heater while in bath tub. One man, 30 years, and one 33 years of age, were electrocuted working with electric wires. The younger man was connecting an extension cord in the basement. A woman 72 years of age was electrocuted while ironing.

Four other persons died as follows: A nine-year-old boy was hit in the head with a brick while playing a game; a 16-year-old boy was killed while jumping over a picket fence. A 21-year-old woman was found in a chair frozen to death. An 87-year-old man died as a result of twisting his leg in turning.

How Home Fires Are Caused

By R. B. CRISWELL

Ohio Inspection Bureau, Columbus, O.

The speaker accompanied his talk with a number of striking illustrations demonstrating how easily fires of various kinds may be caused, and spoke in part as follows:

How often have you struck a match, waved the stick a couple of times and then carelessly tossed it aside while still aflame? Such thoughtlessness has been the cause of several huge conflagrations and has destroyed countless stores and homes. And do you still strike matches in a haphazard manner, on any convenient surface, without paying much attention to the flaming splinters of wood or glowing bit of chemical which may ignite in adjacent combustible material, set your clothing afire, or burn your flesh? From the Canadian Indians of the northwest woods, we learned the proper method to use when discarding matches. Always break the match stick before throwing it away, thus automatically knowing that if it is sufficiently cool not to burn your fingers, it will do no other harm.

The combination of smoking and matches heads the list of causes of our great national fire waste. Now, I do not want to pose as a blue-nosed reformer and seek to deny you the enjoyment of good tobacco, but if you must smoke, make it a safe habit—be very careful where you park your cigarets and how you discard your matches, and especially, I plead with you not to smoke in bed. If you just have to smoke in your bedroom, then keep your feet on the floor. Never put your head on that downy pillow with a cigaret in your lips, or you may wake up in eternity or in the horrors of hell on earth.

When your house was wired, probably several years ago, electricity was used principally for lighting. Since that time you have acquired numerous appliances each of which used more current than a group of lamps. You have probably also installed many convenience outlets with electrical cords festooned and draped almost everywhere. Finally, your wiring cannot conduct the heavier load imposed upon it and something gives way. Probably the first fuse "blows." That silent sentinel or safety valve gives you a warning which a wise man will heed. But let us see just what usually happens—in fact, far too often.

(The speaker had a small doll house, which he explained was constructed with electrical wiring in similar fashion to the usual home. Suddenly this little house burst into flames.)

Here is a typical wiring setup in an ordinary home. Dad comes home in the evening, wants to read the paper a bit before he eats and turns on a light. Sister has a date with the boy friend tonight and is upstairs using the curling iron. Mother starts to get supper and plugs in the percolator or toaster. All these require more current than the system will stand and the fuse blows. Well, every smart-aleck fellow in town thinks he knows just what to do in a case like this, so you, like all the others, dig down in the pocket or rob the baby's bank to get a penny, screw out the fuse that died while doing its duty, and put the penny back of it. Now, lets see what happens. Somewhere in your electrical system the overloaded wiring is going to get red hot and set fire to its own insulation and any combustible material near it. When you go home, check those fuses. Take the pennies out from behind them and see that in the future your circuits are not overloaded. Remember that fuses with a hexagon or six-sided cap are 15 ampere or less and are right for branch circuits, while those with round holes in the caps are up to 30 amperes and are not main line loads. Don't let them be abused.

One of the earliest electrical appliances, commonly used, was the iron. All firemen know that very often they are called because someone was careless about doing this ordinary household duty. Perhaps the doorbell rang, or the telephone, or maybe the baby fell out of the crib; anyway, the iron was not correctly placed on a proper stand, and a fire resulted. The great Wanamaker home in Philadelphia was destroyed by a fire from this cause, with a loss of one and a quarter million dollars. See that your electric irons are equipped with safe cords, with stands providing at least one inch of air space from combustible material and if at all possible have a pilot light or temperature-limiting device.

Spontaneous ignition is another cause of home fires, and (you will observe) our doll house is afire again. Let's see what it is this time. Here it is—an oily mop was carelessly placed under the stairway. In nature there are certain oils, fibers, etc., which when left in a closely confined space, decompose rapidly, generating heat, and at last burst into flames. Oily mops in the home, oily waste in garages, and industries, and painters' rags anywhere, are the worst offenders. When you go home take your oily mop out from under that dark stairway, put it in a can with a close-fitting lid and keep that can off of a combustible floor. Always keep oily waste in a proper metal container, and never put painter's rags anywhere except in a furnace.

Here is a common toy doll made of "celluloid." But this innocent looking toy represents a very serious hazard. When your mother was a little girl, dolls usually had a porcelain china head and a rag body. They were dearly beloved, although often tattered and torn. But the modern child faces an extreme hazard even in her innocent play. Some well-meaning uncle or aunt purchases a bright new shiny doll at the dime store, presents it to the youngster and immediately it is adopted into the doll family circle, perhaps becoming the most cherished of all. But this doll is made of a substance commonly called "celluloid" or technically "pyroxylin plastic." This is really a modern commercial derivitive of that powerful war-time explosive—gun cotton. (At this point the speaker touched a match to the little doll and it blazed up furiously.) Just imagine your baby, rushing in to try to rescue her prized dolly, and becoming horribly burned in that fearfully intense devastating flame.

Many modern toilet articles, such as combs, pin trays, etc., are made of this same substances and if they are heated (as by a curling iron), may start a disastrous fire. Not long ago I was putting on a demonstration like this in Clarksburg, W. Va. Afterwards a newspaper reporter came up, showed us one hand all twisted and scared and said, "When I was a little fellow, I had a comb in my hand, got too near the grate, it caught fire and I couldn't even let go of that sticky flaming mass." A woman in Dayton had her hair all full of wave set combs, which became ignited from an electric appliance, horribly burning her scalp, face, arms and body.

You have all heard of coal dust explosions in mines, but do you realize that in your home at least two every-day articles are equally explosive—ordinary flour and corn starch? Many tests made by the Bureau of Mines show that not only are these just as explosive, but that the flames travel at the rate of from one-half mile to a mile a minute, doing an immense amount of damage such as the wrecking of mines, grain elevators, flour mills, etc. (The speaker placed a small amount of corn starch in a gauze bag and dusted it out over the flame of a candle. The dust burst into a great blaze of flame.) Even in the home there is danger. Not long ago a woman in West Virginia was badly burned while making gravy and sifting flour into it. A flimsy dress could be very easily ignited that way.

Even as innocent a looking thing as a fish bowl full of water may start a fire. One would hardly believe that possible. But the sun's rays, shining through the bowl filled with water, may give to it a burning glass effect, focusing the hot spot on the nap of a rug or other combustible material. A considerable number of fires have been traced to this source. Just recently while delivering this talk in Pennsylvania, the president of a State Normal School stated that a fire in his home had been started in just that way. The same effect may be produced by a defect in window glass. A serious of mysterious fires in the silk sifters of a flour mill at Belle Fontaine, Ohio, was finally noted as occurring at about the same time each day—when of course the sun's rays were properly focused.

Every few days we read of someone who has been burned by trying to quicken a fire with kerosene. Such tragedies keep occurring and recurring. Perhaps you think that you are not interested if you live in a town as you do, but maybe you

have some country cousins that you can convince. Tell them how dangerous and foolish this is.

The attempt to save a little money by doing dry cleaning at home is a mighty dangerous thing to both life and property. Here is a carton containing a bottle of a rather well-known home cleaning compound. It is an innocent looking fluid, carrying with it a pink sheet, listing about fifty uses. Of course, it will clean hats, dresses, gloves, etc., and the sheet even says it will destroy cockroaches or kill fleas on a dog. However, nothing is said about the hazard to human beings except way down here in the fine print somewhere it says a little bit about "Keep away from flames." Just this slight concealed intimation that this breakable glass bottle contains sufficient explosive fury to destroy your life or wreck your home.

In order to demonstrate that this liquid explodes with terrific violence, I am going to put a few drops of it in this can having a compression lid. The can itself is innocent enough and to show you that there is nothing in it, I am going to put a candle flame deep within it. Very soon after there isn't even sufficient oxygen in there to support a flame, and the candle goes out. Now about three to four drops of the supposedly safe liquid will be placed in the can, the lid rapidly pushed into place and the can set over on this bracket. The candle flame is placed beneath the can and very soon those few drops are vaporized to their explosive range, and when the flame is transmitted through this priming hole at the side it lets go with terrific violence. Now, if three or four drops will do that, just imagine what a bottle full might do.

To die of burns is a horrible, terrible death, but even worse may be your fate if you pay no attention to these common fire hazards which are but violations of common sense. In each instance I have shown here, someone was careless. In many cases the unfortunate victims did not know how to protect themselves.

Remember that if you are caught in a burning building, do not open doors and windows to create a draft and spread the stifling flames. If you are so unfortunate as to catch fire, don't run, but drop down and roll over and over slowly, meanwhile protecting your nose and mouth against breathing the flames. If you ever see anyone else afire, try to throw them down and then smother the flames with a rug or other convenient material.

If you ever have to turn in a fire alarm, be as calm as possible. Don't stop to look up the number, for the numbers in the book would be all jumpy anyway. Just take the receiver off the hook, wait until the operator comes on the line and then say, "I wish to report a fire." Then tell the operator clearly the location or address. If the phones in your town are of the automatic type, dial the zero, wait for the operator and do as you just were told. If you are in a city where there are fire alarm boxes, rush to one and then carefully follow the directions plainly printed thereon. Perhaps you will have to break a glass and open a door before you can pull down the hook. But always pull the hook down, just once, then wait at the box to direct the firemen to the proper location.

How Can Home Safety Be Put Across in a Community?

A "Panel Discussion," participated in by various persons, as follows:

By R. L. FORNEY, Statistician, National Safety Council

It will be very difficult to obtain continued interest in a community home safety program unless records are currently available showing the seriousness of the home accident problem in that particular community. National information on home accidents is interesting and useful at times, but unless localized data are also obtained the people are likely to feel that the home safety program is a good thing for other folks but not necessary for them.

There are three approved methods of obtaining information on home accidents in a community:

1. Information on home accidents resulting fatally can be obtained from the Registrar of Vital Statistics in the local Health Department. The law requires every death from whatever cause to be reported to this official, and the home accidents deaths should be specially summarized by him, or the death certificates made available to someone else for summarizing. Complete information on how to do this job is available in the National Safety Council's Public Safety Memo No. 72.

2. Most serious accidents now receive hospital treatment. Information on serious home accidents, therefore, may be obtained by obtaining the cooperation of the local hospitals. In several cities, all hospitals are cooperating in the preparation of a monthly tabulation to show the number, and type of home accidents, and the hospital costs. Complete information on this process is obtainable from the National Safety Council.

3. Many school systems now maintain complete records of all accidents to students which cause absence from school. Home accidents are important in causing such absence, and wherever the school system is obtaining and tabulating these records, the data on home accidents to students become available. The forms used in this student accident reporting system, together with an explanatory memo, are available from the National Safety Council.

Reliable national information on home accidents will become available only as local communities obtain the facts and transmit them for services of national summaries. The National Safety Council regularly collects this information from a number of cooperating cities and publishes the results monthly on the Statistical Page of the Home Safety News Letter, and annually in "Accident Facts." The Council is ready at all times to assist communities who want to get the facts about home accident.

By MRS. F. T. CHAMBERLAIN, Erie, Pa., Parent Teacher Associations

For the teaching of safety, the preeminent time is childhood and the preeminent place is home. It should begin with the infant. It should be an integral part of all he learns. He should receive sympathetic and kindly guidance in his learning process; he should be encouraged and shown how to do things the safe way. His first safety lessons are given as he takes his first step. The wise parent watches, guides, and prevents the injuries that would cow and discourage him. The wise parent also sets an impeccable example.

By DR. A. J. PEARSE, Coroner, Cuyohoga County, Cleveland, Ohio

Home safety work as it appears to the coroner reveals many facts that the average individual does not see or know about. The glaring fault of home accidents is *carelessness*. My investigations show that the use of drugs in the home, for example, is too promiscuous and too careless. Bichloride, the cause of many accidental deaths, should not be used in the home under any circumstances, for two reasons: First, its dangerous character; second, its small value in this day as an antiseptic. In my opinion, bichloride should be stricken from the pharmacopeia. Very few physicians use it. All liquid antiseptics should be carefully guarded. Medicines should not be left around the house. The use of hypnotics is dangerous; yet thousands of people buy these drugs unrestricted.

An educational plan is the way to reach the home. The individual who teaches safety must be practical, forceful and tactful. The family physician should play an important part in home safety, instructing the family about the use of drugs—what they should have in the house and what they should throw away. In my opinion, the physician should accept this responsibility with much more concern than he is doing at the present time.

Poor equipment and carelessly used equipment, cause many accidents. Poorly ventilated and operated stoves, carelessness in using heaters, faulty electrical equipment—these have all been the cause of untimely deaths. As Coroner of a large county, I can say that the majority of all home accidents are absolutely needless.

By DR. H. L. ROCKWOOD, Director, Mt. Sinai Hospital, Cleveland

Education for the prevention of accidents must go hand in hand with education for the treatment of injuries. One particular form of injury not dealt with enough is the dog bite. In all large centers of population the dog population is constantly increasing, and in recent years the large type of animals has become more common, such as police dogs. The injuries those dogs can inflict are serious and the ques-

tion of whether or not the dog which does the biting has rabies is most important because rabies in human beings is an incurable disease.

Prompt cauterization of bites will do as much to prevent rabies as the Pasteur treatment, but the cauterization must be done at once and before one even knows whether or not the animal has rabies.

Education of this kind will prevent many deaths.

There are other modern, well-tried methods of saving life in the treatment of home injuries. The tannic acid treatment of burns is to be recommended.

It should be part of our plan to stress adequate and proper treatment of injuries while our efforts to prevent accidents go on. As a matter of fact, education for first aid is excellent training for accident prevention.

General Discussion

A general discussion followed the panel in which it was agreed that the following organizations should cooperate in the home safety program:

1. Parent Teachers; 2. Visiting Nurses; 3. Granges and Farm Bureaus; 4. Boy and Girl Scouts; 5. Schools and Colleges; 6. Churches and Sunday Schools; 7. American Legion Auxiliaries; 8. Service Clubs; 9. Red Cross; 10. Pre-School Circles. (Work to be correlated by the central Home Safety Committee.)

(2) That the *Home Safety Committee* should be made up as follows: 1. Chairman of Publicity; 2. Contact Chairman; 3. Chairman of Finance; 4. Chairman of Speakers; 5. Chairman of Statistics; 6. First Aid Chairman; 7. Accident Investigator.

(3) That such a campaign requires: 1. Printed instructions; 2. Wide variety of publicity methods; 3. Finance.

(4) And that money can be raised by conducting: Benefit Bridges, Luncheons, Flower Shows, Musicales and dramatic entertainments. (Membership dues and donations and help from such community social agencies as the Community Chest and Chamber of Commerce would aid also.)

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MEMORANDUM

MEMORANDUM

1935

TRANSACTIONS

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Incorporated

TWENTY-FOURTH ANNUAL
SAFETY CONGRESS

Louisville, Kentucky

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Foreword

THE TRANSACTIONS of the Twenty-Fourth Annual Safety Congress, National Safety Council, 1935, are published in two volumes. This volume, the first, contains the general sessions, the special subject sessions, and the Industrial Section sessions. It is supplemented by a smaller volume containing the sessions of the Street and Highway Traffic Section, the Child Education Section and Home Safety.

All industrial members of the Council automatically receive the large volume. The smaller is sent to members believed to be chiefly interested in the sessions it covers. It may, however, also be secured by other Council members upon request.

Many members have found it worth while to distribute copies of these Transactions to supervisors, foremen and others in an administrative or supervisory position who may make practical use of them for reference purposes. For the benefit of those who desire extra copies the following quantity prices are quoted: One to ten copies of the large volume, $1.50 each; eleven copies and over, $1.25 each; copies of the smaller volume, 50c each.

IN ACCORDANCE with the plan of publication followed for the past several years the Transactions are published again this year 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. In other words, 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 any injury to the technical aspects of any address. The original manuscripts are on file in the library of the National Safety Council, where they are available for additional reference. In several cases, 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, but 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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National Safety Council

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Council Purposes and Policies

The fundamental purpose of the National Safety Council is to conserve human life. It seeks this goal through a continuous campaign of accident prevention that is nationwide in scope, applies to all lines of hazardous activity, and directly or indirectly reaches our entire citizenry. It is a non-profit organization, non-sectarian, and free from political affiliations. Since its organization in 1913, it has won respect as an essential national institution.

Inseparable from accident prevention is the Council's work in improving health conditions and preventing vocational diseases in American industry.

Today there are 4,000 members, representing every state in the Union, and many of the Canadian provinces. There are 400 foreign members. The membership includes industrial corporations, firms, individuals, public officials, schools, chambers of commerce, clubs and civic organizations. About 70 per cent are industrial concerns, including the big steel companies, the oil companies, most of the railroads in the United States, the automotive industry, and others of outstanding importance in our national industrial field.

Origin and Growth

The history of the Council is an absorbing story. Unfortunately it cannot be detailed here. Suffice to say that the First Co-Operative Safety Congress was held under auspices of the Association of Iron and Steel Electrical Engineers in Milwaukee, in 1912, and, as a result, the National Safety Council was organized in New York the following year with fourteen members. During the first year the membership increased to 971.

The pioneers of American safety went to work on the sound premise that accidents were an unnecessary part of our social order and that through application of proper remedial measures they could be avoided. They set about to nationalize this theory, and to develop the detailed methods and materials through which accidents could be prevented. The members of the organization now are more than ever convinced that accidents are unnecessary and that they can be and are being prevented. Striking examples of reductions in many different fields prove this contention.

Results of Organized Safety

Since the National Safety Council was organized in 1913, the national accident death rate in all fields excepting motor vehicle has been reduced 38 per cent. The motor vehicle accident problem continues to be a serious one. While there was a slight decline in fatalities in 1932—the first drop that ever occurred—1933 witnessed a slight increase. 1934 deaths reached an all-time high, and the 1935 record will probably show no improvement. 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 bright spots 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 and the best results are to be expected in this field. Here spectacular achievements have been made. The steam railroads, for instance, have reduced the accident rate among employees 73 per cent during the past eleven years. A group of our largest steel industries have cut their accidents 90 per cent since 1913. Every year, scores of industrial establishments go through the entire year without a single disabling injury among their employees.

Along with these reductions the whole psychology of accidents has changed.

Employer and employee both look at the proposition from a different viewpoint than they did some two decades ago. Accidents *now* are really out of date. In many plants they are considered a disgrace that casts a cloud over good management and efficiency. There is very little room today for the careless worker in modern industry.

Looking Ahead

The safety problem is a universal one—and always will be—just as long as human beings inhabit the earth. Safety applies to everybody and to everything, physical or material; to every human act, to every man, woman, and child. It is only natural, therefore, that the idea which seems to have so firmly taken root in the United States should branch forth into other countries of the world. Organizations similar in purposes and activity to that of the National Safety Council have sprung up in many countries. Council posters have been widely copied for foreign use and several Council publications have been translated into other tongues.

All of these are hopeful signs of the times in the world of Safety. The National Safety Council is still young—as institutions go. A great amount of worth-while work has been crowded into its short life. Foundation work is always slow, whether one is building safe skyscrapers or safe men. The National Safety Council has been digging away at the bed-rock of public consciousness. It has made real progress and its achievements furnish ample inspiration for continuing its humanitarian efforts.

* * *

Cooperation

The purposes and policies of the National Safety Council are not always understood by those not in close touch with the Council's work. To meet the need for a brief and definite 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 efficiency 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 14, 1935

The Annual Meeting of Members of the National Safety Council at the Twenty-fourth Annual Safety Congress, assembling in Louisville, Ky., was called to order by John E. Long, president, who presided. An impressive invocation was given by Dr. Joseph Rauch, Rabbi, Temple Adrath Israel, Louisville.

The secretary having advised the chairman that a quorum of members entitled to vote was present in person or by proxy, the formal roll call was dispensed with. Chairman Long introduced Honorable Neville E. Miller, mayor, City of Louisville, who made a cordial address of welcome. He said: "I welcome you especially because of the great humanitarian movement which you represent. We in Louisville are heart and soul in it. I think you know that we are among the leading cities of the nation in industrial safety work. Our factories are fully cognizant of the responsibilities they owe their workers and year after year they have turned out wonderful records in accident prevention. I am truly proud of their achievement."

Mr. E. J. O'Brien, Jr., president, E. J. O'Brien & Company and president of the Louisville Safety Council, welcomed the National Safety Council delegates on behalf of the industrial and business interests of Louisville. Mr. O'Brien said: "It affords me genuine pleasure to extend to you the cordial wishes of the industrial and business interests of this community. I need not call your attention to Louisville's place in the industrial life of America, except to point out that our industrialists look to you, too, for guidance, leadership and inspiration in carrying on a continuous and a militant drive against accidents."

Chairman Long responded to these welcoming addresses with a few brief words of thanks and appreciation, and then read his annual address to the National Safety Council.

The President's Address

By JOHN E. LONG

President, National Safety Council; Superintendent of Safety, The Delaware & Hudson Railroad Corporation, Albany, N. Y.

Before I render on behalf of your Directors, Executive Committeemen and Officers an accounting of their conduct of the affairs of your Council during the past year, permit me to exercise my highly valued privilege of extending a most cordial greeting to you—to members, representatives of members, public officials and guests—all gathered here to attend the Twenty-Fourth Annual Safety Congress of the National Safety Council.

There can be no more convincing evidence of the real worth of the cause to which you have devoted yourselves, nor of the truly democratic character of the institution which you have created in its service, than the strikingly large numbers in which each year you come together to dedicate yourselves anew to the support of that cause, and to determine how its service may best be advanced and enlarged.

I am once more impressed with the constantly increasing interest in the great Safety Movement and with your clear understanding that only through the personal participation and cooperation of all members of the Council can the cause of Safety

be advanced as it should be and our organization retain its proper and important place in the lead of accident prevention effort.

Without such participation and cooperation, the best efforts of those to whom you have entrusted the activities and management of your affairs could not have achieved anything like the same measure of success and the Safety cause would not be what it is today—a National movement of widest range and with practically unlimited possibilities.

Eleven years ago the National Safety Council held its Thirteenth Annual Congress in Louisville. It was an event that we have remembered with pleasure for the gracious hospitality extended to visiting delegates and for invaluable aid to the cause of Safety. To the officials and citizens of Louisville, I express the heart-felt appreciation of the folks who represent the Safety Movement. We are grateful for your continued interest in safety and for the cordiality of your welcome to this Congress. We know that we will profit by the interchange of experiences and by the fellowship of this gathering and we know that the City of Louisville will share richly in the benefits.

Let me take this opportunity also, of expressing the grateful appreciation of the Safety Movement to all who have contributed to the work. This Congress represents the cooperative efforts of many minds, freely given in a worthy cause. It makes available a vast fund of information which will aid us in the conduct of our work during the coming year. To the speakers and to those who have served on the various committees, we are indebted for a devoted service which makes the work of accident prevention a living, vital force.

I am especially pleased this year to note the presence of so many worker delegates. Let me emphasize the point that safety work is not merely an activity for a limited specialized group—the safety engineers. The work of preventing accidents is as broad as life itself. It is concerned in every activity of our daily lives, and it involves men, women and children of every age and of every profession and occupation.

Accident prevention in industry has been a joint endeavor of executives, of supervisors and of workers, with the safety men giving the benefit of their specialized experience and training. This splendid representation, I am convinced, is the underlying reason for the outstanding accomplishments of organized safety work in American industry. When we have the same wide participation in safety activities outside the factory walls, we will see amazing results.

It seems hardly necessary for me to remind you of the disheartening accident experience of the past year which has been displayed prominently in newspapers throughout the entire country. In recent months the world has been startled by the accidental deaths of several prominent persons. An airplane crash in the Arctic wastes claimed the lives of a beloved humorist and an intrepid aviator. An automobile accident in Switzerland resulted in the death of a young queen whose character and charm had endeared her to her subjects. For the second time within two years, accidents brought mourning to the whole kingdom of Belgium. The same causes that bring death to humbler persons care nothing for the rank of the prospective victim.

I believe that the headlines of these tragedies have helped to bring home the seriousness of the accident menace and they must have convinced the public that an accident is no respector of persons.

Industry has shared in the unfavorable accident trend but the bulk of the increase has been in public accidents, particularly those involving motor vehicles. It is appalling to realize that more than 100,000 of our people met accidental death last year. If this toll is not checked, it staggers the imagination to estimate the number of lives that will be lost and the number of people who will be crippled during our lifetime.

We cannot ascribe the increase in public accidents to any one cause alone, speed, alcohol, laxity of law enforcement—all of these have contributed their share to the heavier casualty lists of the past two years.

Speeds on the highways are definitely higher than they were a few years ago. We must face the fact that people are no longer satisfied to travel at 35 miles an hour and many of them are impatient at 45. The modern automobile is a marvelous piece of mechanism, but no amount of engineering skill can make it any safer than its operator. Any current model car can be driven much faster than the average driver's reflexes will permit handling with any reasonable degree of safety.

While speed is involved in only a small percentage of the total number of traffic mishaps, we cannot escape this significant fact—that nearly two-thirds of the fatalities to occupants of cars occur at speeds in excess of 45 miles an hour. Today an ordinary individual may have at his command more horsepower than was even dreamed of a few years ago—often far too much for his skill and judgment.

The other menace which is being brought forcibly home to us is the use of intoxicating liquors by motorists. While the menace of the drunken driver should not detract our attention from the less sensational accident causes, we must include it among the reasons for the mounting death rate.

Alcoholism, like every other problem of human behavior, is far too complex to be solved by such a simple expedient as a jail sentence alone. Our trouble is not only the drunken driver, but the driver who has merely been drinking. It is going to be difficult to get public opinion to support drastic penalties for the motorist whose reaction time has been slowed down by two or three drinks.

Let me make it clear that the National Safety Council does not recommend a multiplicity of laws as a cure for present conditions. The Council, however, does recommend uniformity of traffic ordinances throughout the country, with just enforcement of reasonable regulations. The Council also urges the extension of drivers' license laws with adequate examinations as a means of keeping the obviously unfit off the highways and as a means of control over all motorists.

I think it is becoming increasingly evident to all of us that the present trend of motor vehicle deaths will inevitably result in more drastic methods of control over motorists. It may even amount to regimentation, regrettable as such measures would be. It remains to be seen whether motorists can develop sufficient judgment and self control to forestall more drastic regulation. We must remember that the laws now on our statute books, including many that are unworkable, are there because some evil called for correction.

Legislation, as we all know, is often a cumbersome and inflexible way of dealing with a situation. It is sometimes necessary but its limitations should be distinctly understood. It cannot take the place of a sound program of education for both adults and children.

Our schools have made remarkable progress in training children in self-preservation, but present methods of training do not go far enough. As these boys and girls grow up they will be motorists as well as pedestrians. I believe that in the very near future every high school will have in its curriculum a course in motor vehicle operation. With this training in the mechanics of operation, there should be splendid opportunities for instruction in the morals and manners of motoring.

The engineering side of safety is also important but if we depend upon physical improvements alone, the results are sure to be disappointing. Our wide straight superhighways are by no means free from tragedies. These modern highways, like railway grade crossing separations, are often the result of a demand for efficiency rather than safety. The elimination of delay seems to be a more impelling motive than the removal of danger.

In the industrial field we find the problem of occupational diseases overshadowing many of our other problems. I am sure we would be happy if we could confine our activities to the humane work of prevention, but safety work cannot always be divorced from the complicated results of disability. So we find ourselves at times confronted with medico-legal situations. The safety movement has no sympathy with any effort to reduce accident costs by the avoidance of just claims but our whole system of compensation is complicated by some very human traits. Compensation, particularly in the field of occupational diseases where the responsibility is often vague, sometimes degenerates into a form of relief.

Industry must assume the responsibility for freeing its work places from sickness and accident hazards, but the employer has a right to be assured that he is not paying for a disability acquired elsewhere. I am convinced that public opinion will demand higher standards of industrial hygiene just as it began to demand safer factories and safer transportaton twenty-five years ago.

Our knowledge of industrial health hazards is still extremely meager. It must be augmented considerably in the interests of both the employer and the employee. Compensation cannot be stretched to include sickness insurance, unemployment insurance and old age pensions without danger of the whole system breaking down. Other plans must be made for these social measures.

When the safety movement started, few of us realized how complicated it was to become. A comparison of the program of this congress with a program of twenty years ago will show how far we have traveled.

Guards and education absorbed practically all of our attention then, and it was very elementary education at that. The safety movement has gone to college in the succeeding years. Medicine, psychology and engineering have made their contributions to the advancement of safety. We have taken many a lesson from the advertising profession in presenting our appeals.

Chemistry has contributed much to our material welfare and comfort, but it has also added some new hazards which call for intensive research.

We have learned much about the workings of the human mind and we have a better understanding of the whims of human behavior. We realize, too, the scope of our problem and no longer put our faith in cure-alls. Perhaps we have been too concerned at times with our own favorite remedies to get a complete picture of the problem. But we are beginning to realize that we must consider man's physical, mental and emotional sides in our efforts to preserve his life, health and happiness.

Let us turn now to the administrative side of the Council's experience during the past year. It is most gratifying to report a moderate degree of financial progress. While our income for the past year was about ten per cent greater than 1934, it was only slightly more than half of that for 1929, but careful management has enabled us to maintain the essential services to members.

However, there have been many important new activities which had to be passed by for the time being. Our communities are in urgent need of help with their safety problems and we have done much along this line, but limited resources have prevented us from taking the fullest advantage of opportunities for service. It has become clear to all of us that our public safety activities, on anything approaching an adequate scale, cannot be financed from our usual sources of income. Such a program must depend for its financial support upon public spirited individuals and organizations.

We speak of our accident problem as a national problem, but after all, it is merely a collection of community problems. In industry, safety is largely a departmental affair. The foreman and his men are the shock troops in the fight against accidents. But an army also needs a headquarters and lines of communication. Local organizations must bear the brunt of the work but some central organization is needed to supply information and encouragement. Our National Traffic Safety Contest has shown what a sound organization and a well-planned program can do toward making any community safer. We hope that other communities will also see the light and redouble their efforts toward this objective.

It has been gratifying to note the attention which safety is now receiving from national magazines. Some time ago the *Atlantic Monthly* blazed the trail with a series of safety articles, and other publications are finding safety an absorbing theme. Recent articles which have appeared in the *American Magazine* (Hoffman), the *Ladies' Home Journal* and the *Red Book* are deserving of your attention.

One of the most startling and widely discussed articles yet published, appeared in the August issue of *The Readers' Digest*. It is entitled, "—And Sudden Death." It presents a sickening picture of the human wreckage resulting from automobile accidents. It has been widely distributed in reprint form by members of the Council and by many other organizations. It is most unpleasant but profitable reading and it is to be hoped that those who read it will stop and think before endangering themselves and others on the highways.

Safety work, however, must not stop with horrible examples. The public's sensibilities must be jolted at times, but a steady diet of horror develops in the individual a protective callousness against shock. Our emphasis must always be on the constructive side.

We like to think of safety as being humane but we know that it is also utilitarian. When we see the continuing huge totals of accidents still occurring, many

may wonder whether accident prevention work is really getting results. Those of us who are close to the work have no doubts, but how do others feel about it?

Let me quote the opinion of one who is a lawyer rather than a safety man, but one who has had opportunities of observing the value of safety work as conducted in industry—I refer to Mr. Henry D. Sayer, former industrial commissioner of the State of New York. In a recent address before the American Bar Association he said: "I believe that safety work has been worth while, and I believe further that if we had not done what we have in this field, accidents would have been so many, compensation might have become so burdensome that the risk would have become uninsurable and industry would have broken down."

I need scarcely add that accidents in industry have not yet reached the irreducible minimum and that industry must still control all sources of waste if it is to show a profit.

Compensation laws focused our attention on the costs of industrial accidents, yet these comprise a comparatively small proportion of the total. Other accident losses, for the most part, fall with crushing weight upon the individual victim and his family. But the victims are not the only ones who pay. The accident tax, like any other indirect tax, is paid without our realizing it. We do not realize the terrific drain on our national resources, nor do we realize that for thousands of persons each year, accidents make the depression permanent. The case records of our organized charities contain ample evidence of the devastating effects of accidents and disability on family life.

By any standards of comparison, accidents rank high among our many serious social and economic problems. We are faced with a task calling for our best efforts, and it is from you who constitute the membership of the National Safety Council that the inspiration and leadership must come.

The Executive Committee having selected three inspectors of election, the chair appointed these men to act as tellers of the meeting, as follows: E. Ross Farra, Chairman; John P. Rostmeyer, and Walter E. Dean.

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

Report of the Nominating Committee

Chairman Long called for the report of the Nominating Committee, which was presented, in the absence of the regular chairman, by Mr. W. S. Paine, 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 1938.

"The names of the following directors, whose terms expire October 14, 1935, are submitted for re-election: A. L. Armstrong, J. I. Banash, J. E. Culliney, Lewis A. DeBlois, D. E. Harrington, G. T. Hellmuth, T. P. Kearns, Frank J. Lanahan, J. E. Long, Miller McClintock, H. L. Miner, John A. Oartel, C. E. Pettibone, General G. B. Pillsbury, Lieut. Col. H. A. Reninger, R. E. Solensten, Dr. C. H. Watson, Harry M. Webber, A. W. Whitney, and W. H. Winans."

No other ticket having been nominated, a motion was made and seconded to direct the secretary to cast one ballot for the candidates named for the terms for which they were nominated. This motion was carried. The secretary cast the ballot. It was properly approved by the tellers and their reports showed that 1,340 votes had been cast for the nominees and none against. The chairman announced the formal election of the gentlemen named.

Report of the Resolutions Committee

Chairman Long called for the report of the Resolutions Committee, and the following resolutions were presented by Mr. C. E. Bergquist, chairman of the committee, and were passed by the delegates:

WHEREAS, present trends indicate the total number of accident deaths for the year 1935 may again approach the *100,000* mark; and

WHEREAS, the 1935 death toll will probably be accompanied by more than 350,000 permanent injuries and more than nine million other injuries, representing immeasurable social loss and an economic burden of more than three billion dollars; and

WHEREAS, it is obvious that this costly, wasteful toll is due mainly: (1) to a shameful disregard of caution on our highways; (2) to the natural increase in the hazards in industry due to re-employment and increased production; and (3) to failure to recognize and give proper attention to the accident menace in our home life;

THEREFORE BE IT RESOLVED that the members of the National Safety Council assembled at the Twenty-Fourth Annual Safety Congress and Exposition in Louisville, Kentucky, do hereby pledge our untiring and whole-hearted efforts in carrying on unending warfare against the ever-present menace of accidents through a broad program of activities along the following specific lines:

(1) An organized, continuous safety campaign in every state and every city in our land.

(2) The use of unemployed labor under expert supervision, to analyze the traffic and other hazards in every community and to alleviate these hazards through physical improvements and educational measures.

(3) The adoption of uniform, up-to-date traffic laws and ordinances, including the universal enactment of standard driver's license laws.

(4) The intelligent, impartial enforcement of traffic laws, with emphasis on those places, those times and those violations producing the greatest number of accidents.

(5) The periodic inspection of all motor vehicles at properly equipped inspection stations, either operated or closely supervised by the state or city.

(6) Systematic safety instruction and training in elementary schools, high schools and colleges, including definite instruction in safe driving for every high school student.

(7) An intensified campaign of safety education for the public-at-large, directed toward the acceptance of personal responsibility for accident prevention; greater carefulness and better understanding of how to avoid accidents on the street, at work and at home; and toward the support of public officials responsible for safety.

(8) Continued research in the causes and remedies for occupational accidents and diseases, as well as those accidents occuring in public places and elsewhere.

(9) Acceptance, by all designers and builders of industrial and other machinery and equipment, of the principle that safety must be built into all manufacturing processes.

(10) Intensified efforts to get organized safety more securely established in the small plants, businesses and fleets, while continuing similar activities in the larger industrial units.

(11) Continuous and consistent efforts in marshalling the active cooperation of all interested agencies *in carrying safety into all our homes.*

* * * * *

WHEREAS, the Twenty-Fourth Annual Safety Congress of the National Safety Council, convening in the City of Louisville, gives every promise of being one of the most notable in the history of the safety movement, an achievement made possible not only because of the enthusiastic welcome of the body of citizens as a whole, but also because of the forethought, careful planning, intensive work and untiring cooperation of many trade bodies, technical and professional groups, prominent civic, business and social leaders, the press and the radio, all of whom have thrown into the preparation for this Congress a zeal and devotion inspired by a true appreciation of the importance of this gathering to the whole community; and

WHEREAS, the members of the National Safety Council assembled from all parts of the United States, from Canada and other countries, fully appreciate the fine and unselfish contributions of the citizens of Louisville in furthering the cause of safety and in strengthening its protective influence not only in this city and state but also throughout our country and the civilized world, thus aiding in attaining the ideal of human life preservation; now, therefore,

BE IT RESOLVED that a standing vote of thanks be extended to President E. J. O'Brien, Jr., of the Louisville Safety Council and to its energetic and capable directors, N. P. Bloom, W. S. Campbell, C. F. Denny, W. F. Gardner, H. M. Reed, Jr., A. B. Sawyer, Jr., H. W. Stodghill, J. H. Sweets, W. W. Wilhoit, Edwin D. Wood, R. H. Wyatt and Manager Frank Rodenheber; to Superintendent Archer of the Public School System and Miss Mary May Wyman, in charge of Health and Safety Work in the schools; Rev. F. N. Pitt, Superintendent, Parochial Schools; to E. McHugh, chairman of the Council's Fire Prevention activities; and to Mayor Neville Miller, Dunlap Wakefield, Director of Safety; Edward Callahan, Chief of Police; Roy W. Burks, Director of Works; Frank Gregg, Chairman of the Church Committee and all of the pastors who have cooperated with him; The Louisville Round Table and Affiliated Club; William Stoll, president, and William Morrow, secretary of the Board of Trade; William Harrison, president of the Community Chest; radio stations WHAS and WAVE; The *Courier-Journal*, The Louisville Times, The Harold-Post and F. H. Miller, Norvin E. Green, Lee Miles, M. A. Erskine and William Hoge, members of the Advisory Committee, Mrs. A. B. Sawyer, chairman of the Women's Committee and all of the ladies assisting her.

Because of the fact that 150 men and women served on the Greater Louisville Safety Congress Committee, we will not attempt to name them individually but collectively. We wish to emphasize the fact that the unselfish and untiring work of this Committee to make this a successful Congress deserves the thanks of not only those assembled here but all others interested in the Safety movement who are unable to attend: and that this vote of thanks be accompanied with a deep appreciation of the leaders of the safety movement who understand the need for intelligent guidance in the organization and direction of the many Congress activities and particularly in placing before the people the facts about accidents and the scientific methods for their control to which task this Congress is dedicated.

* * * * *

RESOLVED, that members of the National Safety Council at their Twenty-Fourth Annual Meeting in Louisville this Fourteenth day of October, 1935 A. D., do hereby express their gratitude to the National Council of the Boy Scouts of America for the splendid safety work being carried on among the youth of the nation; and that they especially commend the National Council on the development of its Health and Safety Program. The National Safety Council hereby renews its pledge of cooperation in this Program throughout the coming years.

* * * * *

BE IT RESOLVED that to President John E. Long the entire membership of the National Safety Council expresses its sincere appreciation and thanks for his high devotion to the cause of safety and for his inspired and untiring leadership through a trying two-year period during which time the safety movement has made signal accomplishment in the saving of lives and the prevention of injuries.

* * * * *

BE IT RESOLVED that the very grateful appreciation of the National Safety Council members is hereby extended to all its volunteer officers and executive committeemen who have given so unselfishly of their time, thought and energy to the work of the National Safety Council and the success of the safety movement.

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Chairman Long then introduced Mr. William S. Knudsen, Executive Vice-President of the General Motors Corporation, as "a man who has been actively identified with the automobile industry for a great many years, and who never once has lost sight of the importance of safety and its place in industry."

Safety and Manufacturing

By WILLIAM S. KNUDSEN

Executive Vice-President of the General Motors Corporation, Detroit, Mich.

From the standpoint of manufacturing, safety can be sub-divided into two groups: safety in manufacturing; safety in the product manufactured.

It would seem that one of the safest places to be is at work in a factory. This is partly due to improved machine and tool design, but mostly due to education among workmen and foremen. No doubt the prime mover in this improvement has been the specialist in safety work, the safety engineer or safety man. In the smaller concerns the responsibility for safety frequently falls upon an executive who has other duties. In larger units it is more common to employ a safety man, and it is interesting to note from a recent survey that the large units in manufacturing had the best records in frequency and in severity.

It is regrettable that both the frequency and severity of occupational injury got a little worse in 1934. During 1934 we employed large numbers of men who had never worked in the automobile industry, and it was only to be expected that with many inexperienced and untrained workers, industry would have unfavorable experience in accidents, tool breakage, and damaged work. However, most of the training job of this large group of new workers is behind us, and the results at the end of this year are going to show that much, if not all, of the ground lost in 1934 has been recovered.

The conveyor has perhaps been the greatest means for establishing order in plants and keeping work off the floor, and in this way has prevented many accidents due to disorder—for which the old time shop was famous. Some occupational accident statistics now show that accidents from stepping on or striking objects amount to only about 5 per cent of the total in manufacturing. The conveyor, when looked upon as a beast of burden, a sort of continuous truck line, if you please, is placed correctly; however, when pictured as a means of speeding up work, it is incorrectly placed. Only quality and accuracy of the operations on the individual units produce an increase in the output of the assembly conveyor. The early conveyors were crude affairs, and many accidents were due to parts dropping in the drive, or men getting caught in the chain. Most conveyors today are of the protected type, well enclosed, with safety lines in case of jam, and injuries suffered on them are practically unknown. Furthermore, since a large single cause of industrial accidents is "handling objects" it is evident that in turning this kind of work over to the conveyor, we make rapid strides in reducing accidents.

Fixtures for both vertical and horizontal machines show substantial progress as well. Cam locking devices and box fixtures, dies of the sub-press variety with guide pins, have not only eased the work of setting up and running, but have improved the safety of operating to such an extent that minor cuts and bruises represent the major part of accidents on this kind of work. (Cuts, lacerations, bruises and contusions amount to about 49 per cent of occupational accidents.)

The enforced use of goggles and automatic trip-off on presses with safety control have probably been the biggest discount to bad accidents, which formerly ranked high both in severity and frequency. Today about 95 per cent of the injuries are temporary disabilities with only 1 per cent fatal or resulting in permanent total disability.

A new hazard has been introduced into factory operations by the increase of electrical tools, supplementing air tools in many instances, and necessitating general power-wiring installations. While there were some careless installations in the early days, the number of resulting burns has been small and the progress very great. The greatest benefit in installations of this kind is to have as near as possible a standard hook-up throughout the plant, and to have wiring or bus-bars and switches of the latest approved style. Today occupational injuries from use of electricity in manufacturing are quite low.

Another hazard of recent years demanding the attention of all of us, is the question of elimination of fumes, paint spray, acid fumes, and dust. Early installations showed a lack of knowledge of these problems, with a resulting detriment to the health of the operators. We are happy to say, however, that due to hearty cooperation by engineers, men of science, and equipment manufacturers, there is today hardly a single problem of ventilation of this sort which cannot be handled so that the operator's health is fully safe-guarded, and dangers of fire or explosion eliminated.

We do not claim that manufacturers have gone all the route in getting fool-proof devices, but substantial improvement has been made; safety engineers are constantly working to reduce both accident frequency and severity; and the interest aroused and the information which is spread by meetings of this kind have done much to accelerate the safety movement.

And don't overlook the fact that the doctors have helped a great deal. Many of the temporary disabilities, with their low severity, would be different kinds of accidents without the skilled efforts of our medical men and women. In the field of preventing and restricting blood poisoning, streptococcic and tetanus infections our industrial doctors are probably without equal.

By and large, the mechanics of the safety problem in factories has made substantial progress, and is on the way to more progress. Manufacturers all realize that the workman, unaffected by fears for his own safety and unaffected by the shock of injury to a fellow workman, is a better workman, and will produce better quality of product.

Safety education of the workmen has made its best progress through the campaigns for accident prevention which most progressive factories inaugurate from time to time. The prime formula for success in this kind of work is to get the foreman really enthusiastic about the standing of his department over a period; measures taken to accomplish this result improve the accident experience not only during the period of the campaign, but for all time.

One important feature of employee education is for the foreman or job setter to give a new man a thorough explanation of the hazards of his machine along with careful instruction in its operation before he is put to work. Many accidents have been due to faulty or insufficient instruction of new men when everybody is busy and output is behind. The American workman does not require pushing or speeding up. When he has thoroughly learned the quality part of his job and understands its requirements, he himself will take care of the speed part.

We have found in our corporation that the foreman's interest in the safety problem is the all-important factor. In recent visits to many of our plants, after the close of our last safety campaign, we talked to the department heads. The plaques presented for best results were received politely. The frequency and severity standings in the particular campaign were received as a matter of course. But when the saving of fingers, eyes or lives was explained as being the direct result of the improved standing, this made a profound impression. Figures are figures. But in safety-work if you can convince the foremen that they have actually assisted in saving lives, eyes, limbs or fingers, then your safety work is under way to a real start.

When the foreman has become thoroughly interested the men automatically become interested. The older and more experienced begin to look after the younger men with less experience. Careful reminders, in the form of pamphlets, without scare-heads, but with sound advice to be careful in the handling of machines and tools, gradually have the effect of overcoming careless attitudes. Departmental safety meetings get a better attendance, and the organization as a whole becomes safety conscious. If the safety record of a department becomes a matter of pride to the foreman, and to his men; if it becomes clear to all that lost time accidents represent pain and suffering, and that no accidents mean more health and happiness in the shop, and in the home; then safety has come into its own. And this is not merely true from the humanitarium standpoint, it is good business. Careful people are good workmen. To be safety conscious is going a good way toward being quality conscious.

The Detroit Safety Council has been doing excellent educational work among the men in the factories. Besides sectional meetings of a technical nature, real rallies are staged at frequent intervals in the evening, with entertainment and excellent speakers on safety, and often such gatherings will show the attendance in four figures.

But when we come to the matter of safety in product manufactured, progress is more difficult because while we can control the circumstances under which the product is made, we have no control over who is to be permitted to use it, the cir-

cumstances under which it is used, and the behaviour of other individuals who come into contact with it or are affected by it.

There is no industry where this is more evident than in the automobile industry. There is a great deal being said and written today about the accidents resulting from the use of automobiles. There are some comments to the effect that the manufacturers "ought to do something about it."

Need we say that the executives of the automobile industry are no less human than any other group of men and women; that we regret and deplore the automobile accidents as much as other people; and that we stand ready and willing to cooperate with your association, or any other group, to find a solution to this heavy toll on our lives and property?

But let us go at this problem with the same common-sense and good judgment which have characterized the improved safety in manufacturing. If we were not actuated by humanitarian reasons (which we are) each unit of the automobile industry would be at least actuated by the principle of self-preservation, due to the fact that there is nothing more certain than an adverse public reaction to a motor car which is inherently unsafe, and this would be reflected in the manufacturer's sales position.

We in General Motors have given a great deal of thought to the causes of automobile accidents. We have hired men and spent money to "get the facts."

But no one can say definitely what are the causes of automobile accidents, since to determine these causes requires much more careful investigation than is usually the case in other accidents. Most automobile accidents are the result of a combination of causes, which further complicates the situation.

However, let me give you the benefit of our thinking and our investigations. There are four factors controlling the safe operation of an automobile: (1) the car, (2) the driver, (3) the highway, (4) the other fellow. Let us look further into each of these.

First, *the car:* We believe that in only a small percent of the cases is the car to blame. We control the design and manufacture of the car. We have spent large sums in research laboratories, and in a proving ground so we can correctly design and adequately test the cars. On the proving ground cars are put through breakdown and endurance tests to determine the parts which might prove unsafe. All kinds of roads and hills are reproduced.

We have spent large sums in finding, perfecting and making available to the public, devices for their greater safety and for greater safety in the operation of their cars. Such developments include the self-starter, closed bodies, steel tops, ventilating systems, four-wheel brakes, synchro-mesh transmissions, independently sprung wheels, electric headlights, multibeam headlights, adequate warning signals.

Manufacturing methods in the automobile industry are still regarded as among the best. Labor is highly paid. Inspection is a highly developed art. As for materials, we are always looking for the best. So that in design and manufacture, I submit that the manufacturer has already done much for greater safety.

But even the best mechanical device needs to be serviced, repaired, maintained. We have done and are doing much to equip service stations with adequate tools and machinery. We conduct many schools each year to educate mechanics and service station employees in proper methods of servicing and maintaining cars. We make available adequate stocks of replacement parts in case repairs are needed; so that from the service viewpoint, the manufacturer has also done much for greater safety.

Now, the problem of each manufacturer is to make a product which will fulfill the demands of his customers. We expend much effort every year in finding out what our customers want. So it is with confidence that we tell you that they want cars which will accelerate quickly, negotiate the majority of hills without gear shifting, and transport them at a fairly rapid rate of speed. We are convinced that the public will not buy cars which do not have these performance characteristics.

There is room for reasonable doubt as to whether speed *per se* is the principal cause of automobile accidents. We have heard comments that "Automobiles are being made to run too fast, they shouldn't be capable of such high speeds." What should be the maximum speed, 90, 80, 70, 60? Suppose the average maximum speed capacity today is 85 miles an hour, and suppose it were cut back to 60, how much reduction in accidents would result? Some, doubtless, but there is still room for doubt that any major improvement would result. In Ireland, England, Wales, Scotland, Belgium, Germany and Italy, where the cars are much smaller and lighter than ours and not capable of top speeds as great as ours, the rate of automobile deaths per 10,000 motor vehicles, runs from two to four times as high as ours.

Accidents seem to be more a product of congestion, visibility and other road conditions than speed *per se*.

Therefore, to summarize the part the car plays in safety, I submit that the car itself can and does offer a pretty clean record; that the manufacturers have already "done something" about safety; that we should go slow in assuming that the capacity for high speed *per se* is the cause for accidents; and that we should also go slow in recommending restrictive legislation which might impair the usefulness of the automobile, and still not correct the accident situation.

Second, *the driver:* No matter how finely a machine is made, it is still dependent upon man to operate and maintain it. There always will be operators of automobiles who are too young, who have defective vision or hearing, who are unskilled in the operation of an automobile, who will drive while intoxicated, who ignore traffic signals, who disregard our laws and rules of the highways, who will not keep their cars repaired in a satisfactory mechanical condition.

What, then, can we do to help this phase of the situation? One of the obvious things is education of the driver. We are already engaged in promoting driver education through booklets, radio programs, etc. Further, we are in favor of educational movements made by reputable groups in an ethical fashion. The youth of the country is a most fertile field in which to cultivate the good drivers which we hope will be found on our highways in the future.

We believe there is sufficient evidence to support the conclusion that where operators are licensed after reasonable tests to determine their ability and fitness to operate a car, and their knowledge of traffic rules, the accident rate is lower. We also believe that if we had compulsory inspection of automobiles to determine the mechanical condition of brakes, lights, warning signals, steering gear, windshield wiper and the leakage of exhaust gasses, the accident rate would probably be lower.

We stand ready to cooperate in the formation of recommended practices in both the matter of licensing drivers and inspection of automobiles.

We are prepared to support mechanical inspection of motor cars to insure their being in good operating condition, always, of course, with the understanding that inspection is carried on in an impartial manner and in such a way as to build up public confidence in its fairness and efficiency.

We have already installed at our proving grounds proper equipment for measuring the various items which comprise a commercial safety inspection. This inspection will be applied to current model cars as well as to cars in the process of development; to be sure that we are putting cars on the highway, which, if maintained with any degree of reasonableness, will give a good account of themselves in the hands of the owner.

Third, *the highway:* We are aware of the obsolescence of many of the first so-called "good roads"; we know that many of our highways are too narrow and too highly crowned; that many of the curves are too sharp; that many roads are poorly or inadequately marked with road-signs; that many highways have poor surfaces; that many are inadequate to carry the traffic load which is today placed upon them; that the majority of accidents occur after dark and upon rural highways, and yet a beginning has hardly been made in the matter of highway illumination; we know that provision for pedestrian traffic has been made on only a small percent of our highways; that our present force of highway police is insufficient; and we know that certain corners and road structures offer extraordinary hazards.

We know all of these things, and we should realize that herein lie many of the causes of highway accidents. Yet, knowing these things, and being in the midst of a hue and cry for reduced highway accidents, we permit the diversion of millions of dollars of automobile and gasoline taxes, which by their very nature should be spent on highways, to other and certainly no more worthy or necessary activities. Let us urge that the diversion of our automobile taxes from highway construction and maintenance be stopped, at least until this menace has been removed.

Fourth, *the other fellow:* The feeling that the automobile driver is the aggressor in all automobile accidents is still too general. It is probable that not more than

half of the accidents involving an automobile and a pedestrian are solely the fault of the automobile driver. Far more than half of such accidents result from pedestrians crossing at other than intersections; crossing against traffic signals; crossing diagonally; playing in the roadway; etc. Here, then, are the jobs of educating the drivers to be careful and courteous and educating the pedestrians to exercise ordinary prudence. Our schools have already tackled the job and have shown splendid results. Their work should be encouraged and augmented as much as possible. The operators of street cars and the drivers of teams are not without blame in our problem of highway accidents. Our construction industry has also contributed somewhat to our automobile accident record. Proper education and enforcement of existing laws affecting these activities will help to reduce automobile accidents.

* * *

Chairman Long then introduced the Honorable Harold G. Hoffman, Governor of the State of New Jersey, outlining at some length his career as a newspaper man, a leader in the banking business in his state, a World War veteran, a man active in the political history of his state, and a militant commissioner of motor vehicles for New Jersey.

Lets Save 12,600 Lives

By HON. HAROLD G. HOFFMAN

Governor of New Jersey

Before discussing the subject of highway safety let me go on record as being a most rabid enthusiast of the organization which, in my opinion, has saved more lives and eliminated more physical torture from the every-day world than any other non-profit group in the country: the National Safety Council.

Carrying the gospel of accident prevention from coast to coast, this body, supported entirely by membership contributions, has conserved so many lives, so many limbs, so many fingers, so many heartaches that the true worth of its work can never be evaluated.

When the Council began operations in 1913 the accidental death rate was 85.5 per 100,000. Today, in spite of an enormous multiplication of risk and exposure, that rate has been cut to 79.9. And I think the most concise way to appraise these labors for the past 22 years is to say that there are 190,000 people alive today who would have been dead but for the relentless efforts of this group.

On behalf of those who have been snatched from the hospital and the morgue, I salute the National Safety Council. And to those who think of civilized progress in terms of the steady reduction of this savage waste of life and limb in preventable accidents, let me urge you most fervently to get behind this undertaking in the most practical manner conceivable: by the financial support of membership.

All of which leads directly to my topic because the major portion of this achievement has been in the factory and the mill, the railroad and the mine. To a marvelous degree, serious injury has been minimized in even the most hazardous occupations through this intelligent, persistent war. So the upshot, as I see it, is that the wage earner of today, no matter how dangerous his work, stands a much better chance than he ever did of coming home tonight safe and sound *provided*—and this is where I come into the picture—

Provided he isn't run down by an automobile on the way home!

In other words, the real accident problem now is coming out of the factory into the street and highway where, last year, we set an all-time high record for sudden death.

This situation interests the public as the victims; it interests you safety engineers as their defenders; it interests me as a public official because I feel that the reduction of traffic accidents is as much a matter of public welfare as was the elimination of the fever-breeding swamp or the plague-spreading rat. A life is just as precious whether it be saved by wiping out a mosquito hole or a treacherous highway intersection. And since motoring now kills some ten thousand a year more than that old bug-a-boo, malaria, the point requires no elaboration. We simply must make the

hazards of traffic at least as inconsequential as we have already made the hazards of public plague.

This is obvious from the fact that in 1934 the automobile *driver*—and please don't miss the emphasis on *driver* rather than on *automobile*—managed to kill, maim and injure more than enough people to repopulate the whole state of Colorado.

To put it another way, every week of the year we killed more victims on the highways than were lost in the recent Florida hurricane which impressed the nation so graphically as a grave catastrophe. And the startling thing about it all is that since at least 1925, each year except one has been worse than the year before.

Plain horse sense tells us that this must stop. Two successive years with more than one million traffic casualties apiece is such a wanton, uncivilized waste of life that drastic action becomes imperative. And I can think of no better place in which to recruit and solidify that action than here.

With this ghastly experience casting its prophetic shadow on the years to come, I am taking it upon myself to sound a call to arms.

This summons is in the form of a proposal—a proposal which may seem too ambitious to some, too modest to others—a proposal which will involve widespread co-operation, unflagging effort and painstaking diligence; but one which will pay a fabulous dividend in an amazingly brief time.

This proposal, my friends, is that the National Safety Council declare a definite objective for each state in the union—

A reduction of at least 35 per cent in motor vehicle deaths by the end of the year 1940.

The details, the complicating problems, the methods of such an endeavor need not be gone *into now*: you *safety men know them as well or better than I.* What I should like to emphasize is, first, that the time is ripe for such a movement; second, that this goal can reasonably be achieved; third, that its accomplishment will be enormously profitable in terms of dollars and cents as well as blood and bones, happiness and security.

The time is ripe because general acceptance of the need for drastic action is being fanned into flame by the public-spirited press. Newspapers the country over are giving constructive attention to the problem, and in the past few months I have noticed motor safety articles in at least five leading magazine approaching 15 millions in aggregate circulation. On the heels of such education there will come a lively demand for remedies.

The goal is reasonable because we have already seen more difficult ambitions realized. In the period when adult fatalities jumped 28 per cent, accidents among school children dropped 19 per cent. While deaths among private drivers—I believe some call them "pleasure drivers"]—have increased 40 per cent, commercial vehicle accidents have come down 26 per cent. In each instance reductions have been effected by the methods so well known to you safety men: by consistent education, co-ordinated efforts: the time-honored ORGANIZED CAMPAIGN.

Indeed, these methods are already bearing fruit in some of the more aggressive cities and states which have taken the traffic bull by the horns. You will understand my pride, I am sure, when I say that my own state of New Jersey is one of these. We rank only 45th in territorial area, yet our situation between New York and Pennsylvania makes us a veritable gangplank between the first and third cities of the country with a traffic problem that is staggering. Despite this—and despite the nation-wide increase of 15 per cent in highway accidents last year—we kept our rise down to 3½ per cent. Actually, we had fewer motor deaths than in 1929, 1930 or 1931 with a much greater traffic flow.

This, of course, we credit to organized safety efforts. For the truth is that on the highway, just as in the factory, the mine or the railroad, we can claim a standard technique which if honestly, diligently and patiently applied, will not only check the accident rise but will actually reduce it.

Needless to say, New Jersey is not unique: several other states and numerous cities, large and small, have made genuine progress in the reduction of highway accidents. To cite a single example, Milwaukee, last year's winner of the Council's contest, has not only cut traffic deaths in one year but in four years hand-running.

So to those who say that this proposed 35 per cent reduction is too stiff, I say that it is already being done. So far this year no less than 17 states have cut their

deaths from 17 to 30 per cent under last year. Of our 13 larger cities, 8 show decreases for the first seven months: a total of 301 lives saved in these communities alone. And among the smaller cities you will find that the number not having a single death this year is exactly *double* last year's total!

On the other hand, to those who feel that the goal is too soft—that five years is too long a period for so little improvement—I say that the field for progress is still enormous. As you well know, here are still some 14 states which require no driving license—and 10 which fix no minimum age for the operator of an automobile, thereby making no distinction whatever between a kiddie car and a 120 horsepower sedan.

Such laggards cannot help but detract from the progress of the more advanced. And even in the more advanced, I know, from long experience, that the inertia of large masses of people, the disinterest of some officials, the limitation of funds available, and the thousand and one expected and unexpected obstacles which hamper any movement all combine to make it advisable to refrain from setting the goal too high.

On top of this we are faced with a sharp increase in the number of vehicles on our highways and, especially, an increase in their total annual mileage. Hence I feel that if you take all these factors into consideration, you will agree that my objective is neither too high nor too low.

What we mustn't allow ourselves or the public to forget is that its realization will not come from "prayer and fasting" alone. Hard work is involved. Our streets and highways must be modernized for present day traffic if we are really convinced that the horse and buggy has gone for good. We need controlled rights of way, the separation of highway grades, the separation of opposing vehicular flows, the substitution of 20th century lighting for the mid-Victorian glimmer of our heavily-travelled roads, and many other safety features so well known to you highway and traffic engineers.

I needn't tell you that automobiles must be maintained in a condition comparable to that when delivered by the manufacturer—or that enforcement agencies must be properly organized and adequately climaxed in order to cope with today's conditions—or that education must be pressed into every nook and cranny of the land—or that uniform driver's license laws and, above all, uniform traffic laws are a crying need. To be sure, many of these things will materialize more quickly as more of our states acquire up-to-date Motor Vehicles bureaus: not mere fee collecting agencies, but departments dedicated to safeguarding the public on the highways. And we will doubtless have more bureaus of that caliber when business and civic organizations, womens clubs and churches unite in this war and demand such assistance from their localities.

These details you all appreciate: my sole function is to urge you to work and fight for them in the face of every obstacle. Through legislation, through administration—above all, through *education* all the way from the kindergarten to the university's senior class, we must hammer, hammer, hammer on the fundamentals of traffic safety. In that crusade I take it upon myself, as its governor, to pledge you the eager, unwavering support of the state of New Jersey.

We have fixed as par for the course of the next five years a 35 per cent reduction in accidents and have alluded to the basic methods which can bring this about. If you can score a birdie or an eagle so much the better. The job is no pushover, but it is certainly a practical possibility and *it can be done* if we unite and co-ordinate our numerous efforts. It seems to me that the National Safety Council itself is in an ideal position to define this objective and foster this united drive. The Council's leadership is nationally recognized. It enjoys the most friendly co-operation of governors, motor vehicles administrators, police chiefs and other officials and organizations. I understand that 33 states and nearly 800 cities are officially enrolled in the National Traffic Safety Contest this year. The definite goal of a 35 per cent reduction by 1940 will fit perfectly into the existing program of this contest. In fact, I believe that the announcement of this aim will still further increase the interest which officials and citizens are already taking in this competition.

I believe, too, that we can sharpen our efforts by taking a cue from the movies in their dramatization of another public program which has met with ememplary success. We hear much lately—and justifiably—of the "G-Men" and their success in the war on crime.

I suggest that what we need in the traffic field is a far-flung corps of "E-Men" to shoulder the essential burdens of *engineering, enforcement* and *education*. For,

whatever the layman may think, improved conditions aren't accomplished by waving a wand or murmuring a fervent wish: success sprouts only from the soil of comprehensive study, keen analysis, intelligent remedies: in short, that administered technique of the safety engineer which is so rapidly becoming a new science.

Pursuing the alphabetical strain into that great mass of highway users, pedestrian and motorist alike, I think we could also profit greatly by a general influx of "C-Men"—those who would make *caution and courtesy* on the road more of a habit than a hope!

All of which simmers down to a single broad requirement: in every community we need a definite concentration of official responsibility which will serve to harness to this problem an alert public and individual interest in our objective.

With co-operation thus stimulated and properly directed, the rewards of such an effort will be simpler of realization—and these rewards are monumental. In dollars and cents alone they are staggering, and since this is a time when dollars count mightily, the impersonal, material side of the picture is inspiring in itself.

Or consider the human angle. Put this program across, and in 1940 you will have 12,600 friends and neighbors alive who now have the finger of sudden death upon them.

You will have 31,500 others sound and healthy who will otherwise be bed-ridden, crippled or permanently maimed.

In short, you will save 44,000 families the misery, the mental torture, the indescribable anguish which accompanies grave disaster and beggars appraisal in mere money.

All this you will save—plus a million and three-quarters of those "less serious" injuries: a million and three-quarter broken collar bones, fractured ribs, gashed faces, torn ligaments, pulverized knees, mashed noses, and all the rest of the bloody inventory of the head-on collision or the side-swipe.

This, in a nutshell, is our objective.

We want every state in the union to cut its traffic accidents 7 per cent a year for five years.

We want less misery—less agony—fewer crepes in 1940!

Unveiling of Council Trophies

Chairman Long, in unveiling the handsome plaques to be presented later to individual winners in the various industrial safety contests conducted under the auspices of the National Safety Council, said:

"A special session of several hours' duration would be required to review the enormous reduction made in both the frequency and severity of disabling injuries when we consider that in six of the contests 773 units employing more than 780,000 persons worked approximately 1,200,000,000 man-hours, while in the seventh contest 500 units operated some 33,000 vehicles during an exposure of 561,000,000 vehicle miles. However, during this Congress, each Section has set aside a definite period during which the meritorious achievements of their respective contests will be discussed in detail, and at that time, also, the trophies will be officially presented to the individuals representing the competing units.

"Even though individual winners cannot be specifically mentioned at this time, it is my pleasure and privilege, on behalf of the National Safety Council and its Executive Committee, to officially unveil the trophies which stand as mute evidence of the sincerity with which industry as a whole endeavors to conserve human life and limb."

There were 120 plaques and 74 certificates of merit to be awarded.

ADJOURNMENT

Annual Banquet

WEDNESDAY EVENING SESSION

October 16, 1935

The banquet for National Safety Council delegates and guests was held at the Casa Madrid, Louisville, with President John E. Long presiding. Dr. John Lowe Fort, Executive Secretary, Louisville Council of Churches, delivered the invocation. Chairman Long read letters and telegrams congratulating the National Safety Council on its successful Congress and on the work it had accomplished. Safety Derby prizes were awarded by the Accident Prevention Equipment Manufacturers' Section of the Council.

Mr. E. J. O'Brien, Jr., President of the Louisville Safety Council, was presented with a plaque commemorating the accomplishments of the Louisville Council in winning the Inter-Council Plant Safety Contest for the second successive year Louisville had also won the Contest in 1931.

Chairman Long announced the newly elected officers of the National Safety Council as follows:

New Council Officers

President—Dr. C. H. Watson, Medical Director, American Telephone and Telegraph Company, New York City.

Vice-President for Engineering—Albert S. Regula, Executive Secretary, Industrial Relations Counselors, Inc., New York City.

Vice-President for Industrial Safety—A. V. Roehweder, Superintendent of Safety and Welfare, Duluth, Missable and Northern Railway Company, Duluth, Minn.

Vice-President for Membership—R. T. Solensten, Vice-President, Elliott Service Company, New York City.

Vice-President for Public Relations—D. D. Fennell, Consulting Engineer, Chicago, Ill.

Vice-President for Public Safety—Hon. Harold G. Hoffman, Governor of New Jersey, Trenton, N. J.

Vice-President for Community Safety Councils—John B. Gibson, Publicity Director, Western Electric Company, Hawthorne Works, Chicago, Ill.

Vice-President for Education—Albert W. Whitney, Associate General Manager, National Bureau of Casualty & Surety Underwriters, New York City.

Vice-President for Health—Dr. Hart E. Fisher, Chief Surgeon, Chicago Rapid Transit Company, Chicago, Ill.

Vice-President for Finance and Treasurer—W. E. Worth, Works Manager of Twine Mills, International Harvester Company, Chicago, Ill.

Managing Director and Secretary—W. H. Cameron, National Safety Council, Inc., Chicago, Ill.

Retiring President John Long relinquished the chair to Dr. C. H. Watson, new Council President.

The President's Speech of Acceptance

By DR. C. H. WATSON

President, National Safety Council, Inc.

It is a great honor to become the President of this very wonderful organization. An assignment of this sort is fraught with such obligations that I fear an already well-developed inadequacy complex may become supplanted by a still further faulty psychology. I shall hope, however, to profit by the becoming modesty and splendid achievements of my predecessors, and making use of their productions and their decisions, be able to carry out the term of my administration satisfactorily.

I have many times marveled at the humanitarianism which is the lone stimulus that has maintained the enthusiasm of our members for this great work of safety. Safety may be thought to have become supreme among the altruistic endeavors of our people, and the National Safety Council symbolizes both the sentiment and the action needed for its advancement.

The National Safety Council probably contacts intimately, directly or indirectly, more individuals than any similar group in the country. The appeal of its objectives meets a response, however transient, in the intelligence of every one. The philosophy behind the execution of its objectives is based on the theory of repeated directions of the insight of people, to the ideals which experience has shown, insure safety. We, too, often take safety for granted and pursue our daily comings and goings with little thought as to hazards. People will always be confronted by the elements of human frailty, more laxity, material loss and lack of integrity of the constituent elements in an unfriendly environment. To meet these elements which are opposed to safety, it is necessary that we intelligently use our brains and sense organs to prevent these agencies from functioning. The doctrines which experience and authority have shown lie behind the ideals of adequate safety, concern both the individual as well as the group.

We must think of the safety of others, even more intensely than we think of our own personal safety. Once the safety of others is assured, individual safety becomes a fact. So it is, that the National Safety Council cooperating with our Government and all other interested agencies strives to establish and maintain safety on the sea, safety in the air, safety on the land and safety in the depths of the earth.

Dr. John L. Davis, of New York City, who had addressed the Annual Banquet in Cleveland in 1934, spoke on "The Psychology of Success."

ADJOURNMENT.

Finding and Correcting Accident Causes

FRIDAY MORNING SESSION

October 18, 1935

The session was called to order by Chairman C. B. Boulet, Insurance and Safety Department, Wisconsin Public Service Corporation, Milwaukee, Wis., who presided. After welcoming the delegates, Chairman Boulet introduced the first speaker.

Recording and Analyzing Industrial Accidents

By R. L. FORNEY

Statistician, National Safety Council, Chicago

Analyzing accidents is a process similar in many respects to that followed by a card player who is dealt a hand of bridge.

The bridge player first looks at each card carefully so that he doesn't mistake the six of clubs for the six of spades. He separates the different suits—all the clubs together, all the spades together, etc. Then he is likely to put each suit in order, beginning with the highest ranking card, then the next, etc., until all of each suit are arranged. These steps are necessary before he can visualize the strength of his hand and make an intelligent bid.

The accident analyst follows much the same procedure. His job is more complicated, of course, because an accident report is much more complex than a playing card. Intelligent accident analysis, however, includes the following steps, which are roughly comparable to those carried out by the bridge player:

1. Careful scrutiny of every individual accident report.
2. A classification of those reports to show different types of accidents, causes, etc.
3. Evaluation of the relative seriousness of different accident causes.

The use of this information is as broad as the whole field of accident prevention. From the standpoint of the safety engineer, accident prevention consists largely of making recommendations to all interested parties regarding certain procedures which he believes will eliminate accident causes. These recommendations are not likely to be sound or stand the test of time unless they are based on adequate records.

Recommendations may be made to: 1. management, 2. supervisors, 3. employees, relating to: 1. unsafe equipment and materials, 2. unsafe operating methods, 3. unsafe acts of employees, by means of: 1. accident summaries and analyses, 2. letters and memoranda, 3. personal conversations, 4. publications, 5. meetings, 6. bulletin boards.

Accident records should play a part in every point of this program. Management requires proof, in the form of accident records, before it is willing to spend money on accident prevention. Supervisors are inclined to think that their departments or gangs are relatively safe, unless records are available to prove the contrary. Employees, too, must be convinced, by adequate records, that safety is to their advantage as well as to that of the management.

Unsafe equipment, unsafe methods and unsafe employee acts are determinable only if complete reports of accidents are made and thoroughly analyzed. And,

finally, all of this information must be kept constantly in the minds of those responsible, by means of letters, bulletin board announcements, and meetings.

Safe Practices Pamphlet No. 21 contains the National Safety Council's recommendations regarding suitable forms and methods to carry out these purposes. Five forms are recommended. Every company is asked to consider the advantages of using the entire system. It is possible, however, to use some of the forms and not others. It is also possible that some companies would like to use a particular form but omit filling out certain parts.

The methods recommended in the Safe Practices Pamphlet are not hard and fast rules, but suggestions, with which any company can compare its own methods and forms. Whenever such a comparison shows present company methods inadequate the recommended plan may well be adopted, in whole, or in part, either by use of National Safety Council forms or by revisions of the company's own forms.

The five forms are:

1. *Report of Industrial Injury.* Size, 8½ x 11 inches. Printed on both sides. Used as an original record for disabling injuries; also for non-disabling injuries if desired.

2. *Analysis Sheet of Industrial Injuries.* Size, 17 x 22 inches. Printed on both sides. Used as a work sheet on which are entered the important facts from the report of each individual accident. At suitable intervals summations are made to determine the general accident situation.

3. *Injury Record of Employee.* Size, 4 x 6 inches. Used to record all accidental injuries of one employee.

4. *Summary of Industrial Injuries.* Size, 8½ x 11 inches. Printed on both sides. Used for monthly, quarterly, and annual summaries of industrial injury rates, classified by departments.

5. *Monthly Comparison of Injury Rates and Costs.* Size 8½ x 11 inches. Monthly and cumulative comparisons of accident rates and costs, classified by departments.

It must be emphasized that accident records themselves will not prevent accidents. Records are useful in the safety program only when they are studied and when the lessons they teach are put into practice. Just as the bridge hand must be *played* before the game is won, so much accident records be *used* before safety can be achieved.

Use of Accident Records in the Prevention of Machine Accidents

By H. W. HEINRICH

Assistant Superintendent, Travelers Insurance Company, Hartford Conn.

Accident records are of great value—indispensable, in fact—wherever the exposure is of such extent that the necessary facts and details cannot well be memorized by those in charge of directing the accident-prevention program.

The objective of accident records is primarily that of portraying the essential accident facts in such a way that they will be of value in the work of prevention. Less-important objectives are the provision of data for publicity, historical, and educational purposes.

In a complete safety program the several kinds of records may be grouped as follows: a. accident-investigation reports; b. departmental and other summaries, comparisons, trends, and analyses; c. reports and recommendations of safety engineers; d. minutes of safety meetings; e. corrective action and progress reports.

Accident Investigation Reports. Essential machine-accident facts, as developed by investigation, are few in number but exceedingly important. This part of record-keeping is, in fact, the most vital of the whole program. It is the basis of corrective action, of educational work, of summaries, charts, and meetings, and is selected for special emphasis in this discussion.

A large rubber-goods manufacturing plant in an eastern state discovered after three years of ineffective and costly safety work that its entire program was misdirected because of the lack of the simplest kind of accident records. Minor accidents and first-aid cases were not recorded. Lost-time accidents were investigated, but the findings were not tabulated. The selection of specific safety-educational activities was left to a busy executive who depended entirely on judgment based on his personal contact with relatively few actual accident cases. He spent a small fortune on the guarding of rubber mills at the point of operation and on the relocation of shafting and belts, whereas the most elemental of records would have shown at any time that the accident frequency and severity in the plant were largely attributable to poorly designed rubber molds, the use of which resulted in burns and infections.

Accident facts of prime importance are:

a. Identifying data such as: 1. name of person injured; 2. name of supervisor; 3. time and place of accident; 4. witnesses.
b. Operation or work being done.
c. Name of machine being operated.
d. Description of accident.
e. Description of injury, as: 1. fracture, dismemberment, burn, laceration, etc.; 2. part of body injured.
f. Fault of machine or machine part, as: 1. inadequately guarded gears, shafts, or belts; 2. inadequately guarded point of operation; 3. weak, worn, rotted, rough, sharp, or otherwise defective machine; 4. unsafe design; 5. unsafe installation or arrangement as to space, light, and ventilation.
g. Fault of persons—unsafe acts, as: 1. removing guard; 2. operating at unsafe speed; 3. starting without warning to others; 4. oiling or adjusting machine in motion.
h. Corrective action taken or recommended.
i. Addition data as: 1. name of physician or hospital; 2. lost time; 3. cost.

(*Note—The above list of accident facts is suggestive rather than complete.*)

In this list the two items of most significance are fault of machine and fault of persons.

Safety engineers should bear in mind that no preventable accident has ever occurred or ever can occur unless one or both of these two conditions are present. When this fact is recognized, accident prevention becomes easier to understand and to apply. Find and correct machine faults and faults of persons, and accidents cannot occur.

Value of Records. The causes of many "machine-fault" accidents are so obvious that an opinion might too hastily be formed to the effect that a written record is of little value. It might be argued, for example, that there is nothing to be gained by recording the fact that a foundry employee was struck by a low-swung load carried by a traveling crane. But no conclusion could be more misleading.

In the first place, thorough investigation probably would not have been made if plant procedure had not required the filling-out of an accident investigation report form. Many of the salient points would not have been developed if specific questions on the blank form had not prompted inquiry. The very fact that there was a report form containing pertinent quistions and that its use was enforced, compelled the supervisor to determine, in the case of the injured foundryman, that the crane load was swung too low and that the warning gong did not work. The use of accident records, therefore, can be said to prompt and result in a proper investigation.

Records also tend to develop a supervisor's sense of responsibility for corrective action. When a responsible person, such as an executive or supervisor, is obliged to record not only his statement that a machine-fault resulted in a preventable injury, but also what precautions he has taken to avert other similar occurrences, something of a constructive nature is quite likely to be the outcome.

The accident-investigation record, to begin with, makes it possible to segregate machine-fault cases from man-failure cases. When no records are kept machines are too frequently charged with fault when no machine fault exists, or at least when the primary and most easily remedied fault consists of the unsafe performance of a person.

"Finger amputated at point of operation of punch press" is an expression that bears all the ear marks of a machine-fault accident. The recorded facts resulting from proper analysis may, however, show that the injured employee deliberately tampered with the guard.

The chief value, however, in the use of records to prevent machine accidents, lies in the conclusions that can be drawn from them with regard to specific machines, parts of machines, departments and operations, trends, comparisons, and progress.

Conclusions derived only from judgment or from one or two serious cases, are never as valuable or accurate as are those drawn from a review based on greater exposure.

For lack of adequate records thousands of dollars have been expended in many individual plants for the guarding of machines, because of a single serious injury, to the neglect of other machine hazards that have produced numerous less spectacular but, in the aggregate, more costly injuries.

Faulty Accident-Record System Wastes Time and Money. In a large plant manufacturing brass machine screws, two serious injuries resulted from cuts received by the operators of automatics. In each case a dulled cutting-off tool had distorted the piece being formed so that it whipped around and caught the fingers of the operator, who had reached in to clear the machine. Obviously, a number of factors were involved. *The operator should have stopped the machine.* The *cutting-off* tool should have been kept sharp. There was a question also of the quality of the steel of which the cutting-off tool was made, its tempering, and the rate of feed. Opinions only, not based on facts disclosed by a study of records, led to much experimentation and expenditure that had no effect in preventing accidents.

An accident-record system was set up later, and after it had been in use for a few months it become clearly evident that the quality of tool steel, tempering, etc. were merely infrequent incidentals. Most of the injuries on these automatic machines, including the two serious cases described here, were aggravated by infection. The original injury itself was of less importance than the subsequent infection. The operators could not well wear gloves, and a certain number of minor scratches and cuts were inherent to the work. These, however, would not have caused trouble had other condition been normal.

A serious fault was discovered in the system of reclaiming, sterilizing, and recirculating the cutting compound. As a result of the corrective action then taken, there were fewer accidents, practically no infection, and increased production of a better quality. The improved situation was the direct result of the use of accident records based on a proper investigation.

The relation of records to the prevention of accidents in no way differs from their relation to the control of costs, of production volume, or of any other branch of industrial work.

Changing the Attitude of the Employee Towards Safety

By A. A. NICHOSON

Manager of Personnel, The Texas Co., New York, N. Y.

Safety attitude is an integral part of shop attitude. Units and plants which are comparatively accident free, are those which are highly productive. Therefore, the proper safety attitude on the part of the employee is a key to industrial efficiency, as well as to a downward trend of the accident curve.

There are three main factors relating to attitude. First, this is the age of speed in transportation and in operations. The safety problem in 1985 may be as different from the standpoint of mechanics as the problem of 1935 differs from that of 1850.

Secondly this is an age of mental bewilderment. As an illustration of the psychology which follows bewilderment we find the average mind today vitally concerned with the subject of security at a time when the insecurity of the human race individually and collectively is greater than at any other time in history. A shattered confidence in the minds of men, in those every-day relationships between themselves and business, has rekindled suspicion with regard to safety.

Thirdly, I doubt that we can expect to reach the objective through a proper safety attitude without "stabilization."

Man's resentment for paternalism, pacification and coercion must be considered. Because industry in the past has taken an attitude of paternalism with regard to safety, safety has been resented and rejected by the employee who unconsciously or semi-consciously threw up a psychological barrier.

ADJOURNMENT.

Fire Prevention in Industry

TUESDAY AFTERNOON SESSION

October 15, 1935

The session was called to order by Chairman C. W. Smith, director, Safety Department, Standard Oil Company (Ind.), Chicago, and Vice-President for Industrial Safety, National Safety Council. Chairman Smith spoke briefly on the subject under discussion and then introduced the first speaker.

How to Detect and Protect Against Combustible Gases

By P. S. WILLIAMS

Chemical Engineer, Standard Oil Co. of California, San Francisco

Designation of a gas as "combustible" or "explosive" indicates that the primary hazard involved is a fire hazard, even though there may be other noxious characteristics involved. Many fire hazards such as combustible liquids, fuels, rags, or even finely suspended dusts and mists can be seen, and recognized as possible fire hazards. Combustible gases, however present a different problem. Visual observation no longer suffices. The sense of smell cannot be relied upon as its accuracy varies greatly within different individuals, and even an experienced individual becomes hopelessly confused when any variety of odors is offered. For instance, it has been demonstrated that experienced oil operators mistake oily odors unaccompanied by appreciable vapor for alarming vapor concentrations, and vice versa. Furthermore, many highly refined volatile combustibles, natural gas, and even the light vapors from some "sweet" crude petroleums are so nearly odorless that even explosive concentrations may fail to arouse concern through the sense of smell.

The need for accurate and rapid detection of combustible gas or vapor is vital for many reasons. A small spark will ignite mixtures of vapors and air, while it ordinarily requires the application of a flame, generating relatively large quantities of heat to ignite those combustibles which are not accompanied by vapor at ordinary temperature

Gas or vapor may travel wherever there is space, up or down, through pipes or passage-ways, out of vents, hatches, or holes. It is present wherever the surface of a volatile combustible is exposed, whether the amount of liquid or other parent material be large or small, confined or unconfined. When its visible source is removed, the gas or vapor often remains. A space cleared of vapor cannot be assumed to remain so as long as the volatile material is present or being handled within reasonable proximity.

Added to its mobility and ease of ignition, combustible gas or vapor forms highly explosive mixtures with air. The explosion not only results in immediate damage from its own violence, but instantly spreads flame to all combustible material within its reach. It bursts containers and bulk-heads, and allows the spread of burning liquid.

When we hear of a gasoline tank exploding, it should be emphasized that neither the liquid gasoline, nor its vapor alone is the explosive. The explosive is formed when the gasoline vapor mixes with air. When ignited, the oxygen in the mixture rapidly reacts with the gasoline vapor, thus causing a sudden release of energy constituting an explosion.

Not all combustible gas mixtures are explosive. A flammable mixture of gases, such as methane and air, may be diluted with one or another of its constituents

until it is no longer flammable. The dilution limit of flammability, or simply the limit of flammability, is the border-line composition; a slight change in one direction produces a flammable mixture, in the other direction nonflammable mixture.

There are clearly two limits of flammability, a lower and a higher, for each pair of combustible gas and air. The lower limit corresponds to the minimum amount of combustible gas, the higher or upper limit to the maximum amount of gas capable of conferring flammability on the mixture.

These border-line compositions are usually referred to as the "lower explosive limit," and the "upper explosive limit." Vented into the air, mixtures below the lower explosive limit do not constitute a fire hazard, but mixtures richer than the upper explosive limit will burn, or may form explosive mixtures.

In looking through the annals of the detection of combustible gases, it is apparent that the most spectacular and widely celebrated method is to look for a gas leak with an open flame. This method is based on the operator's elementary knowledge that gas burns, and the fundamental accuracy of his assumption is usually quite amply demonstrated. Aside from these tragically stupid episodes brought to us through newspaper reports, the practice of soberly throwing a lighted torch into a confined space as a final check of its safety, has persisted in some quarters until recently. This was done, of course, after cleaning and before entry of men to use welding torches or other sources of ignition.

The human nose is looked upon by its owner as an infallible gas tester, but the findings of another nose are seldom accepted. Vagrant and unreliable as the sense of smell may be, the advantage of its constant readiness for service cannot be denied. The great value of its protection against gas hazards is quickly recognized where the supply of domestic gas is changed from manufactured to natural gas. Natural gas has practically no odor. To provide a warning of its presence, it may be "odorized" for distribution by the addition of some stinking material, the smell of which may be easily identified as characteristic.

Great credit is due the gas distributors for this effective step in the direction of safety. Like all safety measures, it is not infallible, and its shortcomings must be kept in mind. The concentration of odorant is limited for various reasons to that amount obvious to a normal nose in a gas and air mixture still well below the lower limits of flammability. A bad cold, however, will deaden the olfactory sense to the extent that a dangerous concentration of gas is sometimes not recognized, or a dull sense of smell may miss it. Damp earth has a distinct tendency to absorb some of the smelly constituents of gases.

Acknowledging the shortcomings of these primitive methods of detection, apparatus of many descriptions has been devised, and at present there are available a number of very reliable instruments. The background of their development is of interest.

Methods and apparatus for the detection of combustible gases have naturally grown up in the coal mines, as the menace of explosive gas mixtures was recognized there centuries before the development of industry brought gas hazards into general prominence. When the exhaustion of surface diggings first led to underground mining, and confined spaces were formed which accumulated gas, the open lights used in those days started the long list of coal mine disasters. As early as the 17th century, examinations of coal mines were made by lowering a dog down the mine shaft in a basket. When the dog encountered considerable methane, or "fire damp," in the air, he howled. An echo of this practice persists in Staffordshire where a deputy is still a "doggie." A little later, the sensitivity of an open flame to fire damp was observed, and a class of workers called "candle watchers" developed, who became expert in detecting the approach of explosive concentrations by observing the elongation of the candle flames. From this beginning, through years of sad experiences, the first flame safety lamp appeared early in the 19th century. Clanney, Stevenson, and Davy, working contemporarily toward an identical end, brought out almost simultaneously, devices embodying the fundamental principles which are used in our modern flame safety lamps.

The primary consideration in developing flame safety lamps was to keep the main body of flammable gas from being ignited, and at the same time permit the free circulation of the atmosphere past the flame.

Mixtures of gas and air between the explosive limits burn because enough heat

energy is liberated upon combustion of any one layer of gas mixture to ignite the neighboring unburned layer, and such mixtures are thus capable of self-propagation of flame. Hence a flame arrestor must be some device which will absorb enough of the heat liberated by a flame on one side of itself that a layer of flammable mixture on the other side will not be ignited.

It was found by the investigators mentioned above that fine screens woven of wire would cool the flame of burning methane sufficiently that it would not pass through them, and at the same time would not too seriously obstruct the circulation of air to the flame. Modern flame safety lamps are still protected against flash-back and consequent ignition of the gas mixture being tested by a system of screens. While this arrangement gives satisfactory protection in methane mixtures, and in a number of other gases of relatively high spontaneous ignition temperatures and low flame propagation rates, there are other gases encountered industrially which will flash through the screens. The application of flame safety lamps or any other device so protected is limited accordingly.

In the modern instruments designed specifically for combustible gas detection, free natural circulation of the atmosphere is not essential; therefore mechanical means may be employed to draw the sample for examination through such a device. For this reason more efficient flame arresting equipment can be built into the sampling system, some of these being so well perfected that flame will not pass through them even in the most violently explosive mixtures of acetylene and air or hydrogen and air.

As a source of light, the flame safety lamp has given away to the electric cap lamp. It is still used to a considerable extent, however, both in mines and in industry as a detector for combustible gas, especially methane. Briefly, estimation of the concentration of gas is made by measuring the elongation of the flame of the lamp and comparing it with a standard of flame heights. Such lamps are not regarded as entirely safe equipment under all conditions, and to be a useful gas detector must be in the hands of an expert. The operator must be a carefully trained observer; if his judgment is wrong, tragedy may result. Improper maintenance or other causes may make the lamp a source of an ignition.

As the sciences of physics and chemistry developed, effort was turned toward providing a non-flame-type gas detector. Variations of the gas analysis apparatus found in laboratories have served a useful purpose. Such devices take an isolated sample and make a test under what might be called "batch" conditions. Where conditions are subject to change, as is usually the case in dealing with gases, the considerable time consumed between taking the sample and arriving at the result becomes a serious fault. One of the most successful "batch" sampling indicators is essentially a U-tube, one end of which terminates in a gas reservoir or combustion chamber, and the other end in a gage glass having a calibrated scale. A sample is drawn into the chamber and the combustible burned from it by means of an electrically heated filament. The contraction in volume due to burning is then read off the gage glass to arrive at the proportion of combustible originally in the sample. Temperature changes materially influence the indications, so that this detector requires a skilled operator for dependable results.

During comparatively recent years, there has evolved a group of combustible gas indicators which are designated as the "Catalytic type." The fundamental principle involved is the same for all of this group; namely, that metals of the platinum group may be arranged to promote the oxidation of combustible gases mixed with air, even though the gas may not be present in sufficient concentration to form a flame. The heat liberated by this oxidation reaction at the surface of the metal varies with the concentration of the gas, and the consequent rise in temperature of the metal is then estimated as an index of the gas concentration. This group of indicators has proven to be most flexible in its application, and includes the majority of devices which are considered adapted to general use.

The fundamental difference between the various catalytic detectors from the standpoint of adaptability is in the method employed for estimating the temperature of the sensitive element. The simplest method of estimation is to observe visually the change in color of the element with change in temperature, and compare it to a standard to arrive at the gas concentration. This has somewhat the same primary disadvantage of relying on the skill of the operator for its accuracy as is inherent in the flame safety lamp.

Detectors using this method have been developed with mine service in view, and are protected against flash-back by a system of screens similar to those used in the flame safety lamp. The indicator is carried into the atmosphere to be tested, and the gas mixture reaches the sensitive element by diffusion through the screens. General application of this type of indicator is limited by essentially the same factors as considered under flame safety lamps. It should also be pointed out that indicators depending on diffusion from the surrounding atmosphere to bring in the gas mixture, (including flame safety lamps), lack the feature of remote sampling essential to many industrial uses.

Another method of estimation is the measurement of the temperature of the sensitive element by means of a thermocouple. This idea has been developed into a commercially useful instrument, particularly well adapted to semi-fixed installations. It has been developed around processes such as lacquering, japanning, etc., chiefly for the purpose of ventilation control. Consuming considerable power, it is usually operated from an electric lighting circuit, and could hardly be termed portable in the sense applied to a general testing device. The sample is drawn continuously from its source through a flash-back arrestor and a set of heating coils on into the detector unit. The detector unit, in which is located the warm junction of the thermocouple, is an externally heated platinized mass. As most of its applications have required handling high boiling point vapors, heating means is provided on the sampling line near the detector unit to avoid condensation. Sample is drawn by an electric motor driven fan.

The most adaptable method of indication utilizing the catalytic principle is undoubtedly that of measuring the change in resistance of a platinum wire brought about by an increase in its temperature. The Ralph detector, devised for use in coal mines, was one of the first of this type. It measured the change in resistance of the platinum filament by the galvanometer of a Wheatstone Bridge. As its successful performance was quite limited it was not commercialized. About 1927, however, a detector primarily for use in coal mines was successfully evolved along the lines of the Ralph indicator. This indicator is built to operate on the storage battery carried by the miner to supply current to his electric cap lamp. It is a neat and substantial piece of equipment, particularly well adapted to mine use. The filament is encased in a screen-protected chamber similar to the flame safety lamp or visual type catalytic detector, with an electric cable connecting this chamber, or "head," to the balance of the apparatus. The "head" is held in the operator's hand and thrust into the space to be examined. Indications of the gas concentration are read from a meter or "galvanometer" suspended on the operator's chest.

The indicators developed against the coal mining background were too specific to be transplanted far afield. The need for a combustible gas indicator which could be applied generally to industrial gas hazards was made acute by the rapid expansion of the use of gasoline and other volatile combustibles handled away from the control of expert supervision. The problem was worked out, and in a paper given before the American Petroleum Institute in 1928, Mr. H. H. Hall described a catalytic type indicator developed by the Standard Oil Company of California, which incorporates the essential requirements of a portable indicator for general industrial use. Since then other indicators of similar pattern have become available. The requirements for such a device include:

1. *Safe Operations.* The indicator itself shall not become a potential source of ignition, either through flame originating at the sensitive element, or on account of mechanical or electrical defects.

2. *Simplicity.* Both the physical operations involved and the reading of the indicator shall be such that the instrument may be placed in the hands of non-technical operators with the assurance that satisfactory results will be obtained.

3. *Wide Application.* The readings shall not change materially in meaning over a wide variety of gases and vapors, so that personal judgment or auxiliary information will not be required to interpret results.

4. *Sensitivity.* A positive, unmistakable, reading shall be given at a concentration at or lower than that which represents a liberal factor of safety.

5. *Accuracy.* Readings shall be accurate enough over the range of conditions in which the operator is interested that his procedure may be guided unerringly.

6. *Reliability.* Provision shall be made to warn the operator adequately of any defect or misadjustment likely to impair the reliability of indications.

7. *Remote Sampling.* It must be possible to obtain indications from points inaccessible to the person of the operator, and from toxic or otherwise unsafe locations.

8. *Portability.* The indicator must be an independent portable unit, light and convenient to handle, and provided with means of suspension such that the operator's activities are not hampered.

9. *Speed.* Indications must be continuous during operation of the device, and completed without delay.

10. *Continuity of Service.* A simple, rugged construction insuring economical continuity of service under adverse conditions is essential.

The Wheatstone bridge arrangement used in the Standard Oil development may be taken as typical of the circuit employed in measuring the change in temperature of the sensitive element of a catalytic type indicator by change of conductivity.

To form the bridge circuit, the battery current is split, part of it going through two fixed resistances in series, and part through two filaments. The "bridge" is a connection from a point between the filaments, through a sensitive meter, and to a point between the fixed resistances. The battery current heats the filaments to a temperature at which the oxidation of combustible gas will go on without interference. The circuit is balanced by the zero adjuster so that when there is no gas present, there is no current flowing across the bridge.

Both filaments are mounted as a unit within the reaction chamber. One is open to contact with the sample, while the other is sealed tightly into a glass tube. This arrangement compensates for temperature fluctuations in the chamber. As oxidation takes place on the surface of the exposed filament, its temperature is raised and its resistance rises correspondingly. Such a rise in resistance causes a flow of current through the indicator meter in the bridge. This meter is calibrated to show the concentration of combustible present as a proportion of the lower explosive limit mixture.

The operation of the indicator is very simple. The current is turned on by means of the switch, and if necessary, the voltage and zero setting are adjusted by turning the knobs located below the respective meters. Sample is then drawn through the indicator by working the aspirator bulb. If combustible gas is present, its concentration is registered immediately on the indicator meter.

Should remote samplying be necessary or desirable, sections of sampling hose of appropriate length may be attached to the sample cock, which is the point of intake on the indicator. A section of rigid tubing, called a probe, on the end of a short piece of hose makes it easy to reach inaccessible points or to localize definitely the source of sample.

In most testing with a combustible gas indicator, the lower explosive limit is the maximum concentration in which the operator is interested. This can be taken advantage of in the type of indicator just described to make the readings independent of the composition of the combustible over a wide variety of gases. Hydrocarbons, alcohols, ethers, etc. in their lower explosive limit mixtures have nearly the same heating values, which means that the heat liberated per unit volume of those mixtures upon reaction between the combustible and the oxygen of the air is, for instance, practically the same for methane as it is for gasoline vapor, even though the percentages of gas present are widely different. Hence to mark off the indicator meter scale in proportion of the lower explosive limit allows the operator to see how near the mixture is to being explosive even though he might not know the specific composition of the combustible present.

There often arises the necessity for a continuously operating detector or indicator which will automatically give some warning signal at the approach of danger, operate equipment, or make a record of gas concentrations. The electrically measuring type of catalytic indicator is easily adapated to such service. Such places as plants handling propane, butane, ether, or other volatile solvents, hydrogenation plants, under-ground gas sub-stations, ship's pump rooms, or any location where combustible gas may accumulate unnoticed can be equipped with such a device to warn against danger or to operate protective devices.

These continuous devices may be arranged to reset themselves upon subsidence of the alarm concentration. Preferably, however, they are manually reset by the operator in charge who must go to the indicator case and there determine the seriousness of the trouble by a glance at the indicator dial. The indicator cases

are equipped with signal lights so that in case of a multiple installation, the operator can locate the source of alarm at once.

Motor driven blowers are usually employed to suck the sample through small pipe lines to the continuous indicator, but any convenient source of vacuum may be used. Either alternating or direct current may be used to operate the entire device, the lighting circuit ordinarily furnishing the power.

Several other methods of gas detection embodying such principles as diffusion through membranes, differential refraction of polarized light, heat conductivity of the gas mixture, etc., are available, but as their application is quite limited, they will not be discussed at this time.

The detection of combustible gases and the various means for protecting against them are inseparable safety precautions. Detection demonstrates the need for ventilation or other protective steps, and again it must be employed as a check against the adequacy of the protection. With a satisfactory means for detection at hand, investigations are made easy where otherwise assumptions or guesses would have to suffice. Hydrogen in old acid drums has caused fatal explosions which might have been avoided if some thoughtful person with a handy detector available had carried out the common sense rule of checking the interior of all containers before doing "hot" work on them. Occasionally combustible gas is being handled or encountered without those concerned knowing it is combustible. Many people are surprised to learn, for instance, that ammonia gas is a combustible which forms explosive mixtures with air.

Prevention of combustible gas accumulations, where feasible, is always the best protection. This may mean either stopping the gas at its source, or providing enough ventilation so that the accumulations never become dangerous.

Inspection of equipment handling combustible gas or volatile flammable liquids to insure that it is maintained free from leaks is an elementary but frequently neglected point. Careful design, correct material, intelligent instruction, and safe practices against accidental leaks and spills, go a long way to protect against fire and explosion hazard. Such a simple thing as a plug or cap closing the end of a valved vent line saves many mistakes. When a tank, still, or other piece of equipment is down for cleaning, valves should not be trusted. All connections through which gas, vapors, or combustible liquids can enter should be broken.

A few years ago, just before vapor indicators came into general use, a tanker lay at the repair dock with her after compartments gas-free. Vapor from one of the forward tanks breathed through a leaky steam smothering valve. An explosion occurred which greatly damaged the vessel and injured several men. A steam smothering line, installed originally as a safety measure, was the accessory which allowed the vapor to go where it was not suspected. Today, with the aid of the modern combustible gas indicator, tank ships come in for repairs with every compartment tested and the ship known to be gas-free as a unit.

Ships, incidentally, are particularly well situated to employ the cheapest, simplest and often the most effective method available of getting rid of combustible gas, namely, natural ventilation. When it is desired to make a tanker gas-free preparatory to repairs, cleaning of compartments, or for any other reason, the crew suspend large canvas tubes from a line swung well above the deck. These tubes run through the hatches and down close to the bottom of the space to be ventilated. The tubes are cut down for some distance below their top and the canvas spread to form a sail which will catch the breeze and force air down the tubes into the bottom of the compartments. Such devices are called "wind sails." Even though there may be a little or no breeze, the compartment is usually warmer than the outside atmosphere, and a large volume of air is induced to flow down the tubes by convection.

Modifications of the wind sail idea may be used to solve many ventilation problems ashore. A sight familiar to San Franciscans is the "wind deflector ventilator" employed by the Telephone and Telegraph Company to ventilate cable man-holes while men are underground splicing cables or carrying on other work. The wind sail has been successfully applied to tanks, and is particularly useful in ventilating through roof hatches those field tanks which have not been provided with a side manhole. When a side manhole is available in a tank, it may be opened and an improvised wind deflector of galvanized iron sheet or other available material erected at that manhole to catch the breeze, thus aiding the usual natural tendency toward ventilation out through the open roof hatches.

Natural ventilation has the great advantage of going ahead with its work in many cases and getting the most dangerous part of a job completed without the accompaniment of such potential sources of ignition as machinery, static from steam, and human attendance. No specific charts of the progress of natural ventilation rates are available, but the accompanying sketches, summarizing observations made while driving the huge diversion tunnels at Boulder Dam, may be of interest. We do know that differences in density are largely responsible for most unaided ventilation. Hence in equipment filled with a heavy vapor, conditions will usually tend to reverse from an initial pouring out of vapor at lower openings to subsequent upward movement induced by absorption of the sun's heat or other temperature elevating environment. Street manholes which have accumulated natural or manufactured gas will tend to ventilate themselves when opened as these gases are lighter than air. This all depends on circumstances, however, and the only safe assurance is in checking with an indicator.

If we would take an indicator and investigate, we would find many cases where natural ventilation does a job while preparations are being made to employ some mechanical means. There is the instance when a blower set-up was planned to prepare a very gassy 115 foot by 30 foot crude oil tank for cleaning. The blower was set at the side manhole, and the manhole and the top hatches opened to allow the heaviest of the vapors to "pour" out of the side manhole. The tank was opened at the end of the afternoon and the job left until morning. As data on the rate of ventilation was desired, the man on the job made indicator observations the first thing in the morning preliminary to starting the blower. He found the tank atmosphere well below the limit established at which the cleaning operations were to begin and the blower was not found necessary throughout the job.

In another case, an engineer was sent to get data on the rate of natural ventilation of an isolated 30 foot by 30 foot gasoline tank down for repair. He arrived on the job half sick with a cold, made observations of the initial concentration in the tank, had hatches and side manhole opened, and went to bed for a few hours. Coming back to get the next point on his ventilating curve he found ventilation complete, the tank being sufficiently gas-free for the men to enter and start cleaning.

It is evident that not only safety, but economy as well, may be promoted by having the intelligent picture of gas movements afforded by a combustible gas indicator. One of many illustrations which may be cited is the cleaning of gasoline tank cars in oil refineries and distributing stations.

Gasoline tank cars must be cleaned free of rust each time they are filled. General practice is to steam these cars upon arrival at the filling station for a period of many hours, after which they are cleaned by washing with hose streams and often some scraping or shovelling is necessary after that. This "wet" processs in one refinery where a large tank car business is done averaged $4.00 per car and tied the cars up for around 48 hours.

A study of the natural ventilation which goes on when a gasoline tank car is opened top and bottom was carried out using a combustible gas indicator, and it was found that the cars gas-freed themselves within 8 hours after being opened up. Any small puddles of gasoline which might be trapped in uneven bottoms are floated out by the addition of a little water. When the cars are found to be gas-free, men enter and sweep the dry rust down, and out of the bottom opening. This "dry" cleaning process costs only from $.50 to $.75 per car, as compared to $4.00 per car for the steam and water, or "wet" process. The "dry" process ties up cars only about half as long as did the "wet" process.

Vents on buildings are familiar to all of us. The usual form is some sort of a roof vent, either at the eaves or the apex. This is satisfactory if we are sure that the gas will rise. In plants handling heavy gases or vapors, or volatile combustible liquids such as propane, butane, ether, gasoline, carbon bi-sulphide, etc., adequate vents, or louvres, should be provided at the low points. Pipe trenches, pump pits, or other depressions in such plants which might trap heavy vapors should be eliminated or provided with forced ventilation or with some warning device such as a continuous combustible gas alarm.

It would be impossible to touch on all available equipment and arrangements for ventilation which might be used to secure protection from combustible gas hazards. In general, mechanical ventilation should blow air toward the space to be cleared.

and any equipment which might possibly be a potential source of ignition should be placed well out of the way of the gas which is vented.

Often the expense of providing proper ventilation is offered as an excuse for taking chances. As an example of what can be done, it is worth while to mention a successful improvised ventilating tool consisting of a hand forge blower with a cheap canvas conductor tube. This forms a convenient ventilator for small containers in inaccessible locations. It has been used to clear manholes and small sumps of gas. It is not efficient and is tiring to operate for long; therefore, its application is limited.

Small portable turbine blowers are available either with a direct connected electric drive or arranged to be belt driven. Since it is sometimes difficult to get the blower in a place where it is known no discharged vapor will envelope it, an explosion proof motor is recommended. A gasoline engine driven generator placed in a safe location is used as a source of power where necessary.

Several designs of propellor type blower are available on the market. Such devices are remarkably portable considering the amount of air delivered, and installation cost is a minimum. Briefly, they are simply a motor driven propellor of the aeroplane type mounted directly in the pipe or duct used for ventilation.

Ventilation is only one of several methods which must be considered in protection against combustible gas. As a matter of fact, in any case where the normal concentration of gas or vapor is above the explosive range, ventilation would only introduce a hazard which did not exist before. Gasoline tanks have gas tight roofs with positive acting breathers which allow flow of air inward only to prevent vacuum from collapsing the structure. As a result, the vapor space has explosive mixtures in it over a minimum period of time and in minimum amount. A gas holder too is safe from explosion so long as it is filled with gas, but when being ventilated with air for repairs, it passes through a state of containing violently explosive mixtures.

Advantage should always be taken of a situation which involves vapor spaces normally above the explosive range as a simple means for protection. Vents from such equipment as may fall in this category should be studied carefully, however, to insure that gas may be discharged and disseminated safely. Heavy vapors should be discharged well up into the air so that they will diffuse to a concentration below their lower explosive limit before reaching points where accumulation could take place. The possibility of a vent fire should always be considered, and some provision made for snuffing it out.

Simply venting gas or vapor to the air is sometimes difficult to accomplish without creating some hazard, and usually constitutes an economic waste. These considerations combine to make attractive the installation of gas gathering systems from tank vents, still vents, drying processes, or filling operations which will bring the waste gases to some central location for appropriate recovery treatment. Such recovery systems are in widespread use, turning into profit what would otherwise be a hazard. Valuable vapors are condensed back to liquid form by compression or absorption processes, while any remaining non-condensable gases are available for burning under boilers or process equipment. This is a broad subject upon which much has been published.

Vent fires are sometimes put to use. Waste gas in the oil fields has been burned to avoid creating a hazard. In repairing large gas lines in open country, a slight flow of gas is sometimes kept coming and allowed to burn at a cut or opening. Lines may be welded with the flicker of flame at unsealed sections of the joint giving the operators assurance that gas is flowing out and being safely disposed of while the danger of explosive gas and air mixtures inside the pipe is being avoided.

Where operations, or materials handled, preclude a normal vapor condition outside the explosive range, the ratio of oxygen to combustible can be adjusted to force this condition. In a combustible liquid tank, for instance, where the vapor concentration hovers around the explosive range, it is often possible to inter-connect the vapor space of the tank with that of some neighbor where the concentration of vapor is normally well above the upper explosive limit. Interchange of vapor between the tanks will then tend to keep them both out of the explosive range.

Sometimes, if the vapor is of little value, the desired end may be accomplished most economically by removing the roof of the offending tank, or at least keeping all hatches open. The converse of this is often successful—the tank is made gas-tight,

and by means of suitable appurtenances some foreign gas is introduced to take the place of the air. Natural gas, still vent vapors, and cracking still gas are examples of combustible gases which have been used successfully for this purpose in the oil industry. In some instances, an inert gas, such as boiler flue gas has proven most satisfactory.

A good example of protection against explosive mixtures by the use of boiler flue gas is found in the marine transportation of crude petroleum and volatile petroleum products.

Tankers discharge their contents so rapidly that the air drawn into the compartments does not have time to become laden with enough vapor to bring the mixture above the explosive range. Lack of convection also tends to keep vapor concentration down. As a result, the mixture formed in the compartments is nearly always an explosive one, and persists in this state until the ship is loaded again, when it is forced out amid the deck activities of the ship's personnel. Recognizing these conditions, the Standard Oil Company of California developed a flue gas system which was described by Mr. H. H. Hall in his paper, "Protecting Tankers with Flue Gas," presented before the American Petroleum Institute in 1930.

Briefly, the boiler flue gases are drawn from the uptakes, forced through a cooling and washing device, and allowed to fill the tanks in place of air. A cargo piping connection is also provided, so that in gas-freeing the ship's tanks, the compartments may be cleared of vapor by flushing with flue gas, and thus avoid explosive mixtures. All vapor is collected during ship loading operations or gas freeing and discharged at the top of one of the hollow masts. As these systems and other applications of inert gas are coming into prominence, some discussion of principles involved is warranted:

Explosive or ignitable mixtures result when air and combustible gases or vapors are mixed in certain proportions. The gas is the combustible and the oxygen is the supporter of combustion while the 80% of nitrogen present in the air is "inert" and serves simply as a diluent. If the mixtures contained only oxygen and combustible, much more violent explosions would result. If extra nitrogen be added, the violence of the explosion can be still further reduced, until a point is reached where burning will no longer take place. This is the principle on which the use of inert gas is based.

Common gases other than nitrogen, which may be considered "inert" in this sense are carbon dioxide, and vapors of certain non-combustible organic liquids such as carbon tetrachloride. When the proportion of these inert gases is high enough, combustion will not be self-sustaining, and the mixture is said to be non-explosive. The effectiveness of inert gases results from the fact that they do not enter into the combustion reaction, and serve to absorb heat liberated by the combination of the combustible with the oxygen present.

The quantity of inert gas required to prevent the formation of explosive mixtures depends on the nature of the combustible, the kind of inert gas, and the proportions in which the combustible and oxygen are present. With mixtures of petroleum vapor and air, assuming that the combustible and oxygen bear the optimum ratio one to the other, it has been found that the addition of about 40% of extra nitrogen in the mixture will prevent the formation of explosive mixtures. If carbon dioxide is employed, about 25% need be present in the final mixture to prevent explosion. If carbon tetrachloride vapor is employed, only 12½% need be present in the mixture to preclude explosion. Flue gas, which is a mixture of nitrogen, carbon dioxide, and some oxygen, is a fairly effective inert gas. With flue gas of ordinary composition, a mixture of somewhat over 50% of flue gas with air will be incapable of supporting combustion.

Steam is probably the most widely used inert gas. Its advantages and disadvantages have been argued many times. Wet steam has been shown to be a prolific source of static, and for this reason may introduce that factor which makes combustible gas dangerous, namely, a source of ignition. Few large tanks have enough steam supply available to bring the entire interior of the tank up to the temperature of about 170°F. necessary to preclude the existence of explosive mixtures. To turn steam into a gasoline tank which is equipped with gas-tight appurtenances, and normally contains vapor too rich to explode, seems an illogical method of fire protection. The result of such treatment is that great volumes of vapor are expelled

to create hazard in the vicinity, and subsequently explosive mixtures are formed in the tank when the condensing steam sucks in air. On the other hand, a tank warmed by steam ventilates more quickly than a cold tank, and there is no question that in cleaning small containers an ample steam supply is very effective. The general conclusion is that each case in which steam may be used should be considered individually.

While oxygen-lean gas has great value in substituting for air where combustible gas cannot be eliminated, or in displacing combustible gas prior to admitting air, it should not be relied upon where ventilation will bring unqualified safety. For instance, the recent suggestions that carbon tetrachloride, carbon dioxide, or nitrogen be introduced into small tanks and certain other types of containers which have contained combustibles are not recommended for all cases. These attempted "cure-alls" tend to minimize the importance of proper cleaning. Without confirmatory tests in each instance, there is always a chance for misapplication of the process. Liquid carbon tetrachloride in contact with hot metal breaks down into highly toxic gases, phosgene and chlorine. Furthermore, any one of the suggested inerts is expensive. The American Petroleum Institute has published a manual on "Cleaning Petroleum Storage Tanks" developing sound principles which will serve as a safe guide under most circumstances involving combustible gas hazards in cleaning equipment.

Under certain conditions, substances termed "pyrophoric compounds" are formed which glow or even burst into flame when exposed to the air. One of the best examples of a pyrophoric compound is the iron sulphide formed in equipment handling those crude oils, petroleum distillates, or cracked petroleums which contain considerable hydrogen sulphide. Ventilation with air in this case is inherently dangerous, so that special methods must be employed. The simplest method, and one frequently used, is to completely fill the equipment in question with water before opening it to the air. (If the equipment can be worked on while full of water, the ultimate of safety from fire or explosion is achieved.) Filling with water drives out any combustible gas, and floats off oil residues which might result in fire or explosion after the water is removed and the air admitted. With the oil and vapor substantially removed, cleaning with hose streams can proceed with safety, and if a bit of the sulphide dries out and glows, no harm is done.

Steaming provides a means for ventilating and eliminating oil residues particularly well adapted to small equipment subject to pyrophoric accumulations. The job must be done thoroughly before admitting air, however, as the steaming leaves any residues warm, and, unless the volatile constituents have been evaporated, they are more ready to give off vapor than before steaming. Rapid vapor accumulations following steaming is not an unusual history.

Flue gas has been used with good success in driving out combustible gas without incurring danger from explosive mixtures. A portable flue gas generator for such service in oil refineries has found limited application. After displacement of the combustible gas, washing down of the interior may be done from manholes or hatches as flue gas ventilation continues, or an internal rotating nozzle may be used.

In every problem of protection against combustion gas, assurance of success is gained only by making adequate tests. Simple indicator means are available to check all steps of the various methods of protection. It is necessary where dealing with inert gas mixtures, or with vapor concentrations above the lower explosive limit, to mix additional air with the samples tested by combustible gas indicator. This is done without altering the operation of the indicator by placing in the sampling system a device known as a "range multiplier." The additional air introduced insures sufficient oxygen for reaction with the combustible present. The resulting reading is then multiplied by a fixed factor, usually 10, to arrive at the concentration of combustible in the original sample.

In checking the efficacy of inert gas protection, either the oxygen content of the mixture or the inert gas content may be used as an index. With flue gas protection, a check for carbon dioxide furnishes the correct and most rapid method for estimating what degree of dilution of the oxygen content has been accomplished.

Summing up the subject of controlling combustible gas hazards, greatest emphasis must be placed on the necessity for knowing the condition of every situation as it actually exists. To attempt protection without the intelligence afforded by an appropriate indicator is to work blindly and without assurance.

With the problem illuminated by definite data, plans may be laid to avoid or mitigate hazards. In every case considered, the primary assumption should be made that a potential source of ignition exists. Hence, where combustible gas is normally and unavoidably present, protective measures must attempt to make it a safe neighbor for fire by preventing it from forming flammable mixtures, and then keep the two as well separated as possible. Where gas is incidental, protection must be directed toward its elimination, and continual vigilance maintained to prevent its encroachment, suspected or unsuspected, into an area in which a source of ignition is assumed.

Causes and Prevention of Dust Explosions and Dust Fires in Industrial Plants

By DAVID J. PRICE

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

As the result of our research studies considerable knowledge concerning the nature and behaviour of dust explosions during grain-handling and milling operations has been acquired. We also have been able to secure a better understanding of dust explosion hazards during fire-fighting operations when combustible dusts are present.

Technical knowledge regarding this important industrial explosion hazard, which affects more than 1,300,000 employees, has been instrumental in the development of methods for control and prevention. The practical value of these precautionary measures is being carefully studied at the present time.

The economic significance of research work on dust explosion prevention can be more fully appreciated when we recognize that in the United States the dust explosion hazard exists in more than 28,000 manufacturing plants handling products principally of agricultural origin. In addition to these, more than 25,000 country grain-handling plants, having a capacity of more than 700,000,000 bushels, are subject to grain-dust fires and explosions.

In the last 19 years, the period for which accurate records are available, there have been at least 385 dust explosions in connection with the handling, milling, and processing of agricultural products. In these explosions 311 persons lost their lives, and more than 693 workmen were injured. The property and stock losses (insurance paid) amounted to more than $35,000,000, an average loss of more than $90,000.

These explosions have occurred in practically all the grain-handling operations, such as grain elevators, flour and feed mills and starch factories, and in many industries associated with the processing of agricultural products such as sugar refining, the preparation of powdered milk and other food products, insecticides, fertilizers, wood pulp, wood dust, soap powder, paper dust, and many others.

The Chemical Engineering division of the Bureau of Chemistry and Soils, U. S. Department of Agriculture, investigated 16 major industrial dust explosions in 1934.

(1) They caused the loss of 27 lives, injuries to 52 other people, and property and stock damage of approximately $2,475,000. The average loss for each explosion was about $155,000, the range being from $800 to $700,000.

(2) They occurred in nine different types of industries—malt houses, wood working plants, terminal grain elevators, country (rural) grain elevators, feed mills, aluminum powder manufacture, insecticide manufacture, flour milling, and cocoa pulverizing.

(3) The causes of the explosions can be classified as follows:

Grinding and Pulverizing Operations	5
Fire Fighting Operations	2
Metallic Sparks	2
Friction Fires	2
Defective Extension Lamp	1
Backfire from Boiler	1
Static Electricity	1
Undetermined (attributed to electrical sources)	2
Total	16

Although dust explosions usually occur during the operation of industrial plants, a number of disastrous explosions resulting in the death or injury of firemen have occurred during fire-fighting operations. *In general these explosions* can be classified as follows:

(1) Explosions caused by the full stream of water striking settled dust in various parts of the buildings. The water forces the dust cloud on to the fire, causing the explosion.

(2) Explosions caused by the falling of the floors or the dropping of the *bottom* of storage bins, forcing the dust cloud on to the fire, resulting in an explosion.

(3) Explosions that have taken place when firemen attempted to remove the contents of bins or other enclosures in an effort to determine whether the original fire in the bin had been completely extinguished. The dust clouds thus produced readily ignite when they come in contact with flames.

(4) Explosions that have taken place as the result of the chemical reaction between water and the dust. When water is applied to hot aluminum powder, for example, a violent reaction takes place. The oxygen from the water unites with the aluminum, causing it to burn more rapidly, while the hydrogen, which is an explosive gas, is liberated.

The following precautionary measures are recommended for the prevention of explosions of the various classes referred to:

(1) Plants in which combustible dusts are created during operating processes should be systematically inspected by firemen. This enables firemen to become thoroughly familiar with structural features of the buildings and the hazardous processes carried on in them, and gives them definite knowledge of the contents of the building and of any combustible products handled and manufactured. This knowledge is helpful in working out a plan of fire fighting which will more adequately protect the firemen.

(2) When wetting explosive dusts, a spray is preferable to the full pressure from the hose.

(3) Before undertaking to remove the contents of bins in which a fire has occurred and apparently is extinguished, it is advisable to flood the bin and thoroughly drench the material.

(4) When inflammable metallic dusts that liberate hydrogen by chemical reaction are encountered in fighting fires, water must be used with caution.

A puzzling situation with reference to dust explosions in grain elevators, grain storage plants and other grain-handling and milling operations has been encountered recently. There seems to be a very definite feeling on the part of operators of grain-handling plants that a number of recent disastrous dust explosions may have been associated with residues of explosive gases remaining in the grain after fumigation operations.

It has been suggested that a selective adsorption or absorption of the explosive constituent might take place when grain is fumigated with gases consisting in part of a recognized explosive gas, and in part of some inert gas used as a safe diluent of the explosive gas, the inert gas being displaced eventually by air. The possibility of adsorption of explosive gases by grain during fumigation operations and the later liberation of the gases during storage must be studied further.

Another question concerns possible increase in the explosibility of grain dust and air mixtures due to the addition of small percentages of explosive gases.

In connection with the consideration of this part of the problem it is pointed out that tests by the U. S. Bureau of Mines indicate that, although Pennsylvania anthracite coal dust when mixed with air will not propagate flame, the addition of as low as two per cent of methane gas will produce an explosive mixture. This gas percentage is more than three per cent below the lower limit of explosibility of the methane gas.

Additional scientific knowledge on this problem will assist in the development of further measures for safe fumigation methods.

(a) *Explosion Venting Areas.* Dust explosions in grain-handling plants, particularly in grain elevators, have proved definitely the need for adequate venting areas in the construction of these plants. In one recent case proper venting area to relieve the pressure from an explosion in the workhouse of the elevator would have prevented the complete destruction of the top of the house. In another recent case the workhouse was saved from destruction by an adequate glass-venting area.

The effectiveness of glass vents in this explosion confirmed the tests by the Chemical Engineering Division of the Bureau of Chemistry and Soils. These tests have shown conclusively that it is possible to vent grain dust explosions without structural damage. Our engineers recommend that for satisfactory venting of dust explosions in grain elevators not less than 1.25 square feet of venting area be provided for each 100 cubic feet of space (1 sq. ft. to 80 cu. ft.). The application of this principle should be embodied in all new construction of grain-handling plants.

(These tests are reported in an article entitled, "Venting Dust Explosions," by Hylton R. Brown and Richard L. Hanson, which appeared in the April 1933, Quarterly of the National Fire Protection Association, Boston, Mass., and in the April and May, 1933, issues of the International Fire Fighters Magazine).

(b) *Removal of Foreign Material from Grain.* The desirability of removing foreign material from grain upon receipt at the grain elevator or milling plant has been forcibly demonstrated by several recent explosions in grain elevators. The investigation of these explosions indicated that the dust clouds had been ignited by sparks from metal particles in the grain. It is a difficult problem to prevent foreign material from entering equipment in grain-handling operations. Screens of 1½ to 2-inch mesh, when placed in the gratings over receiving pits, have in many instances stopped large pieces of metal from entering pits with the grain, and the use of such screens should be given practical consideration. The practical value of magnetic separators in the grain-handling sections of the plant should be given further attention.

(c) *Closed Storage Bins.* The value of closed bins and the undesirability of interconnections between storage bins are definitely indicated by the recent explosions in grain-handling plants. Open storage bins and bins with direct connections permit the rapid spread or propagation of flame over the tops of the bins and thereby extend the violence of the explosion. Preventing the spread of fire from one storage bin to another is of prime importance.

(d) *Protection of Electrical Equipment.* It has been amply demonstrated in the investigation of dust explosions that proper provision should be made for adequate protection of electrical appliances and equipment. Electric lamps should be protected with outer dust-proof globes and heavy wire guards to prevent breakage. Portable spot-lights of suitable design and approved construction, to be directed into bins through manholes, should be used as temporary or occasional lights for bin examination instead of extension cords dropped into bins.

(See Safety Code for Terminal Grain Elevators, Section 8, paragraph 804, published in U. S. Department of Labor Bulletin No. 562. See also Section 3204 (j) of the National Electrical Code.)

(e) *Control of Static Electricity.* Static electricity has appeared as one of the prominent causes of dust explosions, and considerable attention has been given to control methods for this hazard. Provision should be made for the removal of static charges on all types of mechanical equipment handling combustible dusts or operating at points in the plant where these dusts are present.

(f) *Inert Gas Protection.* The reduction of the oxygen content by the introduction of inert gas, such as carbon dioxide in grinding and pulverizing operations has proved effective in the control and prevention of dust explosions. When the oxygen content is reduced to approximately 12 per cent in grain-grinding operations, complete protection is afforded. The reduced oxygen content (as the result of the addition of inert gas) prevents the ignition of the dust cloud in the grinding machine, and also prevents the spread of fire through the conveying and elevating machinery.

(See Safety Code for the Use of Inert Gas for Fire and Explosion Prevention, published in U. S. Department of Labor Bulletin No. 562. See also U. S. Department of Agriculture Technical Bulletin No. 74, "The Value of Inert Gas as a Preventive of Dust Explosions in Grinding Equipment," by Hylton R. Brown.)

(g) *Dust Collection and Removal.* Cleanliness and good housekeeping are matters of prime importance in dust explosion prevention and should be insisted upon to the highest degree. It is always impossible to handle or clean grain without making dust. This dust should be collected and removed without being permitted to accumulate in any section of the plant.

Research work on dust explosion and fire prevention is directly concerned with the development of methods and appliances for the protection of human life, property, and foodstuffs. Before further methods are developed for dust explosion prevention

in industrial plant operation and also during fire-fighting operations, we must fully understand the conditions under which dust explosions can occur and the factors which contribute to the explosibility of these dusts.

We must realize that with the introduction of new methods and equipment some dust explosions are going to occur, possibly from new causes or from causes not previously determined. We should therefore continue our efforts by further research studies and by practical application of methods and devices for limiting or controlling these dust explosions.

Causes and Extinguishment of Chemical Fires

By C. B. WHITE

Chemist-Engineer, American La France and Foamite Corp., Elmira, N. Y.

To discuss the fighting of fires in common commercial substances it is well to review some of our modern first-aid fire fighting appliances in order to see what tools there are to work with.

First the *Vaporizing Liquid* type of extinguisher. The extinguishing medium is a liquid which readily evaporates producing gases which will not support combustion. The substance usually is carbon tetrachloride. When sprayed on a fire the heat converts it into gas rapidly. The quantity of vapor which may be produced from one pound of the liquid is about 2½ cubic feet at room temperature and normal pressure. It has a smothering effect, the action amounting to a dilution of the atmosphere to the point where it will not support combustion.

Since the smothering gas is a free gas, it will function better when it can be confined. A good example of this is a fire under the hood of an automobile. Here the fumes may be trapped long enough to produce a substantial dilution of the atmosphere and the fire goes out.

Next the *Soda Acid* extinguisher which operates by means of pressure produced by the liberation of carbon dioxide from a solution of bicarbonate of soda when acted upon by an acid. The fact that the soda-acid device is actuated by chemicals does not increase its extinguishing ability over water. In fact the extinguisher is merely a convenient device for squirting water on to a fire. The extinguishing action is almost entirely produced by cooling with very little if any smothering.

Closely allied to this extinguisher is an old type which has lately come into favor again. This device instead of producing its own CO_2 by the chemical reaction between a carbonate and an acid contains CO_2 under pressure in a small cylinder. The extinguishing medium is plain water which is forced through the hose when the CO_2 gas is released from its little cylinder.

Another similar extinguisher is the anti-freeze type which also employs a cylinder of CO_2 but which contains sufficient anti-freeze chemical in solution in water to render the water non-freeze at minus 40°.

The point to be stressed under this general head is that the fire extinguishing action is accomplished, not by the chemicals used or by the gas produced, but the cooling action of the water.

Foam. Some devices designed to produce fire extinguishing foam are large, intricate and stationary while others are small, simple and portable. Each has its use but I shall confine my remarks to the simple portable types.

Examination of the hand foam type will reveal three marked differences from the soda-acid type. First the glass bottle of the soda-acid machine has become an elongated metal cylinder. Second, instead of sulphuric acid this cylinder contains a concentrated solution of aluminum sulphate. Third, the bicarbonate of soda contains a foam stabilizer or foaming agent usually a derivative of licorice root.

When the device is operated the aluminum sulphate reacts with the bicarbonate just as the acid does in the soda-acid type to produce carbon dioxide but unlike the soda-acid stream, which is thin and watery, there is now produced a mass of foam consisting of minute bubbles which contain the carbon dioxide. Furthermore from a foam extinguisher having a liquid capacity of 2½ gallons it is possible to produce more than twenty gallons of this fire smothering foam.

The striking difference between the stream from the soda-acid machine and that from the foam type is brought about partly by a product of the reaction, aluminum hydrate, which gives strength to the bubble wall, and partly by the foaming agent which takes no part in the chemical reaction at all, but which acts as a protective colloid merely changing the physical nature of the stream from liquid to foam.

Foam accomplishes two objectives in firefighting. It cools and it smothers. The cooling action is accomplished by the water contained in the foam and since fully 85 per cent of the total weight of foam is water, this cooling action is practically as great as that from a soda-acid machine of the same size.

So far as the smothering action is concerned, foam is much heavier than air but lighter than the lightest inflammable liquid. Hence it will float upon such liquids as gasoline like a blanket, effectually cutting off the air necessary for combustion.

Another valuable property of foam is its ability to insulate against heat. It is frequently used to cover property not on fire to protect it from the heat of a fire. In fact it has often been used to protect firefighters when they were forced to approach a particularly hot fire.

The smothering action of foam is produced partly by the CO_2 gas contained in the bubbles and partly by the bubble structure itself. Formerly it was considered that the carbon dioxide did all the work, but we have come to the conclusion that the foam structure itself performs the major part of the smothering and that the CO_2 merely contributes a share in the action.

The *Carbon Dioxide* type of extinguisher is different from all the other types. Into a relatively small bulk the gas is compressed by liquifying it. In this condition it is held in heavy steel cylinders and at ordinary temperatures exerts a pressure of about 800 pounds per square inch. When fire occurs and the gas is released it escapes with great velocity. The expansion is high; one pound of liquid CO_2 expanding into gas will occupy at normal room temperature and pressure 9 cubic feet. Since one pound of liquid CO_2 occupies only slightly more space than 27 cubic inches its expansion is 576 times. This means that into a small package may be packed a relatively large quantity of fire smothering gas.

As in the case of the vapor from a vaporizing liquid extinguisher the gas from a CO_2 extinguisher can do its work better and more efficiently in an enclosed space. However, portable CO_2 devices can do very effective work on small areas of alcohol or gasoline even in the open. This is largely due to the formation of CO_2 snow. This snow has a certain velocity which carries it through the flame and hot vapors above the fire right to the surface of the burning liquid where it floats at the same time subliming rapidly to CO_2 gas.

Under the head of fires in industrial chemicals we might include everything that will burn because every substance has a chemical structure and fire itself is a chemical reaction. For the purpose of this paper, however, we will limit ourselves to classes of fires already established and to such individual flammable materials as seem to fall outside these classifications.

Underwriters' Laboratories recognize three broad types of fires, classes A, B, and C. For convenience we will add class D. Setting up these classes against the extinguishing devices discussed, we are able to prepare a chart which shows where each of these extinguishers fits into the firefighting picture.

The chart tells its own story but in these modern times with our tremendous variety of fire risks, it is difficult to generalize. The chart serves merely as a guide.

[Editor's note: The chart, "Characteristics of Fire Extinguishers" is available from the American-La France and Foamite Corp. or National Safety Council headquarters.]

Alcohol. Looking at the chart one would probably place alcohol under the head of Class B. It isn't gasoline but it is an extra-hazardous risk—a volatile liquid the vapors of which are highly inflammable. But to use foam to fight an alcohol fire would be a mistake. Alcohol is miscible with water. Foam with its high percentage water content simply flattens out in contact with alcohol and ceases to be foam. Alcohol fires may be extinguished by diluting the alcohol with water to the point where combustion ceases but this method is practicable only when the container is nearly empty. The best method is to smother with CO_2. A few other liquids such as acetone are similar to alcohol with respect to fire extinguishment.

Carbon bisulphide is unique because it is a highly volatile inflammable liquid which is heavier than water. Fighting a carbon bisulphide fire is not a pleasant job because the material burns with a light blue flame like sulphur so faint in color that it is very difficult to see unless one is fairly close. But it is almost beyond human endurance to get close to such a fire without a gas mask because one of the products of combustion is sulphur dioxide, a gas so irritating to the nose and throat that it strangles the fire fighters. Once the fire is located, however, the best extinguishing medium is water. Water because of its lower specific gravity will float on the surface of the carbon bisulphide, seal the inflammable liquid from contact with air. Thus water acts as a smothering agent instead of in its usual capacity as a cooling agent. Sulphur fires respond in a similar manner.

Linseed oil seems like an innocent material as a fire hazard but the more we learn about it, the more precautions we will take to guard against it. Linseed oil has long been used with paints because, mixed with pigments it oxidizes to a hard, elastic, weather-resisting surface. It is this ability to oxidize, however, that makes linseed oil dangerous. Exposed on the side of a house as paint it offers no hazard, but linseed oil-soaked rags and litter, provided with the right amount of air to allow oxidation, but more or less protected from draughts, are liable to ignite spontaneously because the oxidation is accompanied by the generation of heat. Other vegetable oils are similar to linseed oil with respect to spontaneous ignition but they have not received quite as much study.

Linseed oil presents still another hazard. It plays an important part in the manufacture of varnish where it is heated in kettles. Occasionally through mistake or because of a fault in the heating system, it is heated above its ignition point. Then there is a mass of burning oil at a temperature much above the boiling point of water, so that even a few drops of water tossed into the kettle will cause frying and spattering due to the sudden formation of steam. The addition of a quantity of water causes the whole mass to froth and boil over, sometimes spattering oil to a considerable distance due to the explosive violence of the sudden formation of steam.

Such a fire may be handled in several ways. First the heating system should be cut off and the surrounding hot brickwork of the furnace cooled as rapidly as possible. Next, if there is room in the kettle, cool linseed oil may be let in until the whole is cooled below the ignition point and the fire is out. If there is not sufficient room in the kettle, foam from a manually operated device will rapidly kill the fire; but *only just enough* foam to extinguish should be used because a big excess will wilt from the heat and the water thus liberated will cause boil-over. Linseed oil fires of this nature may also be extinguished with CO_2 very readily with no danger of spattering or boil-over. If the oil is very hot it may reflash after being extinguished the first time so it is usually necessary for the operator to stand by ready to apply the CO_2 for one or two reflashes.

These remarks about extinguishing linseed oil fires apply with equal force to fires in most vegetable and animal oils, paraffine, heavy mineral oils, tar, pitch and asphalt.

Calcium carbide of itself is non-flammable. A little moisture, however, liberates acetylene gas which is highly flammable and which with the proper mixture of air is capable of terrific explosive violence. Consequently in fighting fires where carbide is stored water or anything containing water should be avoided. Here is the place to use the carbon dioxide or vaporizing liquid type extinguisher.

Pyroxylin Plastic fires are exceedingly bad risks but fortunately they may be extinguished with water. Only on very small quantities of pyroxylin should foam be used. CO_2 or vaporizing liquid not at all.

It is true that either of the latter substances will extinguish a pyroxylin fire but the hazard of fumes from rapidly decomposing pyroxylin is great. These fumes contain quantities of carbon monoxide and nitrogen peroxide either one of which is deadly and in combination they are a first class war gas. Such fumes are produced from burning pyroxylin after the actual flame has been extinguished by CO_2 or carbon tetrachloride or in a small vault after the oxygen of the air has been used up. In certain small pyroxylin fires foam is sometimes used successfully but the true measure of success in such a case is isolation with the foam blanket rather than extinguishment. The proper treatment for pyroxylin fires is to drown them in a deluge of water which will serve to cool the burning material below its burning point and below the point at which it will produce fumes.

Pyroxylin Lacquer is merely pyroxylin in solution. Almost all of the solvents used today are highly flammable. Therefore when fire occurs in liquid lacquer it is more a fire of the solvent than of the pyroxylin. Water will not extinguish such fires but either foam or CO_2 will. After lacquer has been sprayed on objects set up in a spray booth a feathery structure of the solid lacquer may be found at the back of the booth unless careful "housecleaning" is the rule. This material is the pyroxylin minus the solvent. It makes a very mean fire and the only good extinguishing agent is water.

Potassium Chlorate itself is not flammable salt but it belongs to that class of substances which when heated give up oxygen. It is used to some extent in gunpowder and when so used it assists in the rapid burning of the charcoal and sulphur by supplying the necessary oxygen. When potassium chlorate is present with a burning substance it assists very materially in the complete destruction of that substance just exactly as it does in the case of the carbon and the sulphur in gun powder.

Casting about for a suitable fire extinguishing agent for such a fire one finds himself faced with the problem of extinguishing a fire in which the oxygen is being supplied by the combustion. Smothering, therefore, is of not the slightest use. Water would seem to offer a solution of the problem but water has a tendency to cause spattering which *might* spread the fire. Probably the best solution is to isolate the burning mass rather than to attempt actual extinguishment and this may be accomplished with a layer of foam.

Other substances which are similar to potassium chlorate are the chlorates of other metals and the nitrates, the peroxides, the permanganates of metals and nitric acid.

Aluminum dust. Without going into the general subject of dust explosions and fires, a few words on finely divided aluminum may not be out of place.

This material is quite common in industry and it presents a real problem because practically none of our modern first aid fire fighting devices has any effect upon a fire of it other than to make the fire worse. The fire once started is made up partly of a molten accretion of the metal and partly of particles actually being oxidized (burning) by contact with the molten material. The presence of water greatly intensifies the heat and stimulates the combustion. This rules out water, soda-acid and foam as extinguishing materials. Carbon tetrachloride causes mild explosions blowing glowing particles about like a Roman candle. Carbon dioxide, if anything, causes the entire mass to burn more violently. Apparently what is required is some anhydrous material which will conduct away the heat. Experiments indicate that either dry sand or talc will make a passable extinguishing agent.

ADJOURNMENT.

First Aid and Health Service in Industry

TUESDAY AFTERNOON SESSION

October 15, 1935

The session was called to order by Dr. C. H. Watson, Medical Director, American Telephone and Telegraph Company, New York City, and Vice-President for Health of the National Safety Council. Dr. Watson briefly outlined some of the problems to be discussed.

Rehabilitation After Injury to an Employee's Only Good Eye

By DR. THOMAS D. ALLEN
Chicago, Ill.

At first glance this may seem to be a rather limited subject. It is not rehabilitation of the blind; it is rehabilitation of the partially sighted. You are thinking, "There isn't any such animal; no one will hire a one eyed man." This may not be a matter of hiring; it may be a matter of retaining a valuable employee.

How many plants have an accurate up-to-date record on all or a portion of their employees; how many have any idea what proportion of employees have developed during the past year or two any of the following ocular disorders which can put them in the one eyed class; cataract, glaucoma, optic atrophy, Bright's disease, heart disease, syphilis, tobacco or alcohol blindness, diabetes, myopia, detachment of the retina, deep seated inflammations of the eye, etc.? What are you going to do with an employee whom you find on re-examination to have lost the sight of one eye? Of course an effort will be made to regain the lost sight, but if this is unsuccessful or inadvisable, what are you going to do about him? And then, if he injures his other eye, what will you do for him?

Rehabilitation itself is a matter of many angles, no one of which should be considered alone and apart from its relationship to others. We have the physical angle, the psychological, the sociolological, the economic, and before long we shall probably have the political angle. Also, we must not ignore that angle of human relationship which is emphasized by the trade labor unions.

Rehabilitation begins with prevention, not only thorough examination before a man starts work, but periodic check up, especially in certain occupations. The periodic check should also be thorough.

How thorough an eye examination should be, would, of course, depend on the job. For instance, Dr. Hart E. Fisher, of the Chicago Rapid Transit Co., makes three classifications: (I.) motormen, switchmen, signalmen, and towermen; auto truck drivers and motor bus operators; these all must have 20/20 vision without glasses in each eye, normal color perception, good fields and depth perception. (II.) conductors, regular and extra guards, etc., 20/20 in one eye, and 20/30 or better in the other eye, normal color perception. Re-examination in both these classes every two years. (III.) station platform guards, crossing flagmen, shopmen, laborers, combined vision of 20/30, and not less than 20/40 in one eye without glasses, and normal color perception.

Each eye should be tested separately with the Snellen chart at a distance of 20 feet with good illumination—with and without glasses. If the employee cannot see the largest letter on the chart at 20 foot, he should step toward the chart until he can see it. It should be seen by the normal eye at 200 feet distance. If he has to come to within 5 feet before he can see it, the vision is recorded as 5/200. 20/200 is usually taken as industrial blindness. In some states however, allowance is made for errors of refraction correctable with glasses.

Notations should be made of asymmetry of the face, protrusion of one or both eyes, size, shape and reactions of the pupils, colors of the eyes, movement in all directions and in convergence, the condition of the lids and the lining of the eyes, and the presence of pus or mucus in their corners. In the interior of the eyes, the optic nerve head is noted, its color, shape and irregularities, and the vessels that pass from and to it. These latter are traced outward into the periphery of the retina. This can be satisfactorily done only with the pupils enlarged. The fields of vision or side vision are tested with a target and screen or perimeter. The simultaneous use of the two eyes to perceive depth should be recorded, and the percentage of fusion noted.

Naturally each employee does not need such a searching examination.

A disabled person is "rehabilitated" when he has been prepared for and placed in a job that is consistant with his mental, physical, and vocational abilities. This means that each individual must be considered separately. Disabled people display a great variation of ability, and their very disability so increases the variation that it is impossible to treat them in groups without great injustice.

The underlying principle in rehabilitating an employee who has lost the sight of one eye is, first, to place him in an occupation in which the danger of accident to the remaining eye is reduced to a minimum, and where he cannot harm others. Second, in so far as it is possible, he should be encouraged to use his existing qualifications. Third, other knowledges and skills which will render him employable in some other occupation than the one in which he was injured should supplement his previous training. Fourth, psychological adjustment may be necessary.

Lack of sight tends to produce a different psychology than any other physical disability. The blind and partly blind consider themselves, and are considered by others, as a class apart. They assume an attitude of self-pity, self-conceit and self-distrust, partly due to the way they are treated by the public. Thus, rehabilitating such an employee is partly a matter of psychological adjustment. If he is one-eyed and knows it before he injures his good eye, nearly half of the psychological battle is won. Half the solution of any problem is a comprehension of what the problem is. The employee who knows he has only one good eye, not only takes precautions, but he has adapted himself in great measure to the use of that eye, and often has become remarkably efficient as a one-eyed man. Take, for example, Wiley Post; we did not consider him an object of pity. He had ability even to tell depth, to handle an airplane—a thing few one-eyed persons are able to do. A one-eyed man crossing the street is more careful than a fully sighted man.

Very often the psychological adjustment is thrown into or out of gear by the statements or purported statements of the eye physician, the boss, a fellow workman, a friend, or someone in the worker's family. Occasionally there is a bad family history of blindness from one cause or another. This has to be combatted. Some injured men think they are imposed upon if they are asked to return to work.

A malingerer often can be handled so adroitly and in such a friendly way that he himself becomes convinced that pretense is useless. Even a malingerer has to be rehabilitated.

Rehabilitating an employee who has injured one eye and has just become aware of the fact that his other eye is poor is a far different affair usually. He suddenly has to adjust his mind to the possibilities of industrial blindness. A right-handed employee who has poor sight in the left eye and has injured the right eye usually has greater difficulty adapting himself than a similarly injured left-handed man.

It is often possible to give the man a new job closely allied to his old one, a job to which he can easily accommodate himself. When this is not possible, measures must be taken to prepare him for another occupation. Vocational guidance naturally must be given a man who is physically unfitted for his previous job as a result of his injury. It has been found that the rehabilitation of such an individual involves

six fundamental elements: (1) a survey of the case, (2) the selection of a job objective, (3) preparation for the job selected, (4) supervision during the entire period of rehabilitation, (5) placement in employment, (6) follow-up until reasonable permanency is assured.

How then shall semi-blind individuals be counselled and treated? The rehabilitation agent or counsellor must possess tact, friendliness, a well modulated, quiet voice, and the ability to see many sides of a problem. His is a social, economic and educational work, not a charitable enterprise. He must find out the individual's possibilities, and know the type of work available.

The technique of rehabilitation has been well worked out by specialists, who have added considerably to the welfare of society. For instance, the mechanism which may be instantly added to an ordinary switchboard to enable the blind to operate it, has been entirely the work of rehabilitation specialists. How many switchboards are there in this country? More than there are blind of suitable age to run them. The assembly of this mechanism has been the work of the School for the Blind at Jacksonville, Illinois.

Basket weaving was not very remunerative until a method of mass production was introduced, due to the fact that people would not buy baskets at a price for which they could be made. Four baskets selling on the market for 15c each once was a big day's work for one blind man; now with several men working together, each can do a portion of the job, and turn out four times the work he did when alone; and he learns to work in unison with others, and in competition with the sighted.

The United States Census lists 20,000 jobs at which people work for a living. In 408 of these, the blind can be employed. In a study by the Federal government of 4,848 cases rehabilitated by the Vocational Rehabilitation Division in 1928, it lists 229 different vocations for which 204 persons totally blind in one eye were prepared during that year, and 69 for which 116 persons totally blind in both eyes were prepared. These include (a) handcrafts, such as basket making, rug weaving, typing, massaging, etc.; (b) hearing crafts such as musicians; and (c) personal or sales crafts, teaching, selling, etc.

Some of these occupations are taught in schools, others in semi-charitable industries. One serious objection has been raised against the schools, which are tax supported and apt to be run by and for politicians primarily: the students are given too optimistic a view of life; are told they will be welcomed into industry at a ridiculous wage; are not prepared for the grim struggle ahead of them.

In the semi-charitable industries the funds are as insecure as in industry itself. While training in such an industry, the students feel the struggle for existence, and are stimulated by others who are succeeding; by pooling their abilities they form a unit which fosters self respect, self reliance, and a measure of independence. Recently I visited the Chicago Light House where semi-blind and blind workers are taught the joys of struggle, of responsibility, of cooperation. There is no pity for such men, but admiration. It's the struggle that keeps the soul alive.

One of the significant developments in industry is the application of scientific methods in the selection of employees. Many industries now are beginning to avail themselves of the services of vocational psychologists and job analysts in an effort to cut down the tremendous losses in money and human effort due to heavy labor turnover. It is an effort to place the right man on the right job. Some employers state that the physically handicapped often make the most efficient employees, being aware that they must "make good" to hold their jobs.

Different jobs require various degrees of visual acuity. However, it must be kept in mind that one man with, say 20/65 vision, may be able to do a particular job as well as another man with 20/30 or 20/20 vision. Thus, although certain standards must be held, they must not be too rigid; they must allow for certain exceptions. One Chicago company requires a watchman to have 20/20 vision in one eye, and 20/40 in the other; or 20/30 in each. It requires a battery repairman to have 20/30 in one eye, 20/50 in the other; or 20/40 in each. Suppose a long time battery repairman injures one of his eyes, so that his vision is greatly reduced. He may be able to adapt himself, and still do his work as well as he could before, although he couldn't pass the requirement for that particular job.

Haphazard employment is out of the question for rehabilitated workers. Careful

placement is necessary. Job analysis is a necessary preliminary step. Several companies have analytical lists which show the jobs available and the physical requirements necessary to fill them. You safety men should see that such surveys are made of your plants in an analysis of the jobs, so that when you are confronted with the necessity of placing a semi-blind man you will know the possibilities at once.

Good ground work has been laid in taking precautions to avoid eye accidents. The next step is to know the present physical condition of your men, and to know your available jobs. This will lead the way to constructive rehabilitation.

Variations in the Toxicity of Chemical Compounds under Different Conditions

By W. F. VON OETTINGEN, M.D., Ph.D.

Director of the Haskell Laboratory of Industrial Toxicology, Wilmington, Dela.

The discussion of variations in the toxicity of chemical compounds under different conditions implies that there are absolute figures with regard to the minimal fatal concentration or the minimal fatal dose of chemical compounds. This does not mean that we cannot rely on such figures as are assembled in the literature and in text books on toxicology, but rather, it indicates that there exist definite factors which are liable to change the toxicity of certain substances, and that it is, therefore necessary to be familiar with such synergistic conditions in order to judge correctly on the potential dangers. In therapeutics the medical student learns the doses in which therapeutic agents should be administered, but later, when in practice, he finds to his surprise that in one patient he has to overdraw the standard dose in order to get the desired effect and that in another he has to reduce the standard quantity if he wants to avoid severe and violent reactions. As time goes on, he learns to individualize his patients as to their resistance and susceptibility. The same experience may be had in industrial toxicology. It happens not infrequently that accidents occur in operations which are apparently safe, and in order to avoid these it is necessary to be familiar with the factors which contribute to the increased toxic action of chemical substances.

Variations in the toxicity of chemical compounds may be due to *pathological* and *specific physiological conditions* of the exposed individual and may be caused by *secondary reactions* or *changes of the physical properties* which the chemicals undergo in the course of different processes.

In the first group, namely, the *pathological conditions which cause an increased susceptibility*, an abnormal sensitivity frequently plays a very important role. There are people who are extremely sensitive to certain chemical compounds, so that very small quantities and concentrations will cause violent reactions. In order to illustrate this, I may perhaps quote a case published by Karrenberg (Sammlung von Vergiftungsfällen. *I*, A 55, 1930). He describes a female worker in a cigarette manufacturing plant who upon handling tobacco leaves complained of reddening and itching of her hands, and later developed a severe inflammation of all parts of the body exposed to the tobacco dust. It was found that this woman was extremely sensitive to nicotine and a concentration as dilute as 1 part per million applied to the skin caused very severe reactions. There are various substances, as alkaloids, proteins, and certain aliphatic and aromatic amino compounds which are especially liable to cause such reactions, and it may be advisable to make skin tests of new employees before subjecting them to such operations. On the other hand, it is frequently observed that persons develop a hypersensitivity to certain agents after being exposed to them for some time. Substances like phenyl hydrazine and its derivatives which are extensively used in the rubber industry as catalyzers, may cause severe skin reactions and also general disturbances after some time; so that the individuals have to discontinue the handling of these materials. In such cases we are dealing with quantities which are so extremely small that a normal individual would experience not even the slightest discomfort.

Very marked variations in the toxicity of chemical compounds may also be observed in individuals suffering from pathological conditions. Disturbances in the functionation of the heart and of the circulation in general may cause a very marked

increase of the susceptibility to certain substances. Fatty degeneration of the heart or any degenerative changes of the heart muscle will cause an increased susceptibility for all compounds which are liable to affect the heart muscle. In this connection I wish to emphasize the danger imminent to such individuals from exposure to the majority of the halogenated aliphatic hydrocarbons such as chloroform and especially carbon tetrachloride. There are cases on record of fatal accidents which have occurred after exposure to these agents under conditions which would not affect a normal individual. On the other hand, people suffering from pathologic conditions of the blood vessels, especially arteriosclerosis, will show an increased susceptibility for substances which affect the blood pressure, such as the aliphatic nitrites, aromatic nitro compounds and certain metals, as for instance, lead.

The condition of the respiratory tract is also important in regard to the toxic effects of different materials. Recently, Lehman (J. Ind. Hyg., *17*, 37, 1935) directed attention to the importance of the filtering efficiency of the human nose and its significance in the causation of silicosis. He pointed out that there is a considerable variation among different individuals in this respect. The functionation and the vitality of the integument of the trachea and the bronchi are also of great importance in determining the toxic effects of gases and vapors, inasmuch as an existing bronchitis will not only render the individual more susceptible to such irritants, but it will also facilitate damage of the pulmonary tissue proper. Furthermore, it is obvious that a latent tuberculosis may easily flare up under the influence of irritant gases and vapors; and pneumonia or edema of a lung which has already undergone severe pathologic changes on account of silicosis, will have a much more doubtful prognosis than the same conditions would have for a normal individual.

Among the abdominal organs, the functionation of the liver is especially an important factor in determining the toxicity of many chemical compounds because here the detoxification takes place. It is therefore obvious that disfunctionation of the liver will increase the toxicity of many substances which in a normal individual are comparatively harmless. Many compounds, especially those having an hydroxylic group as the terpinols, and also camphor, are detoxified by conjugation with glycuronic acid. If the liver is depleted of its glycogen depots, or if it is unable to oxidize the carbohydrate to glycuronic acid, such detoxification is impossible and a toxic level may be rapidly built up in the organism. There are several reports in the literature that under such conditions small doses of camphor have caused severe convulsions and even death. I remember one case from my own experience where a man suffering from cirrhosis of the liver died from exposure to vapors of terpinol, a perfume which is used quite extensively to mask the unpleasant odor of certain commercial products.

Finally, the condition of the kidneys, which are the excretory organs for a number of substances, is of paramount importance in determining the toxicity of chemical compounds. It may be easily understood that if these compounds are not excreted at the proper rate, they will accumulate in the organism and sooner or later develop their detrimental action. On the other hand, their toxicity will be reduced by maintaining a proper diuresis. So for instance, oxalic acid, which we ingest in small amounts with a great number of foods, but which is very toxic in larger quantities, will develop toxic symptoms which may be very alarming and even fatal if the normal excretion is impaired by disfunctionation of the kidney.

So far only the effect of pathologic changes of vital organs on the toxicity of chemical agents has been discussed, but *normal physiological conditions* are also of great importance in this respect. Many poisons such as carbon monoxide, aromatic amines such as aniline, inorganic and organic nitrites and also certain nitrates change the red pigment of the blood, the oxyhemoglobin, to methemoglobin. The oxyhemoglobin takes care of the oxygen exchange between the air inhaled into the lungs and the different tissues of our body, but methemoglobin is unable to perform this function. At rest, the human organism may tolerate a certain reduction of this vital pigment, but with vigorous exercise, and in severe cases of poisoning even with very small exertions, the lack of oxygen supply may cause alarming symptoms resulting in fainting and even in cardiac failure. Furthermore, with the performance of heavy work the rate and depth of the respiration are increased and therefore the toxic gases and vapors contained in the inhaled air will enter the lungs and the circulation at a higher rate than under normal conditions. In this way concentrations of such substances

which normally are considered as permissible may become toxic. In these cases the action of the heart, which has to perform a greater work under vigorous exercise, will be more readily affected by certain poisons. Especially dangerous in this respect are those compounds which depress the cardiac muscle, such as the halogenated hydrocarbons or substances which interfere with the oxygen metabolism, as carbon monoxide and hydrocyanic acid and its derivatives.

A great number of chemical compounds used in our chemical industries are more or less readily absorbed through the skin. Such substances as benzene, carbon tetrachloride, carbon disulfide, aniline, nitroglycerine, and nitrobenzene, and also inorganic materials as arsenic and lead compounds belong to this group. The absorption of such substances through the skin will be considerably increased if this is hyperemic and desquamated as a consequence of exposure to moist heat. Under such conditions the absorption may be very rapid. There are cases on record of severe and even fatal accidents which have resulted from contact of such skin with the walls of containers covered with arsenic or with aniline.

It should also be mentioned that differences in age and sex may play an important role in determining the toxicity of chemical compounds. It is a well established fact that young persons and especially women are more susceptible to a great number of chemical agents, as benzene, carbon disulfide, and ammonia. The reason is that in such individuals the membranes are less resistant and consequently more easily penetrated and thus allow a more rapid absorption. On the other hand, such individuals are less resistant to reflex actions caused by irritant gases, as ammonia. These reflex actions may be so violent as to cause arrest of the respiration of the heart action.

So far only those factors which affect the toxicity of chemical compounds have been discussed and those which are due to pathologic or physiologic conditions of the individual coming in contact with the toxic materials. The toxicity of any compound may however show considerable variations both as to its degree and character, depending upon the physical and chemical conditions under which it is used.

Presumably the most important factor in this respect is the temperature. A large number of substances are comparatively harmless at normal temperature, but as this is increased the compounds are volatilized to such an extent that they become harmful. The poly-nitro-benzenes and toluenes are ordinarily so little volatile that they offer no health hazard except insofar as their dust is concerned, but as the temperature increases they are volatilized and develop a severe and rapid toxic action. Another instance of this nature is benzene and its homologues, toluene and xylene. It is generally stated that the latter are less liable to produce toxic symptoms, because they are less volatile. But if the temperature is raised sufficiently they may evaporate so rapidly that they become extremely dangerous. On the other hand, substances which are normally comparatively safe may be decomposed when heated and form extremely potent poisons. So for instance, certain phenyl hydrazine compounds which offer only a small hazard at normal temperature are decomposed when warmed or heated and liberate phenyl hydrazine, a very potent blood poison.

Many substances may undergo chemical changes when in contact with an open flame or with hot metals. So for instance, chloroform, dichlorethylene, ethyl dichloride, and carbon tetrachloride are oxidized to carbon oxychloride, or phosgene, a substance which will cause severe pulmonary lesions even in concentrations that are hardly noticeable. Such incidents were quite common in the olden days when our operating rooms were illuminated by gas light, and it was unavoidable for the chloroform vapors to come in contact with the open flame. At present the literature mentions time and again accidents of severe poisonings which have been observed when vapors of carbon tetrachloride and similar compounds have come in contact with an open gas burner set up in the neighborhood of the operation using such materials.

Other substances will be volatilized when in contact with live steam. Naphthalene, for instance, will be volatilized in this way and also other compounds which one usually does not suspect. It may be worthwhile to mention in this connection the fact that oxalic acid is volatilized by steam. In certain operations it has become customary to clean metal parts by boiling them in an aqueous solution of this compound. The inhalation of such vapors has caused severe and protracted illness and suffering, as illustrated by a report of C. D. Howard (J. Ind. Hyg., *14*, 283, 1932).

Finally, it should also be mentioned that the size of the particles of dust is of importance in determining the degree of toxicity of compounds which are absorbed through the respiratory tract. Zinc oxide is not known to cause toxic symptoms other than pneumoconiosis, but when it is formed by oxidation of the hot metal, as for instance, in the founding of brass, it will give rise to a pathologic condition which is characterized by fever and headache and is generally known as brass founders' fever. Another zinc salt, zinc stearate, is so finely divided that when inhaled it will penetrate into the deepest section of the lungs, causing severe and even fatal pneumonia.

It is not possible to cover the entire subject of this paper exhaustively in the time allotted, but these few examples may suffice to illustrate that it is misleading to speak of toxic and fatal doses or concentrations of chemical compounds as fixed values. It has been demonstrated however, that the degree of the toxic action is frequently determined by pathological conditions of workers occupied in certain operations. In order to avoid accidents, it will therefore be necessary to select the men for certain operations according to their physical fitness. Physical examinations should be extended to include X-ray pictures of the chest, and if necessary, also of the lumbar region, and such examinations should be repeated at sufficiently short intervals to detect at an early stage any pathological changes which may develop during the occupation in various operations. Therapeutic measures may then still be effective and promising.

Furthermore, it is necessary to arrange the operation in such a manner that any toxic substance either cannot enter the room or is removed by proper ventilation. In planning the ventilation, the character of the toxic material, *i. e.*, whether it is heavy or light, should be considered, and provision should be made to have the exhaust gases disposed of in a proper way. I have repeatedly observed that an operation was ventilated in such an effective manner that one had to consider it as absolutely safe, and yet the exhaust gases were disposed of in such a poor way that they contaminated the surroundings. It should be emphasized that even the highest smoke stack does not offer an absolute safeguard against such dissemination of toxic materials. This is demonstrated by the fact that in the surroundings of two plants where arsenic-containing-ores are roasted, and which have the highest smoke stacks in the world, the atmosphere was so contaminated that grazing animals contracted arsenic poisoning. It is, therefore, an imperative necessity that exhausts containing dust be purified by passing them through filters and chambers before releasing them into the open air. It should also be taken into consideration that the efficiency of the removal through smoke stacks is often markedly impaired and sometimes completely minimized by meteorologic conditions. In sections of the country where high barometric pressures and humidity of the atmosphere are prevalent, any gas will be forced down sooner or later, causing a dangerous hazard for the surroundings.

It is to be demanded that men working in certain operations be acquainted with the potential hazards, but it cannot be expected that they be familiar with changes in the toxic properties of the materials which they are handling and which may result from unforeseen and accidental changes within the operation and thus give rise to new and unexpected hazards. For this reason it appears to be of paramount importance to have in every plant one man, or preferably a group of men who are familiar with such potential hazards and who are always available in case of accidents. Only if the variability in the toxicity of chemical compounds under different conditions is generally recognized and understood will the number of accidents be reduced.

Periodical Physical Examinations for Detection of the Accident Prone Employee

By HART E. FISHER, M.D., F.A.C.S.

Chief Surgeon, Chicago Rapid Transit Co., Chicago

[Note: The speaker was accompanied by two assistants who aided him in his physical examination demonstration.]

Periodical medical examinations of employee groups are of no value either to the employee or the employer unless competently performed and followed up to see that the employee institutes corrective measures.

Some of the values accruing from periodical medical examinations at regular intervals are:

1. Fitting the employee into work that he can safely and efficiently perform.
2. Reducing the annual labor turnover.
3. Increasing the longevity of the employee.
4. Reducing absenteeism.
5. Aiding employee in health maintenance and reducing the cost of medical expense in event of illness or injury.
6. Eliminating fraudulent claims for personal injury due to undetected physical defects.
7. Reducing the accident frequency and severity rate.
8. Reducing the annual death rate from natural causes.
9. Aiding in the detection of the accident prone man.
10. Reducing the possibility of delayed convalescence from injury due to complications following accidents.
11. Making possible, by conservation of health, an older average age of employees.
12. Aiding in maintaining the employee for a longer period of time with the company.
13. Assuring the travelling public that those employees responsible for their safe conduct daily are safe and efficient. This makes for good public relations.

The examination as here demonstrated is the same as our regular pre-employment and periodical examination. It applies to all employees seeking promotion or transfer to some other position within the company and to all employees who have been absent from their work for a period of one week or more.

Contrary to theoretical statements, very few persons lose their positions by reason of these examinations. True, many defects may be revealed, but their nature is such that they can be corrected, allowing the individual to remain at his occupation.

In our medical examinations we secure the height of the employee to correlate other physical findings against weight classifications and to insure that the employee will be of sufficient height to permit safe and efficient performance. Too much weight predisposes to disease and ushers in fatigue in work performance. Those underweight are prone to similar ailments.

The hand dynamometer is used to determine if the individual is in normal possession of muscular power in his hands and arms. Muscular weakness many times is one of the early symptoms of nervous disorder. Full control of one's fingers and hands is of paramount importance for safety in industry, as these are the members most frequently injured.

In the transportation industry, the perfect interpetation of colors is of great importance, since the two colors most frequently confused, red and green, are the two that are used in train operation. We make use of five different color tests in our color perception examination in order to prevent fraud and to avoid doing an injustice to the employee.

Presence in an employee of color defect that was not present at previous examination is an early symptom of disease of an infectious nature and of constitutional disease. It has also been our first clue to severe interocular disease and nervous and brain lesions. However, the greatest percentage of cases of color blindness is congenital in origin.

The Jennings test provides us with a permanent visual record of the color perception of the employee and is of use in subsequent examinations. The Williams Test Lantern which we use is a very popular and effective color lantern used by surgeons of railway and marine service for the detection of color blindness. This lantern provides the examiner with means of simulating all atmospheric or climatic conditions and making the test for all colors under any conceivable condition. Other lanterns of equal value are the Green Color Lamp and Thomson's lamp. The other color tests used by us are the Holmgren worsted skeins, Thompson color stick and the Ishari Test, all of which the employee is required to pass without doubt or hesitatency if he is to operate safely in transportation.

The testing of the visual fields is one of the most important steps in eye examination and is very seldom included except where symptoms direct the attention of the oculist to possibility of pathology. It is very seldom done with the idea of detection of the accident prone person. In our examination we want to know if the person can see out of the angle or corner of his eyes and if there are any so-called blind spots that might interfere with sight. The perimeter that is used in our examinations, while of an obsolete type, still is quickly applicable for testing the fields and requires no elaborate technique. It is an essential diagnostic instrument for studying the extent of the visual fields of the eye and the range of color perception in a number of nervous and interocular diseases.

Some persons have what is called monocular or one-eyed sight when they should have binocular vision. Those thus afflicted fail to see objects in the three dimensions and lack what is known as depth perception. They are unable to estimate distance, speed or space. We have been experimenting with the Keystone Telebinocular which is a simple scientific apparatus as a diagnostic and depth perception test. From this apparatus we obtained the visual efficiency of each eye separately and combined efficiency of both eyes. Relaxed binocular vision and dynamic binocular vision is likewise determined. Stereopsis or stereoscopic vision is tested. Heterophoria, which is a lack of parallelism between the visual lines due to insufficiency of the ocular muscles and other ocular diagnostic facts is quickly determined with this apparatus.

Acuity of hearing within a normal range is an important requisite of safe and efficient train operation and is also of vital necessity in all industry.

To test acuity of hearing requires more accurate and scientific methods than are used in most industrial physical examinations today. The expensive instruments of precision and scientific character may be had in the Politzer acuometer, Galton's Whistle and others, the findings of which are a true indication of acuity of hearing. The Audiometer provides a visible and accurate record of an individual's state of hearing. The cost of such may seem prohibitive in industry, but the best is the cheapest in the long run.

It is essential also that we carefully examine the eyes with the Ophthalmoscope. With this diagnostic aid we are able to discover ocular defects, signs of disease such as nephritis (kidney disease) and many times changes incident to high arterial blood pressure and constitutional disease. The pupillary reflexes are next elicited and the movements of the eye globe are secured by having the individual follow a light with his eyes. Next careful inspection is made of the cornea of the eye to detect opacities or scars that might obstruct proper vision.

Inspection is made of the nasal passages for evidence of infection or disease. Next the mouth, teeth, tongue and throat are inspected for pathology which undetected may cause discomfort and distract the attention of the person from his work.

The cervical (neck) glands and the thyroid are palpated for signs of enlargement indicating infection and goiter. The external ear is next examined for obstructions (cerumen) and the condition of the drums. The temperature of the person is taken at this point, as often we have found applicants and old employees who were apparently well but who were carrying one or more degrees above normal. This increase of temperature has led to the discovery of undetected and unknown respiratory diseases. These last procedures are used in ferreting out signs of incipient disease and defects that later in the employee's service may be productive of accident proneness or absenteeism from work.

Freedom from heart disease gives assurance that under the strenuous effort of long sustained effort the heart will be able to carry on in safety and there will be less opportunity for man failure from dizziness, sudden attacks of weakness and even temporary spells of unconsciousness which often are caused by heart disease. The presence of heart defects does not infer that the employee shall be made idle or an invalid because of what is discovered but that sensible work placement and frequent medical observation will permit of many of these persons to carry on successfully and without hazard other forms of activity for many years.

To insure both employee and employer against injustice in heart examinations it is necessary to include in all heart examinations what is known as cardiographic records. These tests will often give the real picture of a heart when the ordinary examination with stethoscope fail to reveal the true condition. In addition they afford a permanent visible record of the heart, available for future comparisons. The Cardiograph is a scientific instrument of standardized precision which consists of (1) a galvanometer sensitive enough to register the small electrical currents developed

by the heart in its contractions and relaxations; (2) a timing mechanism for recording the time relationship of auricular and ventricular contractions of the heart in fractions of a second; (3) and a simplified motion picture camera which gives a graphic picture on a film or sensitized strip of bromide paper of the deflections of the galvanometer string as it records the electrical impulses from the muscular movement of the heart.

There is no more controversial condition in medicine today than the physical defect known as high blood pressure. The arterial pressure is secured by means of a manual operated blood pressure apparatus and a visible record made on the self recording Sphygmomanometer. It serves as a visual record for the future. When heart pathology is present by clinical and cardiograph findings, X-Ray examination of the heart is likewise indicated.

The employee should be free of respiratory disease. Measurements are made of the chest in inspiration and expiration, and the capacity of the lungs as well as vital capacity is determined by the spirometer. Vital capacity, also termed breathing capacity and differential capacity, is the maximal volume of air that can be expired after taking the maximal inspiration. It is not identical with lung capacity because a certain amount of air termed residual air always remains in the lungs. The ratio of vital capacity to the weight of a person is termed the vital index and is held to be of extreme significance because it expresses the balance between bodily size and the rate and completeness with which oxidation of the blood is, or may be, effected. The capacity is measured in both cubic inches and cubic decimeters.

We next examine the individual from a neurological viewpoint by taking the patellar or knee reflexes, looking for tremors of the fingers and testing the muscular coordination by bringing the fingers of the outstretched arms together above the head while the eyes are closed. The Rhomberg test is used for the detection of swaying motion while the individual stands erect, heels together and the eyes closed. These tests aid in the detection of incipient nervous disorders. Both the upper and lower extremities are examined for freedom of motion of the various joints. The mobility of the spine is tested by having the patient flex, extend and rotate his body through all planes. Defects in the foot structure such as flat feet, weak muscles and fallen arches are detected by having the person rise upon the toes, sustaining this position for twenty seconds.

The patient's gait is observed by having him walk a straight line on the floor. By this test alone we have detected early evidence of nervous and cord disease.

In the next step of our routine physical examination, the employee is placed prone on his back while the abdomen is palpated and percussed to ascertain the position, size, shape and consistency of the various organs such as the liver, spleen, kidneys, stomach and intestinal tract. Search is made of the abdominal and inguinal (groin) region for evidence of hernia (rupture). The genital tract is likewise inspected for scars and evidence of disease.

We now come to one of the most important parts of our examination, one that is sadly neglected today, especially in industry—the examination of the anal region and the interior of the rectum. The cases are legion wherein the examination of the rectum has revealed the presence of malignant growths (cancer), enlarged prostate glands, painful fissures, ulcers, fistulae and hemorrhoids (piles). These conditions undetected not only produce an upset in the nervous stability of the person but if neglected may become incurable and even result in death.

After careful study of existing methods of determining reaction time, we have been led to the use of the Chicago Psychodometer Reaction Time Apparatus. This is designed to measure in sigma or milliseconds (1/1000 of a second) the length of time it takes a human being to respond to a stimulus.

Physical examinations must include urine analysis, blood examination, X-Ray interpretation tests of the fluids and excretions of the body and metabolism tests.

The person who appears below par after the above tests without a definite diagnosis requires further study through the laboratory for sputum tests, gastro-intestinal series and Wassermans.

ADJOURNMENT.

Heat Exhaustion

THURSDAY AFTERNOON SESSION

October 17, 1935

The discussion was opened by Chairman H. A. Schultz, Assistant to the Vice-President, Industrial Relations Department, United States Steel Corporation, New York City, who presided. The session dealt with the findings of a recent research sponsored by industry and conducted by the Fatigue Laboratory of Harvard University.

The Cause, the Treatment and the Prevention of Heat Cramps in Industry

By JOHN H. TALBOTT, M.D.

From the Fatigue Laboratory, Harvard University, and the Massachusetts General Hospital, Boston, Mass.

My subject is the physiological and pathological effects of high temperature in various industrial conditions. Before I begin I should like to tell you a few of the significant facts about the laboratory from which these data come. As indicated in your program I represent the Fatigue Laboratory of Harvard University in Boston. This laboratory had its beginning under a different name in the Massachusetts General Hospital in Boston about fifteen years ago. At that time Dr. A. V. Bock and Prof. L. J. Henderson were studying the biochemical and physiological changes in the body of normal men performing a measured amount of work. As the work of this laboratory increased in volume the need for physical expansion became imperative. And in 1927 new quarters were provided and the staff of the laboratory increased to include Dr. D. B. Dill. The present name for the laboratory was assigned at this time. Shortly before this event however, the interest and attention of the Rockefeller Foundation had been enlisted and principally through their support the laboratory has functioned.

The name of the laboratory implies that the study of fatigue is an important part of its program. In fact the founders of the laboratory had conceived of the study of industrial fatigue as an important and fruitful project for investigation. But the laboratory was established upon very broad principles. While the main problem was tentatively established as the study of industrial fatigue the interpretation of this problem has fortunately been a flexible one. A better statement of this main problem would be the adaptation of man to his environment. It is obvious that the study of industrial physiology is a very important phase of this problem.

The importance to the body of environment is an old concept. To the Greeks the organism was the first term in the equation of life. The second term was the environment. The Greek philosophers and scientists conceived of life as a constant interplay between organism and environment. And so the study of the ill effects of heat is a study of the adaptation of man to his environment; but more than that, it is frequently the investigation of a failing adaptation in a most strenuous environment.

Before one can properly understand and interpret man's inability to adapt himself adequately to such an environment, we must have information concerning his

normal reactions to conditions that are less severe. To obtain data on this subject various projects have been carried out both in the Fatigue Laboratory in Boston and in localities associated with high external temperatures. In 1929 Dr. Dill conducted an expedition to the Canal Zone, Panama, where a study of normal men exercising in a very humid temperature was made. Sometime later similar studies were conducted in Boulder City, Nevada, at the building site of Boulder Dam. In this locality the contrasting condition was the very hot, dry climate. Interesting clinical studies were made in addition upon several of the workmen that were admitted to the hospital suffering from the ill effects of high temperature. In the summer of 1934 the specific problem of the ill effects of heat upon workmen in the steel mills in Youngstown was investigated at the request and with the cooperation of the Youngstown Hospital association and several of the steel mills. While this field work was being done, the problem of reaction to high temperatures upon the organism was being pursued in the laboratory in Boston in a room where varying temperatures could be produced.

It should be evident that the Fatigue Laboratory's work represents more than the endeavor of any one individual. This type of investigation is typical of a great deal of scientific work now being done in this country in which any conclusion represents the accumulation of knowledge of the group. The basic physiology that was essential for the work that I will discuss must be passed over in a few words which in no measure do it justice. It should be mentioned especially that the part Dr. D. B. Dill and H. T. Edwards have contributed to this study is a very important and significant one.

The decompensation of the body in an environment of high temperature produces a condition that is a distinct clinical entity or rather several clinical entities if a series of such cases be considered. But unlike many diseases studied in the clinic these conditions represent little more than an abnormal state of normal physiology. The response of patients suffering from heat exhaustion to proper therapy is most gratifying and is in marked contrast to many industrial medical problems where the response to our best known treatment is far from satisfactory. You are acquainted with the unsatisfactory treatment of silicosis or carbon monoxide poisoning. Any workman with either disease may be an industrial liability while a workman with severe heat cramps is for all essential purposes a normal man following satisfactory medical treatment.

Data regarding the *incidence* of heat exhaustion and heat cramps are most unsatisfactory. Many of the cases are mild and need little or no medical attention. Several of the large organizations that have many such patients have not considered their data statistically. A suggestion that I wish to make to the various medical departments of the large industries is, namely, to tabulate the incidence of these conditions as a function of grade of work and environmental temperature. In the absence of such data we can at least say that the incidence of heat exhaustion is of sufficient magnitude to warrant a special topic hour devoted exclusively to it. From data obtained in the Youngstown district it was our deduction that most *men* had an attack of cramps or heat prostration at least once a decade, while several of the men had cramps more frequently. Cramps are confined not only to industries in this country but are observed in other countries as well. They have been observed and reported in Australia, South Africa, India, Germany, England and France. In the new Medical Center in Moscow the study of heat cramps alone is an important problem for one large chemical laboratory. It may be concluded that the incidence of heat cramps and heat prostration is high in the heavy industries where a high working temperature is customary and in certain occupations in temperate and tropical climates that require strenuous muscular activity.

There are no known *mortality statistics* for heat cramps or heat prostration in industry. The uncomplicated diseases are frequently fatal, but the mortality rates are a function of many variables that have not been systematically studied in the past.

The *meteorological conditions* necessary for the production of heat cramps and heat prostration are few but very definite. A high working temperature associated with a high atmospheric temperature are the most important factors. In some occupations such as the building of Boulder Dam and serving in Army posts in the tropics, the working temperature is approximately the same as the atmospheric temperature. In other occupations, a high working temperature may be continual and the elevation of the atmospheric temperature periodic; the stoking of furnaces on ships and the mining of coal are examples. If heat exhaustion is a function of the working temperature alone, there should be in these occupations no seasonal or periodic incidence. This has not been found to be a fact and a seasonal variation of the incidence of heat exhaustion in temperate climates has been known for some time. In the Youngstown steel district from 1929 through 1934 more than ninety per cent of the hospitalized patients were admitted between April and October of each year.

The *temperature* at which heat cramps may occur is generally over 100 degrees F. At Boulder Dam where the atmospheric temperatures were essentially the same as the working temperatures, the men had cramps on days when the temperature was 110 degrees F. or above. Probably the highest observations reported for men exposed to high temperatures is in the steel mills where men come very close to temperatures as high as 3000 degrees F. many times in a day's work. It is interesting to note, therefore, that with such a high mean working temperature throughout the year, most of the cramps occur in the summer when the atmospheric temperature is elevated.

Of less importance than the temperature is the *relative humidity*. It is a misbelief that cramps occur only in an atmosphere with a high relative humidity. Most cases are observed among men working in humid atmospheres. This is because most hot jobs are associated with a high relative humidity. There are, however, several jobs associated with a relatively low humidity. The building of Boulder Dam is a notable example of the latter condition. During the heat waves when the patients with cramps were admitted to the hospital, the relative humidity at no time exceeded 25 per cent. There may be a greater incidence of heat prostration in very humid atmospheres but evidence supporting this is not conclusive.

The *predisposing factors* that increase the susceptibility to heat are for the most part known and, once recognized, it is the duty of the industrial surgeon to take heed of them. Organic disease and ill health increase the susceptibility of the human body to sudden changes of temperature. This is especially evident in large cities during the summer heat waves. Many of the victims have an organic malady that probably contributes to their breakdown with the excessive summer temperatures. In the various industries, quite the reverse is generally true of men who succumb to heat exhaustion. The men exposed to conditions favorable for the production of heat cramps have strenuous work to perform that would be impossible in the presence of an existing organic disease. And it need not be emphasized that no man should be allowed to work in high temperatures if any chronic disease is present of sufficient severity to produce symptoms.

Alcoholism has been accused of increasing the susceptibility to heat exhaustion since the earlier discussions of this condition. In the evaluation of the importance of alcoholism as a predisposing factor, it is necessary that any statement made be interpreted intelligently and without moral prejudice. It is a sound statement that an intoxicated man should be prohibited from driving an automobile on a public highway. It is not a sound statement that all men exposed to excessive heat should be total abstainers. In the first place you could not enforce such a rule. Secondly, there is little evidence that indicates such a rule should be enforced. It is very important for us all to know at what level alcoholism begins to be important. Chronic alcoholism may produce organic disease of the heart, stomach, liver, or the brain. When these are observed in any workman, he should be handled as any other case of chronic disease and removed to an easier job. Only a very small percentage of the workmen in a large mill are in such a category.

The belief that alcoholism is a predisposing factor to heat cramps is probably a result of the effect produced by acute alcoholic bouts and not by chronic alcoholism. Many acute bouts are accompanied by nausea and vomiting, and little or no food is retained as a consequence. With the inadequate ingestion of food, there is generally an inadequate ingestion of the mineral salts normally consumed. If, in addition, vomiting and diarrhea are present, the reserve of salt and water in the body may be reduced to a critical level. This sequence of events is intimately related to the pathogenesis of heat cramps that will be considered later. I think we can say dogmatically, that anyone who has been on an alcoholic bout and has ingested little food in the previous 24 hours is a fit candidate for heat cramps and should not be allowed to work until he has fully recovered.

In the above discussion, reference to alcohol implied the stronger drinks rather than beer. Certain advantages may be gained from the consumption of beer in

moderate quantities. In the industrial section of the Ruhr in Germany where the incidence of heat cramps is presumably low, salted beer is the common beverage; likewise, colliers in the English mines use salted beer for the prevention of cramps.

A third predisposing factor is a previous period of *inadequate assimilation of food*. Alcohol may be the contributing cause of such a diminished intake as has been previously mentioned. Gastro-intestinal upsets with vomiting or diarrhea in the period before the onset of cramps is frequently admitted by the patients. Less severe disturbances may be associated with little more than loss of appetite. It is significant that several of the men in our study had either omitted breakfast or lunch on the day of admission to the hospital. There is little evidence that constipation in itself is important enough for us to pay special attention to it. Constipation may be a symptom of an existing chronic disease and when this is the fact the workman should be treated as any other with chronic disease.

A recent attack of cramps or prostration *not adequately treated* renders the subject susceptible to a second attack which is usually more severe. It is a common practice for many men who have very mild cramps not to report them to the medical officer but to go directly home and apply domestic remedies. This is usually successful but not always. I believe it a wise policy to allow all men who have had heat cramps or heat prostration, although very mild, a day off without penalty. There should be no stigmata attached to the reporting of any condition brought on by high temperature, however mild the symptoms. This advice applies to men who have mild symptoms only. All others with moderate or severe symptoms should be prohibited from working and not allowed back on the job until fully recovered and passed upon by the company surgeon.

Another factor less well defined but hardly open to question is *bad hygiene*, which may include living conditions, badly chosen food, irregular habits and inadequate rest. The necessity for periodic physical examinations and an effective social service system to remove many of these predisposing factors should be obvious.

Let us now turn to the *clinical* and *laboratory data* that are pertinent. Before proceeding with this however, I shall tell you of our classification of the various *conditions* related to high temperatures. The differentiation of heat cramps from the other forms of heat exhaustion is generally not a difficult one. The presenting symptom or complaint is usually cramps. In a few patients in which cramps were confined to the abdomen alone the diagnosis was more difficult. Whether we are dealing with an aberration of heat prostration or something significantly different I am not prepared to say. Further investigation obviously is indicated to help us solve this problem. The classification of heat prostration and heat hyperpyrexia is an arbitrary one. In heat prostration the body temperature is normal or subnormal. In hyperpyrexia the temperature is elevated. This classification of the various conditions produced by high temperatures in workmen is subject to certain criticisms. It is the best that we have at the present time however, and it is to be hoped that continued interest and future investigation will establish the value or the fallacy of this classification.

Most of the laboratory data that will be presented in this discussion were obtained during our summer's work in Youngstown one year ago. In order that you may have a better understanding of the thoroughness of our investigation permit me to tell you briefly about the physical equipment used. A separate wing of the new hospital was given over by the Youngstown Hospital association to the study of heat cases alone. This wing was maintained as a separate unit throughout the hot weather. It was supplied with its own graduate nurses, an interne and a dietitian. As physician in this study I was in attendance practically 24 hours a day during the hot weather. The laboratory facilities offered us were most satisfactory. Certain of the laboratory analyses that required immediate attention were done in the laboratory space assigned to us. Wherever possible the other analyses were done in the main laboratory in Boston.

During the summer approximately 65 patients suffering from the ill effects of heat were admitted and studied. Half of this group were suffering from heat cramps. There were a few with heat hyperpyrexia and the remainder were suffering from heat prostration. In such a study the speed with which the sick men are brought to the hospital is most important. The cooperation of the medical and safety departments of the steel mills in this matter was most gratifying. It frequently happened that within 45 minutes from the time the men reported off duty at the mill they were in bed in the hospital ready for examination. Such an arrangement for the clinical investigation of these diseases was most important.

The data that were obtained immediately after admission to the hospital were a short history, a physical examination, a sample of blood and a sample of urine. Subsequent study of these data allowed us to reconstruct a fairly accurate picture of the internal environment of the body at the time the workman reported off duty. The perpetual tendency of the body at rest to restore the disordered physiology to its normal must always be considered.

The *physical examination* of a patient suffering from the ill effects of heat is apt to reveal a relative paucity of information. A workman coming in with heat prostration following a short period of unconsciousness may show little more than weakness. The temperature may be subnormal or slightly elevated. As I have mentioned previously, the arbitrary separation of heat prostration and heat hyperpyrexia is based on a depression or elevation of the body temperature. A prodromal headache, dizziness, nausea or vomiting may precede any of the forms of the ill effects of temperature. The distinguishing symptom of the patient with cramps is usually the presence of the cramps themselves. The picture presented by a patient in a paroxysm of cramps following work in an excessive temperature is characteristic, and once observed, it is not easily forgotten. The examination of the affected muscles may show fibrillary twitchings but stony hardness is generally the only physical finding. This hardness does not yield to direct pressure and any active attempt at movement of the affected muscles generally is thwarted. The body temperature, the pulse rate and the blood pressure in patients with heat cramps are usually in the normal range. The time of onset of the cramps varies widely and may be at any time of the day or night. The usual time is after midday and before midnight. It is during this time that vigilance should be exercised to detect the presence of mild cramps among the workmen. The pain suffered by the men during a paroxysm of cramps is most excruciating. Strangely enough, injections of morphine have little effect upon this pain. If for no other reason than the severity of the pain, heat cramps should be prevented wherever possible.

The importance of *sweating* in the causation of heat exhaustion is an unsettled point. A belief that sweating ceases before the onset of heat cramps or heat prostration is common among men working at hot jobs. This is one of the signs closely watched for that promptly causes the men to stop work. The importance of sweating in the causation of cramps makes this phenomenon one of more than casual interest. Haldane has suggested that marked sweating might be followed by fatigue of the sweat glands and the secretion of a more concentrated salt solution. Thus an economy of body fluid would be allowed at the expense of a dissipation of body salt. Such a sequence of events if it occurred might produce cramps. Experimentally, fatigue of the sweat glands after prolonged sweating is observed infrequently. It is our experience that fatigue of the sweat glands and cessation of sweating is not a regular precursor of heat cramps. The failure to continue sweating, occasionally observed among subjects exposed to high temperature is, nevertheless, a danger signal; it represents a failure of the body to dissipate heat adequately, and may be the important factor in the production of heat hyperpyrexia. It is obvious that no man should be allowed to continue work who is not able to sweat and thus unable to dissipate heat by evaporation. Of equal importance is the recognition of the fact that sweating may continue in a patient with heat cramps or heat prostration even though the man be too sick to continue work.

The *reproduction of heat cramps* by artificial means in the hospital between spontaneous paroxysms is possible in many of the patients. Counter pressure applied against a flexed affected extremity usually brings on cramps. The importance of producing cramps in a subject who presumably had cramps before admission is twofold. The validity of the diagnosis may rest upon producing cramps after admission. Secondly, the test of the effectiveness of certain therapeutic measures is the inability to produce cramps after treatment.

The *susceptibility* to heat cramps implies that adequate adaptation to hard work in a high temperature has not been gained. An absence of adaptation to heat is generally evident the first days of a heat wave, and the incidence of cramps is greatest during these days before adaptation is complete. At Boulder City all of the patients with cramps were admitted to the hospital the first few days of a heat wave which was generally preceded by a period of cool weather. Consideration

of the available data suggests a maximum susceptibility to cramps the first two days of a high temperature period with a decreasing susceptibility as the hot weather continues. This sequence of events is applicable to patients with heat cramps only, and is not the same as the admission data on patients with heat prostration. Few patients suffering from heat prostration were admitted concurrently with the heat cramp patients. They were stricken later as the heat wave continued. The incidence of heat cramps early in the wave and of prostration later suggests different mechanisms as the cause of these apparently related conditions. Cluver has concluded that susceptibility to heat is a function of at least two factors. The tabulation of the tribal distribution of the workmen in a large South African gold mine suggested to him a greater susceptibility to heat among the natives from the cool, dry areas. This was called an inherent lack of adaptation. Secondly, he observed a greater susceptibility to heat the first days on a hot job. This lack of adaptation which may be considered as acquired susceptibility is a similar phenomenon to the one observed by us.

The incidence of heat cramps in the negro is the only evidence we have concerning a possible inherent adaptation to high temperatures. It might be argued that the exposure of many generations of these people to high temperatures would have a favorable effect on their resistance to this malady. This impression is not borne out by our data. It was concluded that any inherent adaptation possessed by the negro was insignificant when compared with his lack of acquired adaptation.

If the phenomenon of adaptation to high temperatures is accepted as probable, an inquiry regarding the mechanism is then in order. For this we must go back to the laboratory and seek an answer from our experiments on normal men. As a part of the study in the Boulder City region in 1932, several men were put on a constant diet and allowed a constant amount of exercise in a cool climate. From analysis of the diet the amount of salt ingested each day was known. All urine samples were collected and analyses of these told us the amount of salt excreted through this channel each day. The difference was the amount lost in the sweat. When this amount lost had reached a constant level in the cool climate the men were transported to the hot, dry region in Boulder City. Here the diet and activities were the same as in the cool region. The different physiological response was principally the profuse sweating. Again the difference between the ingestion of salt in the food and the excretion of this in the urine was the amount lost in the sweat. During the first few days the amount lost in the sweat was very great but decreased with the duration of the stay at approximately the same temperature. This significant conclusion was drawn:—the amount of salt lost in the sweat is greater the first few days of a hot wave than in the days following. It is during this critical period of adaptation when the sweat glands are excreting the maximum amount of salt that heat cramps are most apt to occur. In the men to whom I have just referred physical activity was not great and cramps were not observed. If these same men had done eight hours of work comparable to the work done by the men in the building of Boulder Dam, heat cramps might have been observed in some of them. The loss of salt in the sweat in the workmen may frequently exceed the intake. If this unbalance continues for several days the body reserve of salt may be depleted to a critical level. This depletion is intimately associated with the production of heat cramps.

The deductions that may be drawn from this study of the adaptation to high temperatures are important. If susceptibility is greater the first days of a heat wave this may be combated by one of two methods. The intake of salt may be increased so that it will always exceed the output in the sweat. Or excess loss may be checked by minimal physical activity the first days of any hot wave.

The *chemical changes in the blood and urine* in patients with heat cramps and heat prostration give us the clue to an understanding of the underlying pathological processes. Most of these changes are of less interest to safety men than to medical officers in industry. For a detailed description of these changes I should refer you to the previously mentioned article in *Medicine*. I shall discuss with you at this time only the important chemical changes that were observed by us. When a sample of blood was taken from a patient suffering from heat cramps there were four significant variations from the normal. It was observed first that the red blood cell count was increased as much as 20 per cent in several patients with severe symptoms. With this increased concentration in the red cell count there was an approximately similar

increase in the concentration of serum protein. In clinical medicine, changes in concentration in both the red cell count and the serum protein are associated with one mechanism only. This is known as dehydration and is associated with a decrease of water in the blood.

The concentration of most substances in the blood varies in health within a very small range. Throughout our life whatever be the change in internal environment or external environment the body attempts to maintain the concentration within this small range. When changes of the magnitude of 25 per cent are observed we know that we are dealing with important pathological processes. There is another very interesting phenomenon demonstrated by the body regarding its fluid content. This is the property of always needing some dissolved substances for the water in any part of the body. The dissolved substance may be considered for our purposes to be principally salt. And when we speak of physiological salt solution we are referring to a solution with a salt concentration approximately the same as that which occurs in the body. This concentration is about 0.9 per cent. If we were to analyze body fluid such as serum oozing from a cut or blood obtained from a vein we would find about 0.9 per cent salt present. Not only does the body need dissolved substances in the water within it but when the body excretes fluid it excretes not pure water but fluid containing dissolved substances. I have previously mentioned that the principal dissolved substance in sweat is salt. The concentration of salt in the sweat however is not as great as 0.9 per cent. For men working in a hot environment this is an extremely fortunate circumstance. If the body excreted sweat with a 0.9 per cent concentration of salt it would be difficult to replace the salt loss quantitatively in a man losing two or three gallons of sweat per day. Even though the salt concentration in the sweat is lower than in fluids contained within the body the amount of salt lost in a day's work may approach a startling figure.

To return again to the subject of chemical findings in patients suffering from heat cramps it should not surprise us to learn that dehydration is always observed. Nor should it surprise us that since this dehydration is a loss of salt as well as water, the concentration of salt in the body will be markedly diminished as a consequence. The normal range of the concentration of salt in the body, like the concentration of serum protein and red blood cells, is a very small one. The lowered concentration of salt in patients with heat cramps may be as great as 20 per cent. Such a variation represents a marked degree of disordered physiology. It is this change in the normal chemistry of the body that is most important in the production of heat cramps. It is the prevention of these changes that is necessary in the elimination of heat cramps from industry and it is the restoration of the salt concentration to normal that is necessary in the treatment of these cramps.

All of the changes in the chemistry of the body that have been discussed above have been observed in varying degrees in all patients suffering from heat cramps. These changes have not been observed in patients suffering from heat prostration or hyperpyrexia. It is the absence of these changes in heat prostration patients that has led us to the conclusion that heat prostration is not produced by the same disordered physiology as is heat cramps. The need for further study of patients with heat prostration and hyperpyrexia is imperative before we can understand these syndromes as well as we do those associated with heat cramps.

Not only did we study the significant changes in the blood in our heat exhaustion patients but we also observed many other constituents. Thus it was necessary for our argument to say that certain significant variations were observed and also the concentration of all of the other constituents was essentially unchanged. In consideration of the theories that acidosis or carbohydrate metabolism may be concerned in the pathogenesis of heat cramps, such information is of great importance. It has been assumed by some without experimental evidence that the underlying mechanism responsible for heat cramps is acidosis. The determination of the presence of acidosis in the body is at the present time a very exact one. We may determine directly the hydrogen ion concentration in the blood or we may determine the amount of carbon dioxide at varying tensions in the blood. These two methods are satisfactory and give us a reliable indication of the presence or absence of acidosis. These were determined in the blood of all of our patients studied in Youngstown. The degree of acidosis observed in the patients with heat cramps did not appear to be significant to us and was not thought to play a significant role in the production of heat cramps. In the blood of some of the patients with heat exhaustion acidosis was observed but

it remains for future study to determine the importance of this in the latter condition.

The dextrose theory has had an interesting history. The first reference that I have been able to find upon which this theory may be based is about twenty years old. At that time it was observed indirectly that animals exposed to high temperatures burned more carbohydrates or starches than control animals not exposed to high temperatures. This may be responsible for the prejudice in favor of a high carbohydrate diet in the summer time. Just why a disturbance in carbohydrate metabolism should be associated with the production of heat cramps is not clear. Nevertheless several of the larger industries in this country have used dextrose in the prevention and treatment of this malady. If there is a significant disturbance in carbohydrate metabolism it is conceivable that we should detect this in our studies on the blood. The known disturbances of carbohydrate metabolism in clinical medicine are few. An excess of sugar in the blood is a part of that well-known disease, diabetes. The treatment of diabetes, as you know, is a restriction of the intake of sugar in the diet. If a diabetic condition were responsible for the production of heat cramps it is obvious that a high carbohydrate diet would be contra-indicated. In our studies of the concentration of sugar in the blood we observed no consistent elevation of this substance. We can conclude from these data and these deductions that an excess of sugar does not exist in patients with heat cramps. Let us then examine the evidence favoring a deficiency. In clinical medicine there are three conditions in which a lack of sugar in the body may be detected. These conditions are Addison's disease, insulin shock, and pancreatic tumor. When any of these conditions exists the concentration of sugar in the blood is considerably below normal. No such lowering of the concentration of sugar in the blood was observed in any of the patients suffering from heat cramps. Lactic acid is another constituent of the blood that may increase with a disturbance of carbohydrate metabolism. But just as with the absence of changes in blood sugar concentration, so no significant changes were observed in the concentration of lactic acid. The failure to observe either an increase or a decrease in concentration of sugar in the blood in patients with heat cramps is very significant. The proponents of the dextrose theory must then assume a need for dextrose without any demonstrable changes in the blood sugar. Such a sequence of events represents a hitherto unrecognized phenomenon in clinical medicine.

The changes in the urine in heat exhaustion patients give us additional information regarding the pathogenesis of these conditions. When there is an actual deficiency of salt in the body the kidneys stop excreting this substance. This is a protective mechanism on the part of the body to maintain its normal equilibrium. The sweat glands however possess no such brake and long after the reserve in the body has reached a very low level the sweat glands keep on excreting salt. After the sweat glands have depleted the salt reserve of the body we should not expect to find any salt in the urine. Such is the actual series of events. In most of the urines passed by the patients with heat cramps on admission to the hospital the concentration of salt was very low. This test is not as accurate as the test for the concentration of salt in the blood however because of the following: a concentrated urine containing an abundance of chloride may be excreted by the kidneys before the onset of cramps and not be voided from the bladder until after the attack. This explanation is valid only for cramps with a sudden onset. The relative absence of salt from the urine in severe cases may persist for several days. During this time the body is retaining salt and water and gaining weight. The average gain in weight during hospitalization in the patients at Youngstown was 4.4 pounds. The maximum observed by us was 8.5 pounds. This gain in weight is almost exclusively a gain of water plus salt and represents the amount of these substances lost in the prodromal period and not replaced before the onset of symptoms. There are additional changes in the urine in clinical medicine associated with acidosis or a disturbance of carbohydrate metabolism. In acidosis, ketone and acetone bodies may be excreted in the urine. In a disturbance of carbohydrate metabolism sugar may be detected in the urine. None of these substances were observed in the urine of any of the patients suffering from heat cramps.

Albumin was frequently found in the urine on the first and second days following an attack of cramps. Hyaline casts were observed in the urinary sediment from many of the patients. The casts were not observed after the first day. In all patients the urine was free from albumin on discharge. The evidence that the albumin may be a function of high temperature and not singularly related to heat cramps is furnished by the studies on heat prostration. In this condition albumin is a common finding.

The *differential diagnosis* of heat cramps is usually not a difficult one. Nocturnal cramps and cramps following violent exercise may be confused with heat cramps. Heat cramps may have a long latent period and not develop until several hours after work has ceased. Because of the time of onset similar to nocturnal cramps, any workman who develops muscle spasms during sleep after working in a high temperature should probably be treated as a patient with heat cramps.

Abdominal colic should be considered when making a diagnosis of cramps confined to the abdomen or abdominal wall. When cramps are present in other parts of the body in addition to the abdomen no confusion exists. The diagnosis of cramps confined to the abdomen is not an easy one to make and to confirm by laboratory data. In Youngstown five patients were admitted with a diagnosis of heat cramps confined to the abdomen. During their stay in the hospital none of them had cramps elsewhere. None of the five had the typical chemical changes observed in the blood and urine from patients with heat cramps of the extremities. The final diagnosis of these patients was dietary indiscretion, gastric syphilis and ingestion of excessive quantities of cold water.

There are few *autopsy reports* on patients dying from heat cramps and complete pathological descriptions of these are not always given. In one patient reported by Elliot there was no loss of consciousness until shortly before death. The obvious cause of death was heat cramps. The pertinent observations mentioned by Elliot were the rigid contraction of the left ventricle, congestion of the lungs and congestion of the gastric mucosa. Whether these findings are directly related to the effects of high temperature or are only incidental, will be decided only after further investigation.

A large number of *therapeutic measures* have been employed in the treatment of heat cramps. Most of these measures have been based on impressions handed down in domestic and professional circles. They are empiric in nature and symptomatic rather than specific in providing relief.

Rest is one therapeutic agent that is easy to provide and is beneficial to the afflicted. It is obligatory for all severe cases and generally available for the milder ones. Recovery from cramps with no other therapy than rest has long been recognized by workmen but not thoroughly appreciated by all physicians. The failure to appreciate the frequency of spontaneous recovery has given rise to exaggerated confidence in the efficacy of certain drugs. The evaluation of the utility of any therapeutic procedure in the treatment of cramps is valid only when it is recognized that a spontaneous recovery is possible. At Youngstown twelve of the patients suffering from mild cramps received no therapy the day of admission other than food and rest in bed. The recovery in all of them was rapid and satisfactory. The explanation of this recovery is a simple one. The loss of body water and salt in the sweat which produced a disturbance of the normal equilibrium had not progressed to a serious degree in the mild cases. Cessation of work and diminution of the rate of sweat loss came early enough to allow a partial readjustment of the disturbed equilibrium with alleviation of symptoms.

Whiskey, brandy, vinegar and *turpentine* are domestic remedies that have their proponents. The chief benefit from any of these agents is probably derived from their action as stimulants or counter-irritants. There is no evidence that any of them exert a specific therapeutic effect.

Morphine is one drug that is frequently used in the treatment of severe cramps, but few observers have been satisfied with its alleviation of pain. In our series three patients were given morphine in one-quarter to one-half grain doses and in no instance did it relieve the pain.

Hot packs have been in vogue at various times. They afford a certain degree of temporary relief if water is not ingested simultaneously. The principle action is to stimulate the sweat glands. The sedative action on the body also may be beneficial. The sweat that is produced by a hot pack contains a lower concentration of salt than the body fluids and the ultimate effect is to raise the concentration of this substance in the remaining body water. This temporary increase in concentration may be sufficient to relieve the patient of cramps. The duration of relief afforded is very short, however, and when the sweating is followed by an increased consumption of water the cramps are apt to return.

Castor oil and *saline laxatives* have been used in the treatment of heat cramps. The vegetable purgatives do little more than promote general well-being if the patient

is constipated. The use of saline purgatives with the subsequent depletion of body fluid is harmful and should be condemned. *Calcium chloride, amyl nitrite, chloroform,* Locke's solution, and sodium bicarbonate have been used by various physicians. There is no evidence that any of these have a specific therapeutic effect.

Dextrose ingested by mouth or injected into the blood as a solution is a popular form of therapy at present. In spite of its extensive employment, there is no published series of cases justifying its therapeutic use. Its employment has been empirical and the therapeutic results have not been critically examined. Mild cases are apt to recover without medication and when dextrose has been given to such cases, the credit for recovery has been misplaced. Another explanation of the apparent benefit from dextrose is the common practice of using a saline solution as a vehicle for this substance when it is given intravenously. Relief from such a mixture has been attributed falsely to the dextrose. The treatment of heat cramps by the administration of dextrose has been investigated by us in Youngstown. In all of the patients so treated the persistence of cramps necessitated the subsequent administration of normal saline solution. After the saline infusions no cramps could be induced. It was our experience that dextrose was not effective in the treatment of heat cramps.

Salt or *saline solution* is the last therapeutic agent that will be considered. The use of salt solution is not new in the history of the treatment of heat exhaustion. The earliest report of its use appeared more than thirty-five years ago. Ten years later Elliot advised the use of saline enemata to patients suffering from heat stroke or heat cramps. No discussion of the beneficial effects of saline was given in either instance. In 1918, Pryor advised either dextrose or saline for treatment of heat cramps occurring among stokers on ships of the United States Navy. Haldane and Moss's re-emphasis of the importance of salt in the treatment of cramps was not widely followed, and as recently as 1934 at least one large steel company advised against its use in most patients.

The choice of the route for the administration of salt is optional. None of our patients were in shock; nevertheless, *the intravenous route was invariably used.* Our objection to the injection of salt solution under the skin is because of the pain suffered by the patients during the treatment. In our series approximately one quart of 0.9 per cent salt solution was given in the vein during the first few hours following admission. This was repeated if the patient was markedly dehydrated. After the first few hours following this treatment most patients were able to take a normal diet to which considerable salt was added. Salt may be taken by mouth in salt tablets or in various drinks. At Boulder City a high milk diet was employed for this purpose.

In our hands the use of normal saline solution in all severe cases was highly satisfactory. Every patient that was given saline solution alone was relieved of his cramps before the end of the initial infusion. All attempts to induce cramps following the infusions were unsuccessful. In view of the etiology of heat cramps and the success of salt therapy at Boulder City and at Youngstown, it is believed that this may be considered a specific therapeutic agent.

The *prevention* of heat cramps in the workman is probably the most important aspect of the discussion this afternoon. It is desirable to know about the cause of the disease and its treatment but the prevention is of greater importance than either of *them.* The prevention will be discussed generally and specifically. A state of good health among the workmen has long been stressed and is extremely important in prevention. Most of the mill men in Youngstown on inquiry regarding their individual method of prevention gave first consideration to this. The enforced absence from work of all men not in a state of good health would decrease the incidence of heat cramps. Frequent and thorough physical examinations are a necessary part of any adequate plan of prevention. The more thorough and the more frequent the physical examination the more chance there is of detecting organic disease and protecting the workmen and the company against an attack of cramps.

Suitable environment when off duty and at home has been emphasized by most observers. The need for good food and restful sleep is especially important during the summer months. Failure to obtain these partially explains the high summer incidence of cramps.

The *diet* of men exposed to conditions favorable for the development of cramps may need modification in some instances but usually is adequate and satisfactory.

The belief that the elimination of protein from the diet is desirable for men working in a hot environment is widespread. There is little evidence to support this. The need of an adequate protein intake is obvious for men doing hard physical labor. A large proportion of carbohydrate foods may supply the remaining necessary calories. Of equal importance in the prevention of cramps is an adequate mineral intake. An average salt intake of at least fifteen grams a day is probably necessary for men doing hard work in the summer.

A *liberal fluid intake* is imperative for workmen losing several quarts of fluid in the sweat each day. The temperature at which fluid should be consumed should be governed by the desires of the workman. There is no evidence that cool water is of itself harmful. There should be no attempt made to restrict the ingestion of fluid, the only proviso being that the fluid intake be accompanied by an adequate amount of salt.

Oatmeal water has been used for many years for the prevention of heat cramps. It is probable that the chief benefit derived is the salt contained in the oatmeal.

Whiskey and *beer* have been invested with preventive properties. It is well known that the coal miners in England who drink beer are not apt to suffer from cramps. An important observation regarding the ingestion of this beer is the frequent addition of salt to it. The probable effect of whiskey in small doses is supportive.

Powdered sulphur, the "puddlers' remedy," is one of the older medicines used as a preventive. The sulphur may be ingested, dusted in the shoes, or worn about the legs enclosed in a small pouch. The origin of the use of sulphur is probably associated with the drinking of water from hydrogen sulphide springs. One sulphur spring in Youngstown enjoyed a fine reputation for the prevention of cramps. Analysis of the spring water showed it to be rich in sodium chloride as well as in sulphur. The taste was principally a sulphur one, while the preventive action was probably a function of the salt concentration.

In prevention as in treatment, *dextrose* occupies an important place. Dextrose in two gram packages is dispensed by several of the steel mills in this country, frequent ingestion of this amount on hot days being advised. Such measures have been attended with disputed success. The explanation of the prevention of cramps by ingestion of dextrose is similar to the explanation of its curative power. Both presuppose a deficiency of dextrose in the body or an impaired mobilization of it. Glover speculated on the possible aid that this substance might have in the mobilization and utilization of salt. There is no evidence to support such a hypothesis. Any benefit derived from dextrose is probably symptomatic and not specific. Dextrose is a readily assimilated food, a source of quick energy, useful in the prevention of fatigue, but not specific in the prevention of cramps. A word of warning should be given in this connection. In the steel mills, especially where many men are employed over the age of forty, cases of latent diabetes may be precipitated by the indiscriminate use of dextrose.

The ingestion of salt for the prevention of heat cramps is sound theoretically and has been beneficial when practiced. Since the cause of cramps is essentially a loss of salt in the sweat and urine that is greater than the intake, the added ingestion of this substance will prevent this negative balance. The salt may be given in dilute concentration in the drinking water, dispensed in condensed tablets, or taken with meals. These are mentioned in the order of their efficacy. The addition of salt to the food is neither regular nor reliable. The craving for salted foods is not a dependable criterion of a low salt reserve in the body. Many men are prejudiced against the liberal use of salt at the table or have no taste for it. Occasionally meals are skipped and thus no salt at all is ingested. At Boulder City where most of the men had their meals at a common mess hall the salting of food was a satisfactory means of preventing cramps. This practice has been in vogue for the past three summers and during this time few heat cramp cases have been observed. Such a project is an unusual one and it is only in a few isolated instances such as this that the necessary amount of salt may be ingested with the food regularly.

The dispensing of salt in compressed tablets at the drinking fountains has been tried extensively in the Cleveland district with highly satisfactory results. Engel reports 171 patients suffering from heat in one steel mill in that district between 1920 and 1928. Since 1926 there has been a progressive introduction of salt dispensing machines in the various departments. In the three years following 1928 not a man reported off duty because of cramps. Glover has almost as convincing evidence where

cramps have been very common before the introduction of salt tablets. The experience of the mills in Youngstown is less favorable. The ingestion of the tablets is optional with the men. Many who need additional salt are prejudiced against its use in this form. Salt tablets of one gram each are not palatable, especially for a man doing hard work. Many of the tablets ingested are not assimilated. Several of the patients studied in Youngstown had ingested salt tablets on the day of admission to the hospital. In several of these the number taken was small and insufficient to protect them against cramps. In one patient the number of tablets consumed was large and the patient had had nausea and vomiting and was probably no better off than if he had ingested no tablets at all.

The general administration of salt in amounts sufficient to protect against cramps can best be achieved by its addition to the drinking water. Moss advocated the use of a combination of sodium chloride and potassium chloride in the drinking water. Oswald recommended a saline drink of about 0.35 per cent concentration. Drinking water containing 0.25 per cent to 0.1 per cent concentration has been used successfully in the prevention of heat cramps on the ships of the United States Navy. Bock tried out several concentrations of salt from 0.1 per cent to 0.5 per cent on unaffected workmen in Youngstown. He concluded that from 0.1 per cent to 0.15 per cent was the preferable concentration. Such a solution can be taken cool and if not held in the month too long has no perceptible salty taste. This solution allays rather than promotes a sensation of thirst. Stronger solutions generally increase the sensation of thirst and may be responsible for water retention. The concentration of salt in the bloods from the men who received a 0.1 per cent salt solution were all within the normal range at the end of the day's work.

The hazards to be considered from the general salting of the drinking water for a large group of men are probably not significant. A workman with kidney disease, heart disease or any condition in which dropsy may be a symptom, is infrequently found in the industries where cramps are common. It seems unlikely that any harmful effects are to be anticipated where the men are physically able to perform hard work and to sweat profusely. The advantage of supplying salt to the men in this fashion is almost self-evident. If a man allows his thirst to be quenched with fluid of this salt concentration he is replacing salt and water at about the same rate as he loses it in the sweat. In this way the normal internal environment of the body is maintained, allowing all the while adequate dissipation of heat by sweating. If a man sweats then he will drink, and if he sweats it is advisable that the fluid and salt lost be replaced quantitatively. In no other way can this be done as conveniently as in the salting of the drinking water. If the men allow their sensation of thirst to be the guide for the ingestion of salted water there will be no accumulation of either salt or water in the body. Thus in the winter time or at cooler jobs when the sweating is diminished, thirst will be less and the intake of salted water diminished. Therefore it seems unnecessary to discontinue the salting of water in the cooler months when the ingestion of fluid is below that at other times.

There is little evidence in the medical literature that a high salt diet is in any way responsible for the production of high blood pressure, kidney disease or heart disease. Further, there is little evidence that a high salt diet promotes the progression of these diseases if they are already present. The only condition in which a high salt diet may be harmful is one in which dropsy is present. As previously mentioned, a patient with severe enough chronic disease to lead to dropsy is certainly unfit for the hard work in the large industries.

One cannot be too dogmatic at this stage of the investigation. It may be that some unforeseen circumstance will arise out of the general salting of the drinking water. It is our opinion that if such a circumstance arise it will not be a serious one. We have the experience of the Youngstown Sheet and Tube Company where no cases of heat cramps were observed in the mills in which the water was salted, nor were there any untoward effects from the general ingestion of the salted water. It is to be hoped that the salting of the drinking water will be intelligently carried out by other organizations with proper controls. The effectiveness of this procedure may be controlled by salting the water in some of the mills where heat cramps are found but not in all of them. The incidence of cramps following such a regime may also be compared with previous years.

ADJOURNMENT.

Industrial Nursing

THURSDAY AFTERNOON SESSION

October 17, 1935

The session was called to order by the chairman, Joanna M. Johnson, R. N., director, Nursing Service, Employers Mutuals, Milwaukee, Wis., who outlined the business of the session and then introduced the first speaker.

What Can Be Done to Prevent Tuberculosis Among Employees

By CHARLES S. GALLAHER, M.D.

Medical Department, Eastman Kodak Co., Rochester, New York

The prevention of tuberculosis in industry is one of the many problems confronting the industrial physician. It is well to appreciate that the disease is present among all classes of people and is fairly frequent. Its incidence among industrial employees is approximately 2 per cent.

An analysis of 100 cases of tuberculosis occurring among employees of the Eastman Kodak company, by Dr. W. A. Sawyer and Dr. E. K. Richard, showed some very interesting facts. It was noted that the mortality among women between the ages of 20 and 29 was 109 deaths per 100,000 or about what it was fourteen years ago. The death rate among men was 74 cases per 100,000. In spite of the fact that the mortality rate has been dropping during the past thirty-five years, tuberculosis is the second greatest cause of death among males, being exceeded only by heart disease.

Two other interesting points were brought out in this paper. The first was that the average age of the patient at the time of diagnosis was 31 years. Such an event coming at the crucial time in life, when the young persons are getting established industrially, results in a real economic catastrophe. It decreases the efficiency of the individual; and results often in the loss of a chance for advancement.

The second point showed the cost of an average case of tuberculosis to be $4,062, with the possibility of a maximum of $24,000. Of the first figure, 80 per cent is accounted for by lost wages and sick benefit paid. The remaining 20 per cent represents the cost of medical care. These figures can be more readily appreciated when we find that the average lost time was 542 working days for female patients and 648 for males, an average of over two years in actual working days.

It is not the purpose of this paper to discuss the history or treatment of tuberculosis, but with the above thoughts in mind, to tell you of our methods in dealing with the practical problems of the prevention of the disease in Industry.

In going into the actual work, it is well to appreciate that to prevent tuberculosis, we must first discover the case. The work is carried on by three departments, namely: Employment, Medical, and Safety.

The Employment department's work is only of minor importance. It is its duty to select the proper applicants for the various types of work. The department is assisted by recommendations from the Medical department.

The Medical department is really the fountain head of prevention work. It is its duty to discover, and dispose of each case, properly. In doing this work, there are two classes to consider: the applicant and the older employee.

When the applicant comes to the Employment department, he is given a requisition slip for physical examination. Upon presentation of this slip to the Medical department, a medical history is taken, which is followed by a clinical examination, Wassermann, urinalysis, and a chest X-ray.

We have become convinced that the only way to find the majority of tuberculosis cases, is to have a satisfactory X-ray. Otherwise, cases of so-called "silent tuberculosis" are apt to escape the most careful examiner.

Upon completion of this examination, if the applicant is satisfactory, he is accepted for employment, and subjected only to routine health examinations at intervals.

Applicants who have tuberculosis are divided into three classes: active cases, stabilized adult cases, and juvenile cases.

The active cases are, of course, rejected for employment. They are referred back to their family physician with the X-rays, or referred to the local sanitarium, and the local health bureau is informed so that the follow-up of each case may be obtained and examinations made.

If the case is deemed to be stabilized, but shows a moderate or marked fibrosis, the applicant is still rejected. This is due to bad experience with this type of case. We find that all too frequently stabilized cases reactivate and become industrial hazards.

The applicant is occasionally passed for particular kinds of work when he has minimal pulmonary fibrosis that is very definitely stabilized. This employee is examined routinely, each year and given a chest X-ray, which is kept for comparison with all other previous X-rays, in order to avoid passing up cases of very low activity.

Cases of juvenile tuberculosis are usually passed, and if listed as tuberculosis suspects, are periodically examined and X-rayed. Individuals having suspicious chests are so advised, and educated in protective measures. Suspicious cases are never placed on hazardous work.

Older employees are given periodic examinations. If normal, they are called in at intervals—every two or three years in one plant and yearly in others. If they have tuberculosis they fall into one of two classes: inactive or active.

The inactive cases are examined and X-rayed at intervals of six months to one year to determine if any activity has developed.

The active cases fall into two groups as follows:

1. The quite active case who is being incapacitated by the condition. If the proper treatment cannot be given at home, he is encouraged to go into the local sanitarium for treatment, and when totally and permanently disabled, is given retirement. Frequently, however, he is able to overcome the disease by proper treatment, and ultimately returns to work. He is then given a light type of work which the attending physician is convinced he can do without injuring himself, and of course, which will not involve any risk to other employees. These cases are examined every few months, the medical supervision being similar to a case of minimal activity.

2. The case of minor activity is cared for as his attending physician sees fit. In some cases, home treatment is desirable, and the patient is permitted to do a moderate amount of light work. In these cases, placement is important to make sure that they will not endanger fellow workers. And employment must be suited to their physical condition. These individuals are examined frequently, and given chest X-rays which are viewed in serial, to determine if the case is progressive. Every effort is made to carefuly supervise these cases.

This completes the direct methods of finding tuberculosis and preventing the spread of the disease in industry. There are, however, other methods employed which may be termed, indirect. The most important is the case finding system. A complete medical record of every employee is kept and frequently scrutinized. Employees suffering from loss of weight, nervousness, and indigestion are frequently called in for chest X-rays. It is surprising how many of these obscure symptoms, will show tuberculosis. Hemoptysis is rather rare, and only one case has been found in sixteen years. Most of the patients exhibit vague symptoms, frequently referable to other parts of the body.

The routine check-up on all cases is handled by the "tickler" system, which eliminates the possibility of overlooking any individual cases. This is one of the most important steps in the prevention work carried on by the Medical department.

Another phase is making the patients "health conscious." This is accomplished by personal contact with the physician, who discovers individual health problems and gives advice.

Much depends on the alertness and interest of the industrial nurse. She comes in contact with a great number of employees and frequently patients will mention health problems to her which they are reluctant to bring before the doctor. This is particularly true of female employees.

An alert nurse frequently picks up marked decrease in a patient's weight, a general appearance of ill-being, or minor symptoms elicited from the patient. It is her duty to encourage the employee to see the physician.

Free pamphlets on health are to be found in the Medical department. Bulletins on health are posted about the Plant. Cold campaigns have been carried out with marked success, and cod-liver oil groups have been organized yearly. In addition, a dietitian has been retained to give employees advice.

It might be well to comment, briefly, on pneumothorax treatment. This treatment seems to offer hope to employees for an early return to work. Ambulatory pneumothorax cases do quite well, and apparently are able to do types of work without injury.

The value of such a program, as outlined, cannot be over estimated. The incidence of tuberculosis between the years 1923-27 in the Eastman Kodak Company was 123 patients. By following this procedure, between the years of 1928-32, the number was cut down to 65. When we stop to figure the cost of an average case to the individual and to industry, this saving has been considerable!

The legal significance of such a program to industry is becoming more pronounced, particularly in states having a wide coverage by compensation laws. We find that pneumokoniosises are frequently accompanied by tuberculosis. This applies particularly to silicosis. In view of the many suits being brought against industry, it is necessary to develop some means of protection.

The Safety department plays a fairly prominent part in prevention by its elimination of industrial hazards. This is particularly true in the case of dust hazards such as silicosis, anthracosis, etc. Ventilating problems are solved. In addition the department runs instruction courses for the supervisors, who have a good opportunity to observe physical deficiencies in the employee.

Selling Management on an Industrial Health Program

By ETHEL P. SCHILLING, R.N.

Industrial Nurse, Domestic Coke Corporation, Fairmount, W. Va.

Physical well-being is a pre-requisite to emotional and mental well-being. These, in turn, are essential to an alert and enlarging recognition of opportunities and responsibilities.

Recently a survey was made of some twenty-five firms regarding information about their health programs, and it is evident from this survey that the majority of the employers are not yet sufficiently sold on the idea of industrial health to make a real investment in a well defined health program. It is true we have found that a great many of our larger employers have established a complete medical program and are doing a real job. However, these larger plants are in the minority, and there are vast numbers of smaller establishments, with between 10 and 1,000 employees, who have no program at all, or one which is very limited.

There seem to be three reasons for this: (1) Lack of detailed information with regard to organizing such a program: (2) Lack of definite knowledge of its economic value: (3) Lack of some promotional agency to push the thing into action.

It is evident that our health programs must begin with the management. Some

employers are still under the impression that a worker's health is his own personal problem and that the employer need not concern himself with it. Many of these employers will not fully realize the value of a worker's health until one of their key men is suddenly incapacitated and they find themselves in an awkward position. Even then, I dare say, they may lay the misfortune at the door of Providence. Years ago it was chiefly the cost of accidents that made employers realize that the accident prevention problem demanded attention, and compensation laws spurred many of them into action. I do not mean to imply that we need legislation to make us realize that health is important to industry, but it does seem that unless these problems actually cost us money in visible dollars and cents, we are very apt to disregard them.

Three special problems that the Health Department has to consider are: (1) The physical condition of the higher executives; (2) The health hazard peculiar to industry and its effect upon the workman; (3) The study of early manifestations of disease in the workman.

Time will not permit discussion of all of these problems, but I will touch briefly on the first. Each member of the executive force should have a complete physical examination. This should be just as searching and complete as that given to the workman. In any factory the higher executives control the success of the business. If these men can be kept in good physical condition, their efforts will be the more fruitful. The loss of a single executive in any department may cause considerable difficulty. The Life Extension Institute has called attention to the large number of men, at or about middle age, in whom degenerative processes of serious nature are just starting. These processes, if discovered, can usually be checked, or their progress greatly delayed, by the industrial physician. When we have sold the management on the value of physical examination for themselves and their executives, then, and then only, will we be able to sell the management on a health program.

The cost of health work in industry will average approximately six dollars a position, per year. There is considerable difference in this price as reported by various firms, the range being from $2.47 to $22.00 per employee per year. The plant having the $22.00 cost employed full time medical service, three nurses in the plant and one full time visiting nurse, a fully equipped industrial hospital, eye room, dental room, X-ray and physical therapy room, and required a careful physical examination of all employees with periodic health examination. This plant reported that in two years the average lost-time illness had been reduced from 8 days to 3.4 days per employee, and that no days were lost from infection.

The benefits of a health program may be divided into those which affect the management and those which affect the worker. All who have written on the subject agree on the economic value of medical supervision to the management, but state the difficulty of showing this in figures. Mock sums up these benefits to management as follows:

1. Reduces the time loss due to sickness and epidemics.
2. Reduces compensation for accidents, disability, deformities and death.
3. Increases output by steadier working force.
4. Decreases hiring of new employees at a great financial saving.
5. Increases general efficiency of force.
6. Secures good will of employees.

Many employers have asked, "What size must a plant be before a health service can be established?" The number of employees is not necessarily the criterion for justification of a plant physician or nurse. Health and safety work is important in all plants, regardless of the number of employees. In referring to a recent list of small plants which provide health service, there were a number of instances of employment of part-time physician and nurses where there were fewer than 500 employees. In one instance, however, there was a part time physician employed in a plant having only 167 employees; in another, a full time physician was employed where there were 310 employees.

Any plant, no matter how small the number of employees, can arrange a definite part time health program. The deciding factor is usually the interest of the management in providing protection for his workmen; the character of work done in the plant, and finally, the desirability of maintaining healthy workers. I believe you will agree that it is just as absurd for a plant having a few electric motors and elevators not to employ safety inspection as it is for the plant with a few employees not to need a health service.

The safety engineer who has made a study of accident reports can readily recall numerous cases of long drawn out disability caused from infected gums and teeth. The "Back" case has long been the "Waterloo" of the claim man; any doctor will testify that prolonged disability in this class of cases is due to focal infection.

We also know that every employer has bought many hernias that did not belong to him. We have seen minor scratches fail to heal and have found that diabetes was the cause. The employer has also paid bills for many grafts where bones refused to knit and later found out that a deeply rooted disease was responsible. In short, we are charging ourselves with many disabling injuries, which would not be disabling in the first place, if physical conditions had been isolated and treated before these injuries occurred.

How will your budget be drawn up for 1936. Will it be $20,000 for health or will it be $70,000 for accidents?

How the Industrial Nurse Can Help to Prevent Absenteeism from Non-Occupational Causes.

By DR. R. F. KURZ,

Medical Director, Container Corp. of America, Cincinnati, O.

Absenteeism from industrial plants arises chiefly from industrial accidents and occupational diseases. We have records of many plants which have gone for long periods without a lost time accident, in some cases involving thousands of employees and extending even over years. But we can cite few instances of such plants going even a week without a dozen or more people being absent because of illness. The non-occupational causes of absenteeism are by far the most common and most destructive of good attendance records.

The great progress made in reducing lost time from industrial accidents has been effected largely by education. We must adopt similar methods in reducing non-occupational absenteeism, and in carrying on these educational or training processes the personnel director, the safety-manager, the plant physician and the plant nurse may all cooperate.

The nurse can do much to build up a proper health consciousness in employees, which will secure their cooperation in the correction of physical defects. Most employees can be made to see that such defects not only impair health and efficiency but undermine general happiness. Removal of bad teeth, of infected tonsils, and the correction of defective vision are the chief forward steps. More and more industrial employees and their families are securing regular medical and dental care of good quality and take better care of their eyes largely through the educational influence of the industrial health department, which, in many cases, consists only of the plant nurse. The same may be said for education along lines of balanced diet. Many an ill-suited lunch consists of a quart of milk and a baker's pie or two, the crust of which is hard to distinguish from the cardboard plate upon which it is served. There is also the fellow who brings a half spoiled meat sandwich into the plant at 7 A. M. on a warm day, which by noon is likely to give him a severe indigestion if not ptomaine poisoning. Advice is needed in these cases, such as:

Regular habits—(avoidance of continued dosing with cathartics).
Water drinking—encourage the amount and be critical of its purity and temperature—not too cold.
Regular living—rest, recreation, sleep, etc.
Cleanliness—baths, wash hands before eating, diligent use of rough bath towel after bathing, etc.
Insects—flies, mosquitoes.
Weeds in summer.
Swimming choices.
Boils.

Indigestion.
Colds, etc.
Early recognition of danger signals, such as—loss of weight, chronic cough, night sweats, dizziness, blind spots, bleeding, swellings and tumor masses.

The plant medical department can help greatly by advising employees as to the type of professional service they should seek—avoidance of the quack dentist, or the quack eye man who examines eyes free and charges only for the glasses. These are always the most expensive services. In this connection, a jab now and then at some of the utterly ridiculous advertising of many pseudo-medicines over the radio would not be amiss. Enough of this ill-suited medication, if it can be called that, will sooner or later result in a false sense of security and a postponement of specific treatment in cases where that may be necessary.

Those who have as part of their duties, a visiting nursing service, will have the added advantage of an insight into the home environment, which always permits of a wider service in reducing absenteeism.

Absenteeism from avoidable causes is regrettable for several reasons:

There is the humanitarian aspect, because there is usually suffering and physical discomfort; and there is the loss of wages to the absent employee, plus the cost of medical care. From the employer's standpoint there is the necessity of replacing the absent employee—not always easy. This may require the shifting of several men onto different jobs just because one is at home sick. These are all good arguments, whether presented by physician or nurse, and often convince the chronically sick employee that he should take the necessary steps *now* to avoid illness and perhaps prolonged disability period, which is likely to be the result of neglect.

In every plant of any size there is the employee who is more or less regularly absent every now and then because he must be in court, because his wife is sick, or because his mother-in-law has died. To combat this, an arrangement with foremen can be made, so that anyone absent must present a certificate from his own physician before he can come back to work; or if he was absent for reasons other than his own illness, he must pass through the medical department and get a slip before he can return to work. This makes being absent embarrassing, except in bona-fide cases, and greatly reduces laying off. It could be required that six hours notice be given before a man lays off. These requirements work no hardship on 95 per cent of employees who are only absent when necessary.

Another factor in absenteeism reduction is the matter of keeping good records. To the nurse often belongs the administrative duties of the medical department and hence careful, accurate records of all cases of absenteeism, classified by departments and an occasional bulletin on the subject, will create a competitive spirit among the various departments. Such a record gains help from the employees who will strive to continue unbroken a chain of days or weeks of 100 per cent attendance in their department and this will often tide over a luke-warm case of potential absence. Here however, we must not lose sight of the opposite effect and let over-enthusiasm permit sick folks, who should be at home, come to work. The proper publicity must be given the subject and a premium placed on regular, uninterrupted attendance at work. It must be remembered that the employee contacted in this educational drive is very apt to spread the good news and carry the lesson farther. It is hard to imagine a safety-minded co-operative employee careful only while at work, and shedding his safety-mindedness as soon as he leaves the shop. Most employees carry some of it home, use it on their way home, and if they are at all enthusiastic, their influence will perhaps extend to members of the family and friends. Thus the plant medical department accomplishes some good work beyond the factory walls. And this same enthusiasm is manifest among fellow workers, one helpful to another.

The nurse, therefore, should be more than a finger wrapper or a dispenser of pills. She becomes most valuable when she enters into the economic factors that underlie preventable accidents and illness. When she helps teach the value of good health and freedom from accidents, she is making a definite contribution to better industrial relations.

ADJOURNMENT

Industrial Safety Lectures

The industrial safety lectures were again an outstanding feature of the Congress. These early morning classes were presented in two series, each of two lectures. Mr. William P. Sandford, Ph. D., Sandford Speech Organization, Chicago, Illinois, on Tuesday and Wednesday morning discussed "Public Speaking in Safety Work," subdividing this topic into "What To Say" and "How To Say It." On Thursday and Friday mornings Mr. H. S. Bigelow, Vice-President, Sales Analysis Institute, New York City, discussed "Safety in Foremanship." His subject was divided into "Setting the Working Pattern" and "Putting the Pattern to Work."

Mr. W. H. Cameron, Managing Director, the National Safety Council, presided at the meetings each morning and introduced the speaker.

Each series of lectures has been consolidated and condensed by the author for these Transactions, and they are presented in concise form for study and reference.

Public Speaking in Safety Work

By WILLIAM P. SANDFORD, PH.D.

Sandford Speech Organization, Chicago

I. What to Say

It is not my purpose today to tell you that public speaking is important in safety work. You know it. Safety men *must speak!* Not only must you speak: you must get results. You must move that audience to action; and the kind and degree of action that you get will determine the success that your program will enjoy.

How many men face this situation virtually unprepared? Not unprepared in knowledge of the safety movement—not unprepared in enthusiasm for and belief in its purposes. But *unprepared, in the sense* of having mastered a technique to make that speech successful.

There is a technique. Make no mistake about that. It governs both what to say and how to say it. Two thousand four hundred years of study and experimentation have gone into its development, and it is there to be used by anyone who wants to make his public speeches and his private speech effective. It applies to the safety movement and it applies in every other phase of human activity.

Today my subject is "What to Say"; tomorrow I shall present some principles, which govern the equally important phase of speaking, "How to Say It." A speech must first of all be well-designed, adapted to its audience, adapted to the accomplishment of its purpose, and developed in such a way as to hold interest and attention and eventually stir the hearer to action. That done, its oral presentation before the audience becomes of *supreme importance*. It must be so presented as to do justice to the ideas the speaker puts forward. More, it must have those qualities of communication, enthusiasm, and sincerity which carry the audience with the speaker and, together with what is said, lead to final conviction and action.

So much in general. I sat at a dinner not long ago next to a man who has built up one of the great wholesale businesses of the state of Michigan. He said to me, "I'd give ten thousand dollars if I could stand on my feet before an audience and express the ideas that I have. But I don't know how, and as a result I frequently

give the ideas to someone else, and he presents them before public gatherings and committee meetings and gets the credit. I don't know where to begin to get ready to make a speech, let alone know how to give it when I had it ready." There's a man who has been successful in his business; a man who doesn't lack effective words in dealing with individuals; but to whom the task of making anything resembling a public address is a nightmare. There are many like him. Yet, if they would but realize it, one significant fact would help them out: the principles governing effective every-day talking and the effective public speech are the same. It is merely a mattery of carrying over to the public address the things that work well in conversation. A very important corrollary is this: the *principles of public speaking* can be practiced in every-day conversation. As they are learned and practiced, they not only enable a man to speak effectively on the platform; they improve his speech in dealing with individuals.

Let's assume now that the safety speaker is well-acquainted with his subject, competent to assemble facts and ideas which bear upon it, and desirous of planning for public delivery a speech which will be of benefit to it. I am going to take you through the detailed steps in the preparation of such an address, and as I go along I will try to point out the principles involved. The process is one which applies to every speech and to every purposive conversation. It is a process which will enable you to plan your speeches more quickly and more efficiently than probably any other. It tells you where to begin, what to do first, second and third, and gives you a grasp of the main problems involved at each step.

There are five sample steps, and in taking each step there are several specific principles to be applied. A thoughtful, methodical preparation such as this will get results; and improvement in detail can follow the mastery of the five steps.

The first major step is the preliminary survey. A speaker is like an engineer in that, having been assigned the task of building something, he first studies the location and available materials, and lets them govern his course. To plunge into the composition of an address without such a survey is to work blindly—and that is what too many speakers do. What, then, are the elements of a preliminary survey? They are: the occasion, the audience, the time allotted, and the speaker's general purpose. A safety worker is asked to make an address. He is expected to talk on the general subject of his life work. It makes a vast difference to him whether the occasion is a general public meeting, a school class in session, a meeting of a public safety committee; he must adapt his material and his aim to the situation which confronts him. Similarly, too, he must consider his audience. Is it composed mainly of young people? Then the *simplest language, the most direct style* will be essential. Is it composed of the middle-aged? Then he must come armed with facts, statistics, evidence for people who are of mature years are not easily swayed by mere assertion. If it is composed of the old, he must be even more prepared with facts. What are the politics, the religion, of the majority of the hearers? Important, what are their occupations? To what racial and social groups do they belong? These are but a few of the normal considerations. The wise speaker uses his knowledge of humanity, and everything he can find out in advance about his audience, and thus his whole message is attuned to them. He is seeking favorable reactions: let him be sure that he says nothing and does nothing to arouse unfavorable feelings.

The time allotted to the speaker is another important consideration. To quit on time, or before time is up, is a sign that the speaker has taken pains. His discussion must be limited to such matters as can be presented in the time at his disposal. Therefore, instead of talking about the entire safety movement, it becomes necessary for our speaker to discuss that one angle of it which will be most effective in consideration of audience, occasion, and—his general purpose.

When we mentioned "general purpose" we mean simply this: is the general effect desired informative, persuasive, or entertaining? Do you wish to give information for the sake of that information, in order that the audience may understand what a part of the safety movement is? Do you wish to persuade the audience to take immediate action, to contribute money, or to join a safety club? Or, because of the nature of the occasion, do you wish your speech primarily to entertain and to please? Information, persuasion, and entertainment are the three great general purposes of all speaking, and it is important that the speaker decide which one of these he is seeking to attain. More time has been wasted, and more speeches have failed because of lack of consideration of this point than because of any other one fault

in speech composition. If you decide that your main purpose is to give information, you will avoid the use of contentious material, argument, controversy; you will avoid the use of many stories, jests, humorous remarks, for while these have a value in gaining initial attention, they tend to distract from the main point when overused; and you will avoid, at the conclusion, asking your hearers to accept some definite belief or to take any definite action. Your purpose is *to inform*, not entertain or persuade. You will choose the ideas and details of your speech with a view to inform. You will define, compare, and contrast, in order that clearness and understanding may be promoted.

If you desire to entertain, you will seek the novel, the humorous, the unusual and colorful as your material, and you will keep out prosy explanation and contentious argument.

If your general purpose is persuasion, you will use informative and entertaining material, it is true, but you will use it as means to an end, and the bulk of your talk will consist of reasons why and of appeals to the vital interests of your audience, in order that they may be moved to the desired belief or action.

In short, the general purpose of your speech should dominate the preparation; and failure to consider it will inevitably lead to loss of time and probably to a failure.

We assume that the safety speaker has done these things, and to keep matters clear, that his audience is a mixed one as to age and occupations, that the occasion is a general public meeting, and that he has twenty minutes to talk, with the general purpose of persuasion. He now faces the second main step, which is that of building the framework of his speech.

A speech has a structure of its own. What is that structure like, and how may it be remembered? Picture a bridge. This bridge, first of all, has a specific purpose. It is designed to carry traffic from one side of a river to a point on the other side. Likewise, a speech aims to carry the hearer to a definite, pre-selected point of understanding or conviction.

A bridge consists, usually, of several main spans, which support and are mainly responsible for achieving its purpose. Similarly, the speech consists fundamentally of several main points, principal thoughts or arguments, which contribute most importantly to its success.

A bridge may consist of various materials—brick, stone, wood, steel, concrete, etc., and a speech is made up of various types of material—assertions, illustrations, examples, testimony, statistics, and reiteration.

A bridge has an approach, over which people travel to reach the main spans, and another down which they go to reach their destination. A speech has an introduction and conclusion, which are exactly parallel in function.

Keep in mind this analogy, and the task of building an effective speech becomes a matter of systematic and orderly procedure, instead of a confusing and jumbled composition.

To construct the framework, choose first the specific purpose and main ideas. Why determine the specific purpose, the immediate and definite objective of the speech? Our safety speaker wants a more definite goal than merely to persuade—he wants to persuade *in respect to a definite point of belief or conduct*. Having chosen that point, he can bend all of his energies to the task of persuasion, without loss of time or effort. So let's mark down this square at the top of the blackboard and call it the specific purpose. For this particular speech we select this, "To persuade this audience to participate actively in the safety movement." That's the action which we desire to get. It will be in mind constantly as we plan the remainder of this talk. We will put nothing in the speech that will not contribute to that end. If we had failed to determine it, we might talk about the history of the safety movement, the methods used in it, and a hundred and one other interesting but irrelevant points. Now everything that goes into the speech can be tested by this question: "Does this aid in accomplishing our purpose of getting active participation in the safety movement." The formula is: *the specific purpose must state the exact aim of the speech, in harmony with the general purpose.* It must be capable of being achieved in the time allotted, in view of audience, occasion, and all other circumstances.

Next is the choice of main ideas. Let me state the formula first:

1. The main ideas must support the specific purpose.
2. They must be adapted to the speech-type.
3. They must be a few in number.
4. They must be logical.
5. They must be interesting.

If the ideas do not support the specific purpose they are useless. Our speaker rejects the idea, "The safety movement has had an impressive history," because it does not clearly prove that the audience should participate actively in it. Adapted to the speech type—because if we are persuading, we must give reasons for action, whereas if we are explaining we must define or clarify. So our speaker leaves explanation, if any, to the introduction of his speech. Few in number—because they must be vividly recalled by the hearer, and no one will remember more than two or three main points. Logical, because they must appeal to reason. Interesting—because without interest attention will be lost.

The choice of main ideas is the central and most important task in speech composition. Our speaker realizes this, and after due consideration he chooses these ideas to support his specific purpose:

1. Accidents take an appalling toll of life.
2. Accidents can be prevented.
3. Safety means greater efficiency and happiness.

And we draw these ideas in on the chart, to show their relation to specific purpose. These ideas meet the requirements: they help to achieve the purpose, they are persuasive, they are few in number, logical, and interesting. When properly developed, they should lead to the desired action.

Let's stop just a moment and look at the framework thus far. All that is essential in a speech is shown right here. Aristotle said two thousand years ago, "the essential parts of a speech are statement and proof." We can build our talk around this framework. Nothing complicated, nothing difficult.

Preliminary survey and general framework out of the way, the next step is the development of the main ideas so that they shall be effective. The speaker has five methods—and he should use them all, because variety not only adds to interest of itself, but different hearers react differently to material, and we want to reach them all.

The five methods of development are: reiteration, illustration, examples, testimony, statistics. Reiteration is, of course, the restatement of the main idea in the same, or in synonymous words. It adds force and color, especially when effective synonyms are used. Illustration, sometimes called analogy, is comparison of the subject at hand with a subject of different kind: a speech is like a bridge; a house divided against itself shall not stand; accidents consume life like Moloch. Examples are cases in point: John Smith was crushed to death in last night's accident; the railway wreck in Franch killed hundreds; Will Rogers died in the Alaska crash. Testimony is the words of others: you bring, as it were, another speaker with you on the platform, and he says, "This speaker is right. I agree with him. His views are mine. There are two of us." Statistics, when properly presented, add the force of numbers and authority to your arguments, but they must be related to other forms of support and not be a mere catalog of figures.

Our safety speaker goes about it methodically to support and develop his main ideas. He considers the possibility of using all of the given types of details. His first main idea is developed as follows: Illustration—the yearly toll from accidents is greater than that of the World War. Examples—he quotes a specific accident. Testimony—he quotes a former President of the United States on the slaughter. Statistics—he gives the total of 95,000 deaths and ten million serious accidents. Reiteration—he ends by restating his main idea—"The slaughter is terrific and inhuman." And there, in sketch form, is a complete, well-developed, effective main point. In proving that accidents can be prevented, he mingles statistics and examples, and refers to what the U. S. Steel company, the Clark Thread company and the Union Pacific railroad have accomplished, and quotes from one of the officials of such a company to reenforce his point. We can draw in on the chart these details, to show how they relate to the main ideas. And now we have the body of the speech prepared.

The fourth step is to plan an effective introduction. Too many people make it the first step, because it comes first in the act of presentation, but to do so is an error. Until the main ideas have been planned and developed, it is not possible to plan an effective introduction and be sure that it will work. Now the functions of an introduction are two: arousing interest quickly, and leading up to the main points. To arouse interest, choose something striking, unusual, novel, or vitally important. Our safety speaker chooses a vivid example as a means of arousing interest and directing to his specific purpose, and he begins as follows:

> "Last week several tons of steel girders that were being hoisted to the twenty-fourth story of a building under construction came crashing down and hurled four men working on scaffolds to their death."

He might have used an illustration: he might have quoted striking statistics; he might have begun in any of several ways. The point is that whatever the method, we must start with something of arresting interest, and start quickly. The long, rambling introduction is a thing of the past.

In the introduction, if desirable, one other thing may be done: the subject may be stated, or the main points to be presented may be given. Often such a statement is desirable; often it may be omitted. The introduction must, like every other part of the speech, support and contribute to the achievement of the specific purpose. In a twenty-minute speech, two minutes is long enough for it.

The conclusion likewise has two functions. They are to help achieve the specific purpose by summary and appeal. Summary may be formal, listing the points which have been made, or informal, giving perhaps an example or bit of testimony that effectively reiterates the main ideas. Sometimes it is omitted, where clearness does not demand its use. The appeal is a definite request for action, and should make use of the vital interests of the audience. Our safety speaker concludes with a straightforward appeal to sponsor safety work in schools, to drive more carefully, and to cooperate with the National Safety Council. Finally, he asks that we discipline ourselves and wipe out a national disgrace. The love of childhood and the love of country are mingled as appeals in this conclusion.

Now that we have concluded this survey of the planning of a typical safety speech, I will tell you what some have doubtless realized: we have followed the planning of the speech, "Death Through Accidents," delivered in 1928 by Albert W. Whitney, vice-president for education of your own organization. The text of this speech is available in "Business Speeches by Business Men," published by McGraw-Hill Book company, and elsewhere. It is a splendid example of vivid, forceful, persuasive speech composition.

Let me point out the advantages of the method of organizing and planning a speech which has just been explained:

1. It is simple and direct.
2. It provides a definite order of procedure from start to finish.
3. It puts stress on the specific purpose and main ideas, where such stress belongs.
4. It furnishes an easy method of memorizing or learning the speech. All that must be remembered, essentially, is the set of main ideas. Everything else can be associated with them.
5. It applies to speeches of all types and of any length.
6. It is a method that permits flexibility. The speaker can expand, condense, or leave out pre-planned material as the situation may warrant.
7. It is a method which may be applied to the personal interview and the group conference, as well as to the public speech.

I do not claim that this method, and the steps explained, is all of speech composition. Style, for instance—the choice of vivid, striking language, their formation into sentences, the use of figures of speech—is not included at all, and could not be in one lecture. But this method gets at the essentials, systematizes them, and condenses the theory of speech structure. Follow it, and you can construct an effective "bridge of thought" to lead an audience where you wish to lead it.

Effective speech composition, particularly in respect to varied types of public addresses, can profitably be studied by the critical reading of models. For examples of good, current speeches, most of them on business subjects, I should like to refer you to *Modern Speeches*, published by Crofts; *Contemporary Speeches*, published by Century; and *Business Speeches by Business Men*, published by McGraw-Hill.

In the time remaining, I want to mention three types of business speeches which should be especially important in safety work. The first is the direct persuasive speech, such as the one we have just outlined, where an immediate belief or action is desired. It should be characterized throughout by strong appeals to the wants and desires of the hearers. Self-preservation, property, power, reputation, sentiments, affections, and tastes should be stressed, and the audience should be shown throughout that these wants and desires will be satisfied if greater safety is attained. These seven motives for action should dominate such a speech, from the choice of main ideas to the selection of details, and a strong appeal should be reserved for the conclusion.

Another type of importance is the good-will speech. Here the persuasion is attained by indirect means. The body of the speech should consist of interesting and useful information about the safety movement and its methods, but it should be informative rather than persuasive in tone. The object is not immediate action, but good-will,—as Cicero put it, "to render the hearers well-disposed toward speaker and subject." There are many occasions where such speeches are acceptable and appropriate, and a direct appeal for action is not. An account of recent developments in the safety movement—new fields it has entered, what is being done in them, what results are being achieved—would constitute such a speech. In *Business Speeches by Business Men* a dozen such addresses are given in full. I commend to your reading sometime the speech, *Color in Industry*, by Margaret Hayden Rorke of the Textile Color Card association. She traced, first the history of colors and their symbolical meanings. Then she dwelt upon the expanding use of color in manufacturing and home decoration. Finally, she humorously discussed the color-blindness of the average male, ending on that note. The speech was packed full of useful information, but it had, in addition, novelty and concreteness. It was well-designed to create good-will for her organization, and yet no direct appeal for belief or action was made at any time.

Finally, out of many types that are useful, the safety man should, I believe, understand the special techniques of the inspirational speech. This is a well-defined variant of the ordinary speech of persuasion, cut to fit a well-defined situation which too often arises among men and women working hard to achieve some difficult end. That situation is the one of discouragement, of fading hope and enthusiasm. The inspirational speech is designed to restore enthusiasm, remove discouragement, and get people to work again with faith and confidence. Essentially, it may be given to one man, to a small group, or to a large audience. The problem is the same and the procedure is the same in any case. Four things must be done, and the main ideas of such a speech should be chosen to accomplish those four things: (1) Confidence must be restored. (2) The wants and desires of the hearers must be stimulated, and related to the desired action. (3) Definite things-to-do-immediately must be suggested. (4) The subject must be elevated to the highest moral plane of unselfish service.

Follow that formula. Suppose you are talking to co-workers in the field of safety. You can restore enthusiasm and faith, first by pointing out to them their record of accomplishment in the past, by recalling noted victories in the long fight, by helping them re-live their former successes. You can restore confidence by showing the chances for future success, by stressing their ability and interest, and by showing that others no more able or fortunate are achieving great things today. Appeal to them to summon their latent powers. Point out that most of us use only ten per cent of our energies and abilities. In these and other ways confidence can be built up. Then stress their active interests which are affected by their work—their chance for promotion, distinction, eminence, and what rewards financially and socially will come through the doing of excellent work. In other words, show that renewed effort will be worth while. Tie to that some definite things that can be done immediately, so that they will have an immediate goal toward which to work. Finally, exalt the subject: put it on the highest moral plane. Show them that in serving themselves and the safety movement they are also serving their country, and humanity, and the highest of principles; surely, in this great work of yours, that is the case. The drive and enthusiasm with which you speak, plus the ideas that you lay before them in following this formula, will get the desired result. Renewed confidence and enthusiasm will follow. I commend for your reading the ten inspirational speeches in *Business Speeches by Business Men*, every one of which covers the four points of the formula I have given you. No more important type of speech exists for the man who wishes to lead others in any worthy business, enterprise, or movement.

To sum up: Speaking is important to you. Its principles can be studied and practiced in conversation. Systematic planning is the basis of effectiveness. Survey your problem, in the light of all surrounding circumstances. Choose a specific purpose and main ideas. Build those main ideas to effectiveness by the use of reiteration, statistics, striking introduction; a short, appealing conclusion. Apply that method of preparation, and you will at once save in time and grow in effectiveness. A speech well-prepared is on the way to being a successful speech. You can use this method of composition, confident that it has been tested and found not wanting.

II. How to Say It

Cicero, the greatest of all Roman orators, had this to say of the importance of the manner of speaking: "All these things, I say, succeed according as they are delivered." In other words, no matter how effectively the speech is planned, no matter what richness of ideas, details, style, is employed, the final test of the speaker is and always must be how he delivers what he has to say to his audience.

Demosthenes, when asked what was most important *to the success of the orator*, is said to have exclaimed, "First, action. Second, action. Third, action!" And the term action as used here is synonymous with effective oral presentation.

But we do not need the testimony of great orators to realize the importance of being able to appear before an audience and to deliver what we have to say in a telling manner. It is the most difficult to acquire of all of the arts which combine to make the successful speaker.

I might add that through the ages more nonsense has been written about how to speak than about almost any other subject of like importance. Few of us have not been the victims of false teaching concerning it. Open any of the books of elocution which were on the living room tables of our fathers, and you will find something like this: "assume a posture with the right foot slightly advanced, at an angle of 45 degrees to the left foot; hold the chest high and breathe deeply. If you wish to register indignation, bring your right arm sharply down from the shoulder with the fist clenched, and corrugate the eyebrows into a frown of dignified anger." Well, perhaps that is an exaggeration, but there were books which told you exactly what to do with feet, body, face, hands and arms in order to convey any particular emotion to the audience. You were told exactly what kind of tone to employ, what kind of quaver to put into the voice, and just what inflection to use—as if speaking were a kind of parlor performance, and as if artificial expression would solve the practical problem of influencing an audience! I have been exposed to teachers who sincerely believed that all that goes into the making of an orator is the ability to follow set rules of voice and gesture, and indeed there are hundreds of teachers today whose teaching is not less ridiculous than that. They would make of the speaker a kind of marionette, whose actions are controlled by invisible strings based on mechanical rules, and whose every tone and inflection is but an echo of what some one else has deemed appropriate.

Well, you can't teach effective delivery that way, and no one can learn to speak with force and smoothness who tries to learn expression as a matter of externals. Good speaking comes from within. It is a matter of the activity of the whole man. It depends upon the possession of certain fundamental qualities which can be defined, developed, and practiced—but it can never depend upon the posture, voice, or oral expression taught by someone else.

Let's discard the books. Let's forget about the matters of grace in posture, gesture, and facial expression. Let's try to get down to bedrock and study by the observation of speakers what it is that makes their delivery effective or ineffective.

You have seen a business man, called upon to fill in the program of a luncheon club. You have seen him rise hesitantly and self-consciously at the introduction by the chairman, haul out a manuscript from his pocket, and stand there, eyes fastened on his paper, embarrassed and ineffective as he wades through what he has written to say. You have "listened" with polite attention, but actually your mind was far

away. The speaker was not talking to you: he was in reality talking to himself. Not once did he look at you. Not once did he drive home an idea with the full force of his personality. No matter whether he is an effective talker in conversation, there was something about the speech situation which caused him to withdraw into himself. His voice was flat, expressionless. His face showed little if any expression, until at the end, when, perhaps, the emotion of relief spread over it like the sun after a rain. He sat down. You applauded. You didn't mean it. What was the matter with that speaker? Fundamentally, he failed to realize that effective communication is the great demand of good speaking. He had no notion of communicating anything from him to you. What he was thinking about was "reading a paper" or "giving a speech." He did that. He "got it out of his system." The notion that there were people there ready to be influenced by him, ready to give sincere, interested attention if he but presented his subject in a communicative manner, had not occurred to him. For him, the thing was an ordeal, to be passed through with as little damage as possible. He lacked the basic knowledge that the speaker must possess, first and always, a highly-developed sense of communication.

Then, too, you have, upon occasion, gone to church. You have "listened" to a sermon. And if the minister was not a good one, that is about all you have done. I am not condemning the speaking of ministers as a class, but I am referring to a type of speaking altogether too common. Singsong voice, a certain set expression of sanctimony, eyes looking above and beyond the congregation—and again, a failure to communicate facts and ideas to the individual who is in the audience! So long as any speaker has in mind that he is giving a performance, that he is there for any other purpose than to take things that are in his mind, and through the exercise of every physical and vocal ability that he has to communicate those things to the individuals before him, you have speaking that fails to hit the mark.

Three times I had the pleasure of listening to Col. Raymond Robins, progressive politician, supporter of Theodore Roosevelt, and head of the Red Cross in Russia during the war. The audience in the smallest meeting was over one thousand; in the largest four thousand. Yet every man, woman and child in those audiences got the impression that Col. Robins was talking to *him*. There was something about his attitude, manner, voice, and gestures that said, "I *have something to say to you*. This is an idea I want *you* to consider. I am appealing to *you* to vote and believe as I do." He looked at individuals. He leaned toward the audience. He put energy and *enthusiasm* into his talking. He was conscious of the reactions of his audience to what he said, and he established and kept open the lines of communication. More than any other test, the good speaker can be judged by whether or not he has this attitude, this spirit of communication—and it is the greatest single attribute that can go to the making of an effective manner of speaking.

Therefore, if you would make your delivery effective, discard everything else for a time, and work on the development of a sense of communication!

How can it be done, and what are some of the habits which must be established?

Go back to the preparation of the speech. When you have chosen the specific purpose, have you done it in terms of the audience that you are going to face? Have you chosen main ideas that will appeal to your particular hearers? Have you been thinking all the way through, "What will my hearers think of this?" Then, in a way, you have made a beginning. Now in the course of getting ready for delivery, how have you learned your speech? Have you tried merely to fix certain ideas in your mind? Good as far as it goes, but you should do more. You should practice your speech *as if you were in the actual presence of an audience*. Take your notes or your outline, stand up, and speak to the chairs in your office as if they were individual hearers. Look at these hearers. Speak directly to them. Express your ideas in language that they would understand. Set up, so far as humanly possible, the conditions of actual speechmaking. Get someone, your wife, to listen to you. Speak all the time to that one person. Don't let your attention waver from the audience.

The whole problem is of getting the right mental attitude. What do you think of an audience? Do you think of it in terms of a mass of people, individually undistinguished from each other, before whom you are to come much as an actor comes before the footlights to give a performance? Then you have the wrong conception of the public speaking situation. The actor is separated from his audience. He is in a picture-frame, living his part as a unit in a larger picture which is being displayed to the audience. The speaker, however, is in no picture-frame. He is there to make vital contact with his hearers, to talk to them, to set trains of thought in motion between him and them. He must consider his hearers, in the truest sense, not as "an audience" at all, but as individuals to whom he is to talk, man to man. For him the barrier of the footlights does not exist. His whole purpose is to communicate his ideas and emotions to the audience, and to get the audience to believe as he believes, to have the same emotions that he experiences.

Once the speaker understands that his function is communication, and that he must talk to individuals, rather than to "the audience," he is on the way to success in delivery. He has the right point of view.

What can you, as an individual, do to heighten communicativeness in delivery? One simple exercise is to practice speaking to one person, being sure that you talk directly to him at all times, then to increase the audience, to two, to four, to twenty, and to try to hold the attention of all of them. In speaking before a very large group, select individuals in different parts of the hall, and practice talking directly to them. The effect will be that you seem to be talking to everyone in the region of the particular individual. *Look* at individuals. The speaker who constantly looks over the heads of his hearers, or down at the floor, or out of the window, or who merely stares into space in a reverent manner, is clearly out of touch with his audience. Practice looking squarely at people, and you will find that your sense of communication is improving.

You can lean toward, rather than away from, the audience. By so *doing you bring hearers closer to you*, not only in terms of physical distance, but psychologically. Try this (leaning backward on heels) and this (leaning forward on balls of feet) and observe how much closer the latter position brings you.

You can permit yourself to have natural facial expression. The "poker face" has been exalted in the movies, and in American life, entirely too much. If you feel that you are the possessor of a "poker face," either confine yourself to poker or try to loosen up and develop natural facial expression. It aids communication.

You can gesture toward your audience. I know that you will say, in some cases, "I never use my hands in talking." But action is a part of normal expression, and if you use it in a way that will aid contact with your hearers, it will be an asset to you.

You can observe what your hearers are doing. If that man is the fifteenth row is looking down at his morning newspaper, or fiddling with his watchchain, you have not established communication with him. Pick him out and talk *to* him directly for a while.

You can avoid doing things which break up the lines of communication. Habits of fumbling with notes, fidgetting about on the platform, nervous, jerky, purposeless walking around—all these attract attention to themselves and away from what you are saying. Poise and control are physical aids to communication. Use them.

Thus there are numerous physical signs which mark the communicative speaker. Back of them, however, and basically important, is the development of a sense of communication—the realization that the speaker's sole purpose is to reach every one of his hearers, individually as in conversation, with his message. If I have brought out no other point in these two days, and if this one has been made effectively, some benefit, at least, should be derived.

From what I have brought out thus far, it is apparent that you can set no formal, mechanical rules. Delivery is a matter of mental attitude, translated into physical terms. There is a second point, almost as important. That is this: no speech can succeed unless the speaker is willing to expend considerable physical and nervous energy in its presentation. Animation is the second fundamental of effective delivery.

I hasten to add that I do not mean by animation loud tones of voice, sweeping gestures, or any of the things associated with rip-roaring oratory. The energy of which I speak may be revealed in quiet intensity, rather than in loudness. There is a power in suppressed excitement, in calm tones, in variety of emphasis. To be loud, merely, is to emphasize everything and therefore to emphasize nothing. But what will surely defeat the speaker's purpose is a lackadaisical, inert, lifeless manner. Dead men tell no tales—dead speakers communicate no ideas.

Without laboring this point, tests and examinations have shown that a vast majority of speakers need to develop more physical activity in speaking. We have

tested over a period of several years at the University of Illinois our beginning students: nine out of ten were either lacking in energy when speaking or nervously attempting to suppress excitement. Without a general, all-over bodily activity it is impossible fully to communicate ideas and emotions to the audience. In the case of the speaker who is *too* relaxed, as well as in the case of the highstrung, nervous individual who tries to freeze himself into immobility, the first prescription is to get physically free. At the beginning, almost any activity is better than none. Don't be afraid that you will overdo activity, especially in the practicing of speeches. If you have difficulty, force yourself into it. Swing your arms, walk about, pound home points with what seem to you to be exaggerated gestures—but get free. The good speaker is able to give full physical response to the ideas and emotions that are his. *Restraint destroys expressiveness and takes the life out of your speaking.*

It is important that for speaking you "key yourself up" physically. Just as many actors go through vigorous physical exercise in order that they may be physically in *tune with their part, so the speaker should "warm up"* to be at the right activity level. If your speaking at the beginning lacks animation, and the speech is not holding attention for that reason, go into action. Psychologically, for both speaker and audience, any activity that tends to promote vigorous speech is good; and the lack of activity is bad.

Like begets like. A speaker who is both indirect and inanimated tends to produce a like reaction in the audience. Just to the extent that you are communicative and alive, your audience will respond with alert interest. That is true without consideration of what you say; it is truer, of course, if what you say is well-organized, interestingly developed, and well-phrased.

Possession of a strong sense of communication and of an animated manner, then, are prerequisites for effectiveness on the platform. Without attempting to preach a sermon, I want to add another fundamental, and in so doing I want to quote no less a speaker than Daniel Webster: "True eloquence must exist in the man, in the subject, and in the occasion. Affected passion, intense expression, the pomp of declamation, all may aspire for it, but cannot reach it." Basic indeed is the sincerity with which the speaker confronts his audience. Fundamental to his success is what has been termed his emotional identification with his subject. Twenty years ago, as a newspaper reporter, I witnessed a demonstration of the importance of a deep sincerity and conviction on the part of a speaker. A meeting had been called for the establishment of a civic registration of welfare cases. It was proposed to set up a list of families receiving help from charitable organizations, and to have the list open to public inspection so that relief should not be duplicated. On greased skids the preplanned meeting moved toward the adoption of this plan. Everything seemed favorable, when a tall, black-clad minister arose and said, "I am in favor of any device that will help the poor: but never, for the sake of cold efficiency, will I make public the names of those I aid." He sat down. Such had been his emotional intensity, such his conviction, that the plan was immediately modified.

The speaker must steep himself in his subject. He must not only know it—he must realize its significance. Actively at the time of speaking, he must be attuned to his topic, alive with its emotional implications, and fully convinced himself of its supreme importance. When it was said, "What you are speaks so loud I cannot hear what you say," it was with reference to just this point.

Can we do anything about it? I believe we can. If we are cold, unresponsive, lacking in reaction ourselves, we can at least make the effort. The safety movement is not merely one of techniques and procedures: it has the utmost significance in terms of healthy, happy bodies; it is protection against disfigurement, wounds, and tragic death. In furthering it, you are protecting people who otherwise might suffer agony untold and privations indescribable. Surely a contemplation of this—a visualization of what the safety movement means in terms of human welfare—should be able to stir even the most unimaginative speaker to active emotional response. It is that kind of contemplation and visualization that is sometimes necessary before a speaker can attain his highest effectiveness. Psychologically, too, we know that there is the closest identification between bodily reactions and emotional states. The actor knows it and brings himself to the proper emotional pitch by simulation of its physical reactions. We can do the same—adopt, as it were, the attitudes, the facial expressions, the vocal reactions of the desired emotional attitude—and behold, it is with us.

Unimportant, or stretching a point, you think? Well, the speakers who have been truly successful, who have swayed people with their oratory, are just the ones who have achieved this essential of delivery; and who are so wrapped up in enthusiasm and sincerity for their subject that nothing, not even physical difficulties, has stood between them and the accomplishment of their aim. Demosthenes, the greatest orator in history, was the possessor of a voice inferior to that of the average speaker. It was burning zeal for his cause, more than anything else, that gave him the supreme ability. William Pitt, rising from a bed of pain to make the greatest speech of his life; the greatest *missionary* of the Christian church, St. Chrysostom, unable to stand while preaching—these are just a few examples of what that dedication to cause and purpose can do to make the speaker triumph over obstacles. That's the kind of *attitude* that any great cause demands, and it's the attitude that makes great speakers.

A sense of communication—that realization that one must reach every individual in the audience with his message; adequate animation—so that force and drive shall aid *in bringing the message home*; and a basic sincerity and enthusiasm that will not admit defeat—these are the fundamentals of successful speaking.

I could tell you a lot about posture and gesture; there are rules about deep *breathing*, relaxed and open throat, clearcut enunciation, proper pronunciation, and all of that which indeed are beneficial. But fundamentally, none of these alone, nor all of them together, will make an effective speaker.

Moreover, let me point this out: a person who has mastered the three fundamentals of which I have spoken will automatically have mastered many of the physical details. He will have an advantage over the man trained in mere technique, in that all of his effort will be directed toward the attainment of a goal—the winning of the audience, and there will be no distractions because of mechanical rules. He will have self-confidence, because he will get results from the outset, and he will be completely and fully himself.

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Selling Safety in Foremanship

By H. S. BIGELOW

Vice President, Sales Analysis Institute, New York

I. Setting the Safety Pattern

Several months ago we were approached by friends and clients and asked to prepare a report address on the subject of "Safety in Foremanship." The matter was presented to us in this manner: "The Sales Analysis Institute is serving a number of large organizations—analyzing their products and selling problems—and aiding them in various ways to serve the customer better. Since your charts and systems aid in the more efficient selling of products and services, it stands to reason that you can present some interesting and profitable food for thought on the subject of selling safety. For safety, like life insurance, accident insurance or any manufactured product, must be sold. Therefore, you can undoubtedly contribute something of value to our great cause of saving human lives and reducing accidents and suffering."

Naturally we accepted such an opportunity to try to aid in a great cause; for only a slacker could refuse to respond to such a challenge. And the opportunity was the more welcome because safety isn't a side line any more and the work dovetails so perfectly with what we have already done in the development of a course of work in human relations, which deals with the relationships between executives and employes, between foremen and workmen, and between the workmen themselves.

Many times in delivering talks on selling products or services or in talking about selling as applied to human relationship problems, certain of my listeners say, "all this is too general. I wish he would go more into detail."

Well, if you say that as I go along, I will agree with you, but at the same time we must remember that this exposition is but a part of a complete program reaching over many weeks.

To make clearer the outline and demonstration which are to follow, let me give you a very brief picture of our methods. Then you will more easily understand their application to the general safety program.

In our service to selling organizations, we use an analytical chart. We use it in this way: We accompany skilled salesmen as they call on customers and prospective customers. We listen to what they say, note what they do, and thereafter, with the chart as a guide, we take their talks apart and find out the reasons for their successes. We are then able to aid all the salesmen in an organization by passing these same methods on to them.

So that you may have a broad idea of the scope of the chart, let me say that six titles are printed across the top of it which show the "motion" which a successful sale undergoes. It is started when the salesman *approaches* the prospect and *introduces* himself; it is advanced when the salesman gains the *attention* of his listener; it is advanced still further when the listener becomes *interested* in what is offered for sale; and a most important advance takes place when the listener comes to *want* or desire the services or product offered. Thereafter the salesman can suggest that the purchase be made, and in this way *drive* his sale to a *close* when the listener agrees to buy.

In listening to a salesman as he talks to his prospect, we take care to note when these advances take place—the motion the sale undergoes—and at the same time we most carefully note the selling points used by the salesman. For it is the information the salesman gives the prospect—the sale movers he uses—which causes the advancing motion in selling.

All the selling points a salesman may use, or can use, are easily classified. We note how the salesman uses these various kinds of selling points, and thereafter we know what he did to bring success, or what he did or said to cause failure.

Anyone can analyze any spoken or written sales talk. He can also recognize the obstacles encountered, and determine which ones retarded the sale, or even defeated the salesman.

So much for the purely sales analysis part of our work. I have explained it in detail so that you might the more easily see how the same fundamental ideas developed naturally in our human relations work, which relates definitely to foremanship and its responsibilities.

For, as has already been pointed out, both in your own publications and from this platform, the promotion of safety is essentially a selling problem.

First of all, our human relations work led us to do the same things with foremen that we had done with salesmen: that is, study the ways and means certain foremen are using to persuade the workmen under them to do certain things. Since your interests deal primarily with safety, we will develop here that part of this research which had to do with persuading men to carry out safe practices.

A number of safety engineers had told us that much of the man-guidance which, according to its efficiency, determines safety ratios, falls upon the foreman. Therefore, foremen, according to their ability to educate and influence workmen in safe practices, were responsible for the saving of lives, prevention of accidents and the saving of money which accidents waste.

As the first step in our analysis, we sought an answer to these questions. "How do the most *successful* foremen go about getting safety methods?" "What do they do and say to *sell safety* to the men under them?"

Let us define the phrase "sell safety," as "That process of workman education and persuasion which makes a man *want* to follow safe practices." Selling safety is like selling life insurance or anything else. As we have said, it is the application of *educational* and *persuasive* methods which causes people to *want* and use what is offered! A thousand average people could be commanded to buy life insurance, but the very fact that they were commanded to do so would set up a resentment, a great resistance to life insurance. Yet thousands of average people are sold life insurance every day because they are *educated* to *want* it and *then* persuaded to buy it.

Of course, there are those who buy through pressure-persuasion, but they never fully appreciate or utilize their new possession because the salesman did not properly *educate* them to *want* or desire to use the plan.

Most people who buy life insurance, however, are educated as to its very real benefits and this, we found, is true of safety. The foreman who commands his men to follow safe practices will get a certain result through his authority alone, but will he cause workmen to want to wear goggles, to want to wear protective masks, to want to do the thousand and one things required in industry to keep accidents to a minimum?

From our investigation we found strong evidence that the best results were obtained, not by commands, but through education and persuasion—by selling safety and causing workmen to want to follow safe practices.

Take the case of a workman in a plant which we shall refer to as Plant Ten. This man was under a foreman who attempted to insure safe practices in this manner: He found this workman, whom we shall call "Steve," wearing his goggles over his cap instead of over his eyes. The foreman said to Steve:

"Put your goggles down where they belong and keep them there! The next time I catch you without them it's going to be too bad for you!"

Steven flushed, muttered something, and put his goggles on as ordered. But he didn't *want* to do so.

Later, we talked to Steve—got close to him. He told us that goggles were a nuisance. They bothered him. And anyway, he was careful. He hadn't been hurt in ten years of such work as he was doing.

All in all, Steve hadn't been sold on the very real benefits to himself of wearing safety goggles. He had been commanded to wear goggles. He had been bawled out and told that he would wind up in the hospital blinded and have to beg on the street corner. But he was a man of courage, a hopeful, reckless fellow, a good workman; and *he couldn't imagine himself blind.*

[At this point, Mr. Bigelow asked anyone in the audience who had sustained a painful injury within the last three years but who had completely recovered from that injury, to raise his hand. He then indicated that he would give his audience four seconds in which to endeavor to think that hurt back again. He said he wanted everyone to think very hard and to endeavor to their utmost to make the injury hurt again as it did when the injury happened. At the end of the four seconds, Mr. Bigelow remarked upon the fact that nobody had yelled or cried out, therefore, he assumed that it had been impossible for anybody to recall, physically, the pain of the injury. Consequently, he made the point that if people who had already been injured could not imagine the pain of their injury, how could we expect an individual who had never been injured on his job and had never suffered the pain of such an injury, to be greatly impressed with a simple statement from a foreman that "you will be in pain if you don't do as I say."]

Steve enjoyed good health; he had had good luck; he was the type who would make a brave soldier; and he didn't fully appreciate his good fortune. He didn't really see the idea of fully protecting his good health and good fortune. He resented commands and threats of ill fortune. He just didn't *want* to follow required safe practices, because he hadn't been educated and sold on the benefits of them! Taking Steve as a subject for an experiment, we started to sell him safety. We experimented to see how he would accept education and persuasion of a selling nature. Here is what we said:

"Steve, you've got a pretty good job, haven't you?" He agreed that he had.

"It pays about twelve hundred dollars a year, doesn't it?" Steve figured up and agreed that he got about $1200 a year.

"Well, Steve," we said, "That's around $12,000 in ten years time or $24,000 in the twenty years you'll probably be working. So you and your wife and kids have a pretty big lot of money at stake. If you keep your health and avoid accidents, you'll get all that money—and maybe more when you get promoted—to feed, educate and clothe the family. You like to see the kids fed well and dressed well and you want them to go to school and have an easier job than you have, when they grow up. The company really ought to see that you get every kind of protection possible, shouldn't it?"

Steve agreed to that. He even said that his company *owed it to him to provide* all the safety possible. So then we kept on educating him—that is, selling him

safety—in this way: "Here's the way a workman has to look at it Steve: You want to keep yourself in shape to make that $24,000 or more in the next twenty years. You want to avoid accidents—pain and hospitals—and you want all the good times you can get for your family and yourself. There's only one way to do that and that's by being careful. Why, a fellow's only got to make one mistake—get indifferent for only a second when luck is against him—and an accident happens that perhaps makes him lose $1200 or more of his earnings and some of his savings.

"You're a good thinker, Steve! You can dope things out since every time you wear goggles and use care on your job, you're protecting yourself and your family and $24,000 or more in cash, even though you don't like them it's worth while to wear them, isn't it?"

To make a long story short, Steve now *wants* to wear his goggles. And, moreover he urges others who work beside him to do the same thing. Why? Because he has come to see that he benefits through doing so. For him the wearing of goggles is no longer "something that the foreman yells about." It is no longer just an annoying rule the company has made. Steve now understands that *he* and his family are the actual beneficiaries of safe practices—so he *wants* to follow them!

So because Steve desires the benefits he has been *educated and persuaded* to see, he wants to follow them; he does follow them and uses his influence to get others to do the same thing.

Many actual experiences such as this proved to us that safety, like life insurance and other forms of protection, has to be sold and *can be sold!*

In an enormous plant in Indiana we learned that a crew of men engaged in dangerous work had completed an unusual number of working hours without an accident. Talking with these men and using the chart to analyze what they said, we found them proud of their record and we found that they had been *educated and persuaded* to use care continually. Not only did these man *want* to practice safe methods, *they did so.* They did so because their company officials and they themselves were proud of the record and life was more secure because of it!

So, in considering the subject of safety in foremanship, we see the problem as one calling for the training of foremen to sell safety to each and every man under them; to be fitted to sell safety so successfully that they will cause every workman to think about the benefits of safety; to realize the benefits to themselves; and to want to practice safe rules so that they, personally, will reap the full reward.

In spite of all the "wise cracks" about the gall of a few brass-nerved life insurance salesmen, there is today an army of serious minded men and women engaged in educating people to the need of life insurance and then persuading them to want to buy it and enjoy its benefits. So let's imagine the great advance that could be made in safe practices if a like army of safety engineers were engaged in selling the indifferent workman, the careless motorist, the thoughtless pedestrian the benefits of safety!

There can be such an army. In fact there is a considerable army now engaged in such selling work, and the need is for an increase in the number of foremen and others who know how best to sell safety with tact, skill and success! The more such salesmen there are, the greater will be the saving to humanity and to industry!

And so, in cutting the *working pattern*, that pattern by which foremen may be guided in obtaining greater safety results, we suggest a pattern fashioned about the science and art of selling human relations.

How can we cut a pattern from what we have seen which can be used by the foreman in his talks with his workmen, a pattern which will enable the foreman to compose and deliver effective safety talks, to educate and persuade, to sell safety? Chart No. 1 gives a pattern framed on those we are using in our human relations work. On the basis of it we start to cut the pattern for the better selling of safety.

This guide-chart is simple. It shows the *motion* a successful talk must have. With this it is easy to trace the motion a successful safety talk must undergo, the path of its progress. *But how is a foreman to compose and deliver such a talk? What is he to say and how is he to say it so that the workman's attention will be gained, his interest aroused, his desire to do developed, and the action obtained?*

Still another pattern for composing such a talk is needed, and with our experience in sales analysis as a background, we began an investigation to see if pattern-

building principles of a nature similar to our successful selling method could be applied in human relations work. Again restricting the discussion to the safety idea, the accompanying simple, easily-followed but effective pattern was developed. (See Chart 2):

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The
SAFETY TALK
GUIDE

A—ATTENTION
B—INTEREST
C—DESIRE
D—ACTION

1 BENEFITS OF SAFETY
2 CARE
3 CARELESSNESS
4 LOSS

Chart No. 1

You will note that this guide includes the same progress route for the talk that we saw in the other chart, but here the *means* of accomplishing each step of that progress is laid out in its proper place. The total result of a talk so planned and delivered is that the workman is brought to the point where he *wants*, he desires safety, and where he has a personal reason why he should employ safe

practices. He is taught to consider the benefits which care will bring, comparing thoughtful care with thoughtlessness and indifference, and choosing to seek the benefits which care and safety provide and avoid the losses which thoughtlessness and indifference cause.

In tomorrow morning's talk, I will demonstrate the use of this guide, but I believe that even now you can see that, when understood, it will enable any foreman to compose, practice and deliver effective safety talks to his men or to any individual man. So much, then, for today regarding the cutting of the pattern.

Let us think now of the foreman who has been trained to educate and persuade his workmen by talking to them briefly and effectively on safety whenever, during the working day, it seems advisable to do so. Let us also think of the great work that could be done for American industry by an army of 10,000 such salesmen of safety. Let us think of the foreman-army, *not* as bosses who simply *command* workmen to follow out recommended safe practices, but rather as leaders of men who have *the skill to* sell safety to each and every man under them.

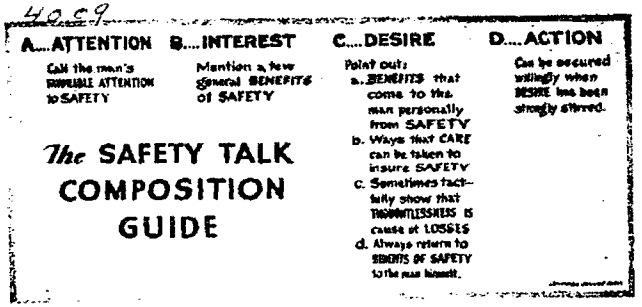

Chart No. 2

What a force for good this army would be! Think of the support they would give to the safety engineer who had previously addressed the workmen in group gatherings! Think of their value in educating and persuading workmen to want to use care so that they personally could enjoy the benefits of safety! Certainly such a foreman selling force would popularize the safety rules and regulations of any firm or industry!

The next question, then, is "How can foremen be trained to become efficient sellers of safety?"

That best can be done by working with them in groups, which means carefully selecting the group of foremen to be trained. It is much to be preferred that those foremen whose departmental activities are most closely related should be grouped together.

For example, in a large metal furniture and office systems organization, the foremen of the metal stamping department, the assembly department and the metal finishing departments—whose work is closely cooperative—could be collected in one group. Into another group would go the foremen of the printing department, the bindery, and others whose duties were related. Each industry will have its own peculiar problems in selecting the groups.

PLANNING THE SUBJECT

The safety engineer will plan his subject according to the particular problem facing him. For example, let us say that in the metal stamping department of our large office furniture and systems concern, the rushing of several large orders has necessitated putting on a number of additional workmen. Also that minor accidents are on the increase. The foremen of the group are called together after the safety engineer has carefully planned the subject of his address.

In his planning, he first considers the conditions he faces, and prepares a clear, concise review of those conditions to be given to the foremen. He will point out the importance of the new orders that have been received—and the work they are providing to the benefit of the workmen. He will then call attention to the firm's desire to protect each workman from accidents, so that he may enjoy his full earning power. And he will use his Guide-Chart to teach the foremen how to talk to the workmen and sell them on using care—using care for their own benefit and safety—and avoiding thoughtlessness, so that losses of money, health and ability may be avoided.

The safety engineer will make use of drama, to impress and teach his foremen. He will, by means of short acts, illustrate how the foreman can talk to his men. He will demonstrate how the workman's attention can be called to safe practices. He will demonstrate how interest can be created and how desire to benefit can be developed. And also how action can be obtained.

CONFERENCE ARRANGEMENT

It has been the experience of educational institutions that the lecture-and-conference arrangement is the most effective form of education. Therefore, each group meeting should be carried on in the conference form. Salesmen learn best when they first listen to a lecture, and, thereafter, are given the opportunity to ask questions, discuss recommended methods fully, and confer with their group as to the carrying out of those methods. Foremen, like salesmen, we have found, also learn best by following the conference arrangement.

TIME AND PLACE.

Conferences held on the company's time and meetings held in a place which duly impresses the foremen with the importance of the subject are essential.

For example, one executive of a nation-wide company informs us that he formerly held his meetings after hours and that he addressed his foremen as they sat around on benches and boxes. Today he conducts his meetings during working hours *in a room with comfortable chairs, a blackboard, platform and speaker's table.* Results have been greatly improved, he says.

Tomorrow morning I will ask you to imagine yourselves foremen attending a safety conference in a large plant. I will then demonstrate how this simple safety talk guide chart can be used to train foremen in the art of composing and delivering effective impromptu talks on safety. The methods exposed will be fundamentally the same as those now being successfully employed by thousands in selling products which vary from petroleum to office systems, from life and casualty insurance to wholesale hardware and real estate. And it will make me happy indeed if I succeed in aiding you in some measure to make your foremen able salesmen of the many benefits which safety brings to the workman and to his family and to industry as a whole.

[NOTE: Mr. Bigelow, in closing, called on George C. Pfahler, Superintendent of Sales Promotions of the Indian Refining Co., Indianapolis, Ind., to offer his thoughts as to whether such a pattern could be applied profitably in delivering short selling talks where time was limited and where the atmosphere was anything but helpful. Mr. Pfahler stated emphatically that it had, that it could, and that it would. He mentioned his experience in the use of such talks in this work with service station attendants, who, despite the fact that motorists are always in a hurry, sold items other than those which they came in for.]

II. Putting the Pattern to Work

Yesterday morning I showed you the SAFETY TALK COMPOSITION GUIDE for planning and delivering short but effective talks on safety, a guide which foremen could be taught to use for the purpose of preparing them to deliver impromptu talks to workmen on the value of conforming to safe practices.

Our theme was that safety, like life and accident insurance, must be sold. We pointed out that the workmen must be educated to want the benefits of safety before they could be persuaded to follow successfully and efficiently safety rules and regulations.

We compared the results of commanding workmen to conform to safety rules, with that of selling the workmen on doing the same thing. Our belief was that a great army of foremen can be trained to sell safety to the workmen as effectively as the great army of life and accident insurance salesmen sell insurance to the American people.

Just as the successful life insurance salesman employs a selling art which requires an analytical chart to take it apart and understand it, the foreman can better sell safety by understanding and employing this simple guide or chart. We say this in all earnestness after 18 years of research into the methods employed by successful salesmen.

The foreman, in giving impromptu talks, can be quickly trained to employ this guide. Let me refer to the chart as the *pattern* by which he makes up the talks.

But I promised you a demonstration of the application of this chart to the training of foremen for safety selling. I am going to ask that *you* all *imagine* you are attending a Foreman's Safety Conference in some large industrial organization. These gentlemen who are on the platform with me are acting the parts of my foremen, and you are observing the manner in which I, as safety engineer, conduct my meeting with them.

We will use the conference arrangement, by which I mean that, as safety engineer of the plant, I will talk to them and they have the right to ask questions and discuss anything said as they may choose to do. In other words, they do not just "sit and take it"; rather they take their part in the conference—their full part.

Proving the Pattern With a Selected Group of Foremen

[Mr. Bigelow addressed the group on the platform.]

SAFETY ENGINEER: Fellows, we have a problem facing this company on which I want to ask your full help. Here are the conditions we face: this plant is busier now than it has been for five years past. We have a lot of new men on and have taken back a number of men who have been on part-time schedules. Our problem is to keep these men—and all workmen—alive to safe practices.

Now I know that you fellows are proud of your department safety records and I know *you want to do everything* possible to keep your records up—to protect your men—and you know that that also is of the greatest interest to the company executives; so we are all agreed on that. The question is, just how can we teach these new men and some of the old men to use due care to protect themselves?

I'll do all I can in the group meetings when I address them from the platform, but you fellows are closer to your own men than anyone else in this company. You know them best. You are their leaders and they look up to you and will take what you say quicker than what anyone else says. So, as you supervise your men, you can help keep your safety record high and help your men protect their lives and earnings by giving them short talks on safety whenever the opportunity presents itself.

FOREMAN NO. 1: Say, Mr. Bigelow, what kinds of talks do you mean? I bawl the tar out of anyone of my men I catch without goggles or rubber gloves. They know I *mean business!*

SAFETY-ENGINEER: Yes, I know, Mr. Conner, but don't you find that some of the workmen are indifferent when they think you aren't around? * * * [Foreman No. 1 nods.] They may take chances and then *they* suffer and also spoil your chance for a record. What you want is that every man will use care. Isn't that so?

FOREMAN NO. 1: Yeah. That's right.

FOREMAN NO. 2: Yes, but a lot of men *will* take chances. We've got to watch them all the time.

SAFETY-ENGINEER: Well, just as I said, you want to keep your records high and you want to protect your men. I've got a simple little plan here, boys, which you can use to make the men *want* to follow every every safety requirement. By it we can make men so want to carry out safety rules that you will be relieved of watching them all the time. Do you want to hear the plan?

VOICES: Yes. What is it?

SAFETY-ENGINEER: *(Exhibits Chart)* Here is a guide which you can use to make up half-minute or one minute talks that will help you to make workmen *want* to conform to safety rules for their own benefit.

Now, before I explain this guide, let's agree on one thing first: that we all have a tendency to resist when someone says we've *got to* do something. For example, people see signs "Do not trespass on this property" and they *want* to just because it is forbidden. Then, at an amateur ball game, we may be standing near the right field foul line when a fellow walks up and says "Stand back there! Who do you think you are, the Governor?" And what do we do? We growl or talk back with wise cracks just because the fellow *commanded* us to move on. That's the way with human nature. Our workmen are human. They want to enjoy every benefit of safety, but when we say "You've got to do this or that" some of them resist and they don't want to do as told, and then we have accidents. So our job is to talk to the men about safety so that they will want to follow each safety rule. Do you agree on that?

FOREMAN NO. 3: Yes. That's common sense. (Rest nod heads in assent)

SAFETY-ENGINEER: Good! Here's how we can do it. We use this guide to make up short talks which you fellows can try out any time the chance to do so comes during working hours. Now suppose, for example, that we happen to be talking to a man about some part of his job. We finish that and then get his *attention* on safety. We say "Fred, you are one of the boys with a good safety record. Keep up the good work!" That places his *attention* on safety. Next we say something to make him more *interested* in safety. Then we say *something* else to make him *want* or *desire* every benefit safety rules can bring him. Then we get the fellow to take that *action* which insures protection to him and keeps our record up high.

FOREMAN NO. 4: Yes, but Mr. Bigelow, just what is all that stuff we have to say?

SAFETY-ENGINEER: Just this: *[Mr. Bigelow here pointed to Chart]* We point out the benefits of safety. We point out that care in observing safety regulations will protect a *man*, will keep *him* healthy and fit, and will enable him to earn a full month's pay every month in the year. If a man makes $100 a month, we point out that he protects $1200 coming to him every year by being careful. In that way we hold the man's attention. We make him interested in safety, because he himself sees benefits! We make him *want* those benefits and therefore desire to observe safety rules. Further, we tactfully point out that thoughtlessness and indifference will cause a *loss* in pay—maybe six or eight hundred dollars a year that he and his family will have to do without. Or we talk about the misery a fellow suffers who gets a chunk of hot iron in his eye, and so on. That will make him compare the benefits of using care with the losses which indifference brings. In that way we more than ever make the men *desire* to follow safety regulations. To make the men *see things* straight—to see that they benefit personally, or lose personally—that's the idea! They will want to do whatever benefits them, but they may not be so eager to help the company cut down the cost of accidents. It's what we gain personally that makes us want to do things. By talking to the men in the right way we can sell them on observing the rules every hour of the day whether we are around or not. Now I know this is all new to you fellows, so I'll show you how it works. Mr. Conner, will you help me?

FOREMAN NO. 1: Yes, I'll do what I can. (Mr. Conner stepped up beside the speaker, and Mr. Bigelow handed him a short, written sales talk on safety.)

SAFETY ENGINEER: Well, let's imagine that I'm talking to you. Let's say you are working with a pipe-laying crew in the oil fields. I'm the *foreman*

of the big gang. You are the *workman* wiping the sweat out of your eyes as I walk up. Here is what happens.

FOREMAN: Pretty hot today, Charlie.

WORKMAN: Yeah, awful hot. The boys are gettin' pretty much all in.

FOREMAN: Well, we only have another hour to go. And now is the time, when the boys are tired, to be more careful than ever to avoid accidents. When a man's tired he may get thoughtless and break a leg or something.

WORKMAN: Yeah. That's right.

FOREMAN: Here's the way to look at it, Charlie. You carry home a full week's pay every week by being careful and avoiding accidents, but you only have to be careless once to break a leg and go through a lot of suffering. Isn't that so?

WORKMAN: Yeah, that's right.

FOREMAN: Watch your step then, Charlie. Take care of yourself!

WORKMAN: I'll sure do that.

SAFETY ENGINEER: (*Mr. Bigelow addressed the group of foremen.*) Fellows—all I did in talking to Charlie was to call his attention to the subject of safety. Then I pointed out the benefits of safety which come through using care. Then I pointed out the losses that thoughtlessness would bring. In that way I made him more interested in safe practices. I made him want the benefits of safety, and want to follow out safe practices. That's easy enough to do. Any one of you can deliver such talks to your men!

Take notice that I didn't tell Charlie that he *had* to do anything. Nor did I say a word about the firm's being eager to reduce accident costs. Everything said was intended to educate Charlie to see how *he personally* benefited, and that means that his own common sense will make him want to use care.

You can all make up and use talks far better than that. These are admittedly simple but do contain in easily discernable form strong fundamental elements of education and persuasion which can be spoken in a short space of time. I've written out six or eight that cover the wearing of goggles and masks, care in inspection of machinery, and other subjects. Here are some copies of them. Read them over and then we'll practice delivering such talks.

[*Here Mr. Bigelow passed out mimeographed talks to his group of foremen actors on the platform, and then spoke to his audience.*]

I am now engaged in teaching my foremen the use of the chart, a chart which will guide them in selling safety.

How to Use Charts

I will ask you to imagine that these foremen have read over the several simple talks that I just gave them. Also I will ask you to imagine that they have seen me deliver each of those short mimeographed talks to a man acting the part of a workman, as Mr. Conner and I have already done. Such practice informs the foremen as to how they can use this simple guide to make up short talks on safety for themselves, talks which they can deliver to their men in impromptu style.

My next job is to convince my foremen that they can make up and deliver such talks with ease. To do this I give them practice of the kind which will now be demonstrated. I first develop an atmosphere, an atmosphere in which the foremen actually see themselves delivering talks such as I have recommended. This is how it is done. I am once more the safety engineer.

Developing Atmosphere

(*Here Mr. Bigelow spoke to the group of foremen actors on the platform.*)

Mr. Conner, will you take the part of a foreman in my plant? (*Mr. Conner agreed to and stood up.*)

SAFETY ENGINEER: Now, Bill, all you have to do is to imagine that I am a workman under you. You practice on me and deliver one of the talks I just handed you. Just imagine I'm standing beside my work bench as you talk to me. Read off the talk and, in that way, you'll get familiar with the method.

(*Foreman sees man changing speed on his lathe, using his hands in place of belt stick.*)

FOREMAN: Hey, Joe, don't you think you'd better use the belt stick in place of your fingers?

WORKMAN: Oh, that stick's a lot of bother; I don't need it anyway.

FOREMAN: I know you are a good machinist, Joe; you do darn good work, but the company provides these belt sticks for changing speed or putting belts on pulleys so you can stay on the payroll. When I see you using your fingers, I know sooner or later you are going to get your fingers caught in the belt or perhaps get your arm wrenched out of place or one of your fingers pulled off or something like that. That would cause you a lot of unhappiness and, above all, it would be mighty painful. You know, Joe, you can't beat fun and there's plenty to be had with a family like yours.

Use more care, Joe, and you will enjoy living a lot more by knowing always that you are not going to get hurt.

WORKMAN: O. K., Boss, I guess you're right!

[After Mr. Conner had completed his talk and it had been discussed, showing the elements it contained and how it followed the necessary logical steps to get action, Mr. Earhart was called on to deliver his talk, Mr. Bigelow again taking the part of the workman.]

(*Foreman notices a cut on workman's hand.*)

FOREMAN: Say, Bill, how did you cut your hand?

WORKMAN: Oh, early this morning, on one of the machines.

FOREMAN: Why haven't you been over to the first-aid room to have it dressed? You need that hand, don't you? That's the one you grab your pay envelope with.

WORKMAN: Yeah, this scratch doesn't amount to anything.

FOREMAN: It may not seem to amount to anything now, but an infection may start and cause you a lot of trouble. One of the most painful things in the world is poisoning that comes from just such little scratches, and to save you the pain and agony which results from such poisoning the company operates a first-aid dressing station for your benefit. I know that you don't want to have that hand get sore and make it necessary to carry your arm around in a sling for a month or so.

There are many things you want to do around your home over this week-end like driving your car to the beach, perhaps. There is nothing like playing safe! Now take advantage of what the company provides for your comfort and health and get that cut dressed immediately!

WORKMAN: All right, Mr. George; thanks.

[Note: This talk was also discussed and Mr. Bigelow put on an act with Mr. Earhart, wherein Mr. Bigelow tossed a baseball to Mr. Earhart while he was talking. Mr. Earhart deftly caught the baseball and did not interrupt his talking at all, but continued without a break until stopped by Mr. Bigelow.

Mr. Bigelow then explained that the delivery of plan and practice sales talks could be as unconsciously done as the catching of the baseball without interrupting other thoughts and duties which the foreman might have to think of and do. He explained that Mr. Earhart, when a youngster, could not have caught the baseball without stopping his talking and focusing his entire attention upon the act of catching the baseball, but that through practice, his sub-conscious thinking had become so co-ordinated that he could give his attention to what he was saying or to what he would do with the ball after he caught it, if he were in a baseball game, without, in any way, affecting his ability to catch the ball. Mr. Bigelow further explained that this act should prove that the composition and practice of short, safety selling talks would train any man with a knowledge of the Safety Talk Composition Guide, to deliver strong safety selling talks without omitting any of the powerful elements such a talk must have to be successful.

Then Mr. Sullivan was asked to deliver a talk, Mr. Bigelow again taking the part of the workman. Mr. Bigelow called the attention of his audience to the fact that in the first part of this talk, Mr. Sullivan, as the foreman, gets off to a bad start, but checks himself by the chart, corrects his talk, and finally gains the action he desires, because the strong elements of the chart are combined. Mr. Bigelow asked his audience to check Mr. Sullivan by the Safety Talk Composition Guide as he delivers the talk.]

(*Foreman sees workman carrying heavy materials up ladder.*)

FOREMAN: Hey, George, that ladder is liable to break with you. You have it setting at an improper angle.

WORKMAN: (*Comes down from the ladder.*) What's the matter now? I've been using ladders for a long time.

FOREMAN: I cautioned you last week that the proper angle at which to set a ladder for safe work is about 17 degrees.

WORKMAN: That's all right, but I'm afraid of the ladder slipping, and the way it's set now it's up against a rise in the concrete.

FOREMAN: (*Angrily.*) Listen, how many times is it necessary for me to give you an order. With these ladder-shoes a ladder will *not* slip when *properly* used. All ladders are provided with them.

WORKMAN: (*Sneering.*) I know, I'll take care of myself all right.

FOREMAN: (*Seriously.*) George, I suppose that if you were to kill yourself, your wife has enough money to bury you, and then enough money left to keep her going until your kids get older?

WORKMAN: No, my wife hasn't enough money to bury me even. What are you talking about?

FOREMAN: Well, George, if you follow instructions with regard to safety, your wife never will be in that jamb, and you won't be worried over it as you are now. You keep yourself all in one piece for a while and, instead of a wooden kimono for you, she'll have money for a new coat for herself. Will you go with me on that?

WORKMAN: O. K., Big Shot; I never thought about the old lady and the kids. I'll do it.

[Mr. Bigelow called the attention of his audience to the fact that it was far better to have *men* practice composing and delivering such talks among themselves so that they could unconsciously deliver all of the strong elements, rather than practicing such talks before the workmen and slipping back into old habits as Mr. Sullivan did at the beginning of his talk.

Mr. Bigelow also called the attention of his audience to the fact that moods are contagious as was shown in Mr. Sullivan's talk, and therefore the foreman should practice controlling his moods so that the greatest calming effect could be produced on the workmen.

Then Mr. Miller was called upon to deliver his written talk, Mr. Bigelow taking the part of the rackman.]

(*Foreman sees gasoline tank truck driven up to a loading platform and observes that the rackman is not fastening ground clip to truck.*)

FOREMAN: Hello, son; how's the truck running and how's your good health?

RACKMAN: O. K., Mr. Jones, this sure is fine weather we're having isn't it? This is this fellow's fourth load today. Guess the weather is bringing a lot more people out on the roads.

FOREMAN: Guess so. It sure is great to be alive in weather like this. Bill, give me your idea about being alive and healthy. Pretty good way to be, isn't it?

RACKMAN: Sure, I'm always healthy.

FOREMAN: Well, I notice that you haven't put the ground clips on. That clip is there for a purpose that experience has proven valuable to life and health. It grounds out any static electricity in the truck and prevents any sparking between the fill pipe and the truck. I'm sure that leaving that off is just a thoughtless slip on your part, but let me tell you, son, that slip might rob you of all the good health you enjoy for a long time to come, and they might miss your wife's smiling face at the bank when she deposits your pay check.

RACKMAN: Not a bad idea, that clip, but it's a big bother.

FOREMAN: Yes, I suppose it is, but half the fellows around here as well as yourself get paid as long as that truck and those tanks stay in one piece on the ground. Don't be a heel [*smiling*]. Let all of us stay healthy, will you?

RACKMAN: Sure, Mr. Jones, I see what you mean. I just hadn't thought enough about it that way I guess.

[Mr. Bigelow then discussed this talk with the foremen and audience and called their attention to the fact that it was more effective to use 90 per cent education and 10 per cent persuasion than to suffer the possible rejection of the plan through 10 per cent education and 90 per cent persuasion. Mr. Roberts was then called upon to deliver his written talk, Mr. Bigelow taking the part of the workman.]

(*Yard Foreman observes workman out in the rain without proper protection.*)

FOREMAN: Gee, what chances you fellows run some times, Jim. All dolled up in a fine slicker and rain hat—and no rubbers! I know you've got 'em, and how about that safety record you're trying to hang up?

WORKMAN: Yes, I know; but these shoes are good. They don't leak, and the rubbers are *heavy*.

FOREMAN: I know rubbers are heavy. And lots of shoes are not supposed to leak; but you know this cold weather and wet feet don't go well together for your health, and poor health may mean an accident, or if you get laid up with pneumonia, you and your family will lose, because when you are sick in bed your income is not quite the same as when you are working for it. Get your rubbers out, put them on and protect yourself!

WORKMAN: O. K., boss, you're right. I'll pick them up when I pass the locker.

FOREMAN: I wouldn't wait—better go get them now.

WORKMAN: O. K.

[Mr. Brehmer was then called upon to deliver his written talk, Mr. Bigelow again taking the part of the workman.]

(*Foreman sees pipe fitter using 36-inch Stilson wrench in making up pipe joint.*)

FOREMAN: Just a minute, Fred, before you finish connecting that joint; play safe, fella! You have good strong fingers which permit you to earn a good living; but the way you push on that pipe wrench so close to the floor, is likely to smash a few of them. You should never wrap your fingers around a wrench in pushing down on it, because if the wrench slips it is almost bound to break a couple of *your fingers*.

WORKMAN: Aw, the Hell with that. When I put a pipe wrench on a pipe it never slips.

FOREMAN: I know you are a good pipe fitter, Fred, but there is nothing in the world quite as good as *safety*. Some day the teeth in that wrench may break and let the wrench slip, regardless of how well you place it on the pipe; and when that occurs, you are liable to hurt yourself. And, as you know, a smashed finger *hurts*. I know that you don't want to have anything like that happen. So when you are pushing down on the wrench, Fred, take care of your hands by opening your fingers and pushing with the palms down. Then, if the wrench slips, you can still take your family out for a drive on Sunday, and also you're too important to this job to let you take chances. What ya say, fella?

WORKMAN: O. K., skipper.

[In each one of these cases, Mr. Bigelow discussed the various phases of the talks in connection with the Safety Talk Composition Guide, and indicated the simplicity, completeness and strength of talks so designed. He now addressed the audience.]

To place the foremen in the atmosphere of their daily duties, an atmosphere in which they see themselves delivering talks which were chart-planned, is the one best way to educate and persuade them to plan such talks for themselves, deliver those talks, and thus become one of the army of safety salesmen.

HOW TO SUMMARIZE

Now a Foreman Safety Conference must end with a careful summary if best results are to be obtained. So I will now address my foremen, summarizing our meeting:

SAFETY-ENGINEER: Fellows! * * * Many executives have said that the greatest opportunity to reduce accidents in industry is through the foreman. You men are the ones who can save hundreds of lives yearly. You can keep a man and his family happy and enjoying full income, keep his kids well fed and healthy, and aid industry to reduce, to greatly reduce, the cost of accidents. But, in order to do that, you will have to get your men to *want* to use care and to benefit through doing so.

Remember that it is difficult to get full results by being hard boiled and simply issuing commands. Remember that a healthy man, who never has had a serious accident, often thinks he never will. Such fellows do not scare easily, and pictures of bad accidents or such warnings aren't as effective as they should be. But if you

will educate your men, using short talks made up by this chart guide, you will fully utilize the value of words and you'll make them see the personal benefits of using care. Then we'll get the best possible results.

Now this kind of chart is used by thousands of salesmen who make good money educating and persuading people to buy what they have to sell. It has been used with good results by foremen like yourselves. So, because it may mean the saving of lives, and because it does mean a saving of money for your workmen and our company, and better departmental records for yourselves, I'm asking you to give this chart a month's trial. Deliver talks to your men, talks made up with this chart as a guide, and you will do your men a big service and yourself and the company as well.

[*Mr. Bigelow addressed audience.*]

It is my hope that some ideas were passed on to you during my talks which may be of value to you in carrying on your great work of saving lives and reducing human misery. Remember that just telling isn't teaching by a long shot, therefore, simple telling is far removed from educating and selling.

Many thousands of men and women each January 1 make the finest of resolutions, but they are also broken by the thousands about January 2.

Teaching alone will not do the trick. Back of it all must be organization and *practice*. Few indeed are the *big* men in sports who have refused to practice when they were not actually in competition. Many men have tried but have failed miserably and found that they went "stale." Conferences such as you have seen here in abbreviated fashion, form the basis of a method of getting over ideas by teaching and of *Practicing putting those ideas over*, to someone else.

"There has never yet been devised a method more sound and more profit producing.

[Mr. Bigelow then called upon his audience and asked if there was anyone who, after the first meeting on Thursday, had used the Safety Talk Composition Guide to prepare a talk. Mr. Sheeran, in the audience, said that he had and Mr. Bigelow requested that he read it.]

(*Line Foreman observes lineman working on high voltage line without rubber gloves.*)

FOREMAN: Say, Fritz, where are your rubber gloves?

WORKMAN: Oh, I didn't bring them along. I have insulated pliers.

FOREMAN: You may have insulated pliers, but how safe are they? When did you last have them tested?

WORKMAN: Oh, about three or four weeks ago. The insulation is all right, it isn't cracked.

FOREMAN: Well, Fritz, we test the rubber gloves we use *every night*. They are provided so you can plan some good shooting this fall and be there when you plan. You want to play with the team Saturday. I know you don't want to miss that. Come on down, kid, right now, go to the supply wagon and get your gloves.

WORKMAN: All right, Jim; I don't want to do anything to make me miss that game Saturday.

Mr. Bigelow commented on the completeness of this talk and continued:

Ladies and Gentlemen: Many times after you have purchased something, you have probably said to a companion regarding the salesman: "That fellow certainly has a fine personality. By George, he fairly makes his sales talks sing." And, ladies and gentlemen, that is what we must do, and our foremen must do. We must make our sales talks on safety fairly sing.

[NOTE: At this point a band was introduced and a safety song, composed by Mr. Bigelow, was presented on a large chart. The song was written to the tune of "Pack Up Your Troubles In Your Old Kit Bag" and was lustily sung by all those present.]

After the song, Mr. Bigelow called attention to the fact that to do a proper safety selling job, he had emphasized that both reason and emotion must be stimulated, and that the words and actions which a foreman uses and displays to the workmen, are his means of getting the desired results through reason and emotion.

ADJOURNMENT

Industry and Its Motor Vehicle Accident Problem

THURSDAY AFTERNOON SESSION

October 17, 1935

The session was called to order by Chairman R. C. Haven, safety engineer, Continental Baking Company, New York City, who presided.

Industry's Interest in Community Traffic Problems

By I. L. GILBERT

Division Plant Employment Supervisor, Michigan Bell Telephone Company, Detroit, Michigan

Twenty years ago the dangers of traffic were not realized. It is only within the last few years that a comparatively few people began to appreciate the enormity of the problem and began to work toward its solution through laws covering the examination and licensing of drivers, financial responsibility, the construction of safer highways, the instruction of children in our public schools and of adults who drive.

What has already been done? The National Safety Council has done much to disseminate information and arouse interest nationally through printed literature and through its great annual congresses. Community safety organizations have aided with their programs of group meetings for safety engineers, supervisors and the public; their publicity material through the press and over radio, through contests and first-aid instruction.

Has all this done any good?

The irrefutable fact that the commercial driver who has been reached by these methods has had a decrease in his accident rate, while the rate for the private motorist has increased, proves that good has been accomplished. Progressive police departments have also aided in decreasing accident rates where they have tackled the job with courage and common sense.

Of course, the courts must work hand in hand with the police if the efforts of the latter are to bear fruit. A police department which conducts a wirth-while educational program and patrols the streets firmly but courteously will do much to stop accidents, has has been proved in Evanston, Illinois, and Rochester, New York, and other cities. Where people are sufficiently progressive to require a periodic check of mechanical equipment we can look for a still better accident rate. The public schools through their training of their pupils and the establishment of safety patrol leaders in conjunction with the police have shown that it is possible to reduce accidents materially. The insurance companies, in instructing their clients and furnishing posters have done a worthy part in reducing traffic toll.

Now, why should industry take a part in this community traffic problem? Who is it that composes the community? Why, you and I and our friends and neighbors, the large majority of whom drive autos and who therefore object generally to laws which limit us but would welcome laws to limit the other fellow. This is why it

is so hard to arouse public interest and to bring effective pressure to bear. Industry too, is a vital part of the community. The people in the community earn their livelihood in serving industry. Anything that imperils their safety or their usefulness will harm industry. Industry pays a large share in the upkeep of any community through taxes. So industry by its very nature has a selfish interest in each community. But over and above this, most industrial concerns take an active pride in their communities.

What has industry already done and what remains to be done? First and foremost as industry's contribution, stands its record of a continual lowering of the commercial drivers' accident rate. The automotive industry has kept far ahead in the design of mechanical safety factors in the cars themselves, until today, with four-wheel brakes, steel bodies, and shatter proof glass, and other factors of safety, mechanical defects are responsible for less than 15 per cent of all motor car accidents.

Inasmuch as the larger industrial concerns each employ a number of drivers, it stands to reason that industry has concentrated more on the problem of preventing motor vehicle accidents than any other group. This record of improvement has been accomplished by safety rallies, posters, competition among companies, and within companies on accident prevention, by offering bonuses, by giving safe driving awards, by thorough inspection of cars, by training each driver in the proper operation and care of his car, by competent medical examination, by traffic courts conducted by supervisors to determine causes of accidents and to prevent similar occurrences, by fair but stern discipline of drivers, by having a supervisor caution each driver on leaving the garage, especially when road conditions are more hazardous than usual, by having a specially trained supervisor examine each driver before permitting him to handle a car, by giving each driver the American Red Cross training in first aid by impressing on the supervisors that the safe operation of each motor vehicle by his men was the supervisor's responsibility, by periodic check up on drivers with questionnaires.

Let me tell you what happened in our own company back in 1929 and 1930. During this period metropolitan Detroit was breaking all records for traffic accidents, and frantic efforts were being made to abate the slaughter. We called together a committee of our drivers and put the problem squarely up to them, and they met it squarely. They mentioned the fact that one could always depend upon a driver of the Standard Oil Company to obey all traffic ordinances and to be courteous. In Detroit if you see a Standard Oil truck coming to a corner, you know that you have nothing to fear, he will stop and give you the right of way. Our men said that if one company would have that reputation, there was no reason why we should not have the same.

After several meetings the committee drew up a short Drivers' Club Agreement, which promised to obey all ordinances, to be courteous and to render assistance whenever the occasion arose. They went beyond this and asked the management to advertise in the papers, so that all would know what was being done. The result was that in March, 1930, our company ran a series of ads in all the metropolitan publications, displaying the pledge card, and gave the names of the 450 drivers who had signed. This action of our drivers has spread to many other cities, which shows how the good work once started will increase.

Just one personal incident following this: Our installation superintendent was out in the field when he saw this incident unknown to the driver involved. The man was driving his car along a dirt road which had been made very muddy by recent rains. As he came to a crossing, a lady was having difficulty pushing a baby carriage through the mud. The driver stopped his car, got out and pushed the carriage through the mud and then went on his way. Just a simple thing, but these courtesies will help to build up good will for the company.

In this way, industry, by caring for its own problem has to that extent aided in helping the community problem.

The very life of some of our industries is dependent upon the solution of this traffic problem, because if the traffic toll continues to mount, many people will stop driving with consequent loss not only to the automobile manufacturer, but also to the oil industry and to all dependent upon them, such as rubber, glass, steel, and fabric makers. And yet in some quarters there is opposition to licensing laws on the basis that such laws will tend to lessen automobile purchases. It seems to me

that such a view loses sight of the fact that if unfit drivers are allowed to continue to drive automobiles, ultimately the situation will react unfavorably on the automobile industry and in consequence on the whole nation. All industry, to a greater or less degree, is affected favorably by public good will, and each of us knows how an efficient, clean, and courteous driver can help build up good will for his employer.

In the second place, industry has in general been the prime backer in all safety campaigns conducted by the community through its police departments. Where the community has offered facilities for testing brakes, lights, horns, steering columns, etc., industry has urged all its drivers to take in their company vehicles for test, and in addition, has urged each employee to have his personally owned car tested. Where the police have conducted special training classes, industry has again urged its drivers to attend and has worked closely with the police to make their efforts worth while. In some special cases, as in Evanston, Illinois, industry has aided in training police officers in first aid so that they might be better equipped to do their work. In some communities, public spirited citizens and industrial organizations have aided the police department in obtaining specially equipped public address cars to assist in carrying on their educational work. Police officers have been invited to talk to industrial groups, telling the problems of the police and their aims for safer highways.

In Detroit when it was made known that many of our school safety patrol leaders lacked rubber coats and boots, and that these helpers were getting wet in bad weather, and then sitting in school in that condition, the industrialists bought the needed things so that the boys' work might be carried on without danger of sickness. I have no doubt that this has happened in other cities as well.

Why is it that industry, represented by its commercial drivers, and the younger boys and girls in school are the only groups which continue to consistently lower their accident rates? The reason, I think, is obvious; they are the only two groups which can easily be controlled. The commercial driver operates his vehicle carefully because he is taught to do so and because his job depends on it. The younger children are in the habit of obeying their teachers and they too are given careful instruction.

As I see it, the only effective way to reduce traffic accidents by the ordinary driver of his or her personally owned car is through fair and firm enforcement by the various community police forces. Education will help, safe engineering of roads and cars will help, radio talks will help, advertisements will help, but when between 85 and 90 per cent of automobile accidents are due to carelessness in some form of the operators, then the only way to make a sizeable reduction in the traffic toll is to control the drivers. And the only sure way to control the majority of drivers, is through strict enforcement of the law. You know that your foot is lighter on the accelerator when an officer is behind you.

How can industry help in promoting this? They can aid largely in arousing the public to cooperate, because the police can do little if strong public opinion is against them. Here industry with its leaders and is trained advertising men can aid in forming favorable public opinion. If the leaders of industry stand solidly back of the police, there can be little doubt of the success of the efforts expended. The following eight points will give us a very satisfactory program:

1. Construct roads for the greatest possible safety, divided where possible with lanes marked where division is impossible; properly banked curves for high speed; roads marked to call attention to danger points and well lighted at night.
2. Pass laws to compel mechanical inspection of cars by designated commercial garages and require immediate correction of defects. Cars to carry stickers showing that such inspection has been complied with. Police to enforce the law by writing up cars without stickers.
3. Have laws to require rigid test of drivers before being given a license to drive. And along with this, a re-examination at least every third year to assure continuing ability of the driver. The fact that we are all OK today is no assurance that we will be the same even one year from now.
4. Have uniform traffic laws through the entire country. Statistics prove that the out of state driver is more liable to an accident than is the native son.
5. Have a law to impound any or all cars in an accident until the circumstances have been investigated.
6. Have a law to take away the license plates from operators who are habitually careless.

7. Have just but firm enforcement of the traffic laws.
8. Compel attendance at a traffic school for all first offenders and increasingly severe sentences for second and third offenders.

Before strict enforcement is started, newspaper advertising should notify the public, the radio should be enlisted to broadcast what is to be, and if possible publish a pamphlet which would contain plenty of illustrations that would cover a digest of the traffic laws and set forth safe driving practices. This should be made available to every driver by calling at the police stations, so that at least a minimum of instruction should precede the strict enforcement program.

Many of us here are members of some club or organization, such a Rotarians, Kiwanians, Lions, etc., and at every opportunity all of us should do what we can to enlist these organizations to help solve the safety problem. The combined influence of the industrialists, through all their manifold contacts is the one thing that can exert sufficient pressure to bring about these reforms, and at least cut in half this terrible traffic toll. Each community will have its own peculiar problems and must educate its drivers to meet those conditions.

How to Drive Safely

By ALVHH R. LAUER

Associate Professor of Psychology, Iowa State College, Ames, Iowa

I wish to set forth here six general principles of safe automobile driving. A certain amount of intelligence and sound judgment are assumed in considering these principles. Granting ability of the individual to think clearly, the important factors of safe automotive manipulation are:

1. Know yourself.
2. Know the other fellow's failings.
3. Know your car.
4. Know the law and traffic regulations.
5. Know the road.
6. Be careful all the time and in specific ways.

Few persons realize their actual capacities and limitations. Most persons overestimate themselves. Many underestimate themselves. Still others make no estimations at all. They just proceed and hope for the best. To consider some very basic facts, one must know something of three aspects of his being or existence; (a) how well he receives situations or stimuli; (b) how well he interprets such stimuli; and (c) how well he organizes his responses to meet a given situation. The third depends upon his speed of movement, psychophysical lag or reaction time, and the necessary energy or strength to complete the desired response in a satisfactory manner.

To receive experiences from the outside world we need sense organs. Without eyes we do not see, without ears we do not hear, etc. Persons vary in acuity or keenness of vision, to the extent of reading a letter 20 feet across at a distance of 20 feet, and reading a letter less than one-fifth of an inch at the same distance. Few persons attempt to drive an automobile with the poorest vision cited but many are on the road today who can not make out what a boy on a bicycle is until they are within a distance of 30 or 40 feet!

Poor hearing is not so common. Many drivers are on the road, however, who cannot hear ordinary signals from automobiles.

A good driver should use all of his senses. Smell gives many cues to the proper functioning of an automobile. A hot brake, low oil, or a slipping clutch can often be detected by smell. One driver tells me he drives his car from the seat of his pants. Here is his explanation. The pressure on the seat gives him cues as to curves, acceleration, deceleration, etc. It sounds reasonable. Most of us observe such cues at times.

A safe driver knows his shortcomings and avoids taking chances. He is aware that his distance judgment may be faulty, that he may be easily excited, that his field of vision is narrow, that his reaction time is consistent or inconsistent, that he is slow to react or fast, that he moves quickly or slowly after getting into motion.

He further knows that his color vision is normal or weak, that lights bother him at night (if such is the case), that he has a tendency to let his mind wander while driving or to become peeved at the "bird" who drives slowly in the middle of the road. He also knows when a situation is dangerous and when it is not. He knows that other drivers are sometimes careless, like himself, and he tries to stay out of their way—to compensate for their errors.

When I say the safe driver knows these things I have really overstated the case. What the safe driver really knows is that he is not sure of himself in certain respects and does not take a chance. In our studies of automobile drivers, we find a large percentage of those who have accidents tend to overestimate their ability. Even the "timid-soul" type may overestimate his ability in certain respects. He may overestimate his fear of certain situations, to say the least. Any underestimation is merely a form of overestimation. Probably it would be better to say one misjudges his ability. The chief function of a driver's examination should be to tell the man the truth about himself, to give him a picture of the driver he actually is.

Next to a thorough knowledge of one's self must be placed the ability to anticipate what the other driver may do. Your observation of people is sufficient to convince you that other persons do not do the same things you do. Some take more chances while others do not take as many as you. Some have better vision than you

Table I

Range of Differences of Psychological Nature

Trait	Mean	Upper Limit	Lower Limit
Intelligence	I. Q. 100	I. Q. 200	I. Q. 0-25
Observation (errors made)	4-5	10 or more	0
Mechanical (alertness manipulation)	13-17	35 or more	4 or 5
Parking time	35 sec.	400 sec. or more	10 sec.
Knowledge of road laws	50-60%	100%	10%
Years of driving for each accident	4-5 yrs	20 yrs. and more	0-1 yrs.
Hearing loss (Western Electric Audiometer)	5-10%	less than normal A minus hearing loss	75%
Acuity of vision (Clason or Snellen)	90%	150%	5-10%
Astigmatism (difference in axes)	20-23	63	0
Field of vision	168-175°	210°	Under 100°
Alignment of eye muscles (Bhorias)	1.5-2.4°	20° and over	0°
Effect of glare (scale readings)	56-67	100	37 and above
*Color vision (Ishara digits wrong)	60%	90%	20% and below
Distance judgment (cm. error in 16 trials)	57-78cm.	200cm.	22 or below
Bodily changes to shock stimuli (change in ohms)	6-9%	20%	below 2%
Blood pressure	110-120	225 above	90 below
Index of activity (10 sec. interval)	67-70	100	30
Reaction time (Simple auditory stimulus. Units milli-seconds)	160-170	300	100
Strength (in kilos grip)	52-56	80	25.

* Color blind only.

and some have vision inferior to yours. Some are more adept with their car and others are not as adept as you, and so on through the gamut of capacities which man possesses. Probably the accompanying table showing a few of the limits of ability found in the ordinary requirements of life situations may help you to get the picture. Many other differences are known but could not be presented here. It suffices to say that the driver must assume any other driver coming toward him may have a bad combination of traits for safe driving and it is necessary to act accordingly. Note the wide range of differences shown in the table.

The next principle of safe driving is to know your car. Did you ever hear of a first class garageman—not a racing driver, of course—who had a serious accident on the highway? For the eight years during which I have interested myself in accidents not a single case has come to my attention. This probably means, among other things, that such a driver usually knows what his car can do. He knows its steering potentialities, its tendencies to skid, its acceleration and deceleration limits, and other things about it so well that he takes adequate precaution to keep out of trouble. He also recognizes that other drivers may not know the possibilities of their own cars and acts accordingly. Professor R. A. Moyer has shown that a car with two wheel brakes can stop within a certain number of feet if the road surface is satisfactory. A car with four wheel brakes should stop more quickly. There are many other things the driver should know about a car to be a very safe driver. It takes but a few minutes to learn the controls of an automobile but it takes years to learn to drive safely. Become thoroughly conversant with your car.

Next, the driver should know the road. It has been shown experimentally that certain curves are not suited for speeds greater than 40 to 50 miles an hour, due to the way they are banked. A speed much greater than 65 miles an hour may actually cause a car to slip off a dry pavement. These more subtle aspects of knowledge of the roadway include, of course, the nature of the surface and its coefficient of friction under all conditions of weather. Some surfaces are much more slippery in wet weather than others. The more obvious aspects of such knowledge consist of actual first hand experience of the road to be traveled or careful observation of markers to note what some of the dangers are before coming upon them. For this reason I have always advocated a pictographic form of marker which will show the driver what to expect. Any obstructions to vision will keep the driver ignorant of the real nature of the roadway ahead. The intelligent and careful driver will note such hazards and avoid most danger. It is the thoughtless driver who ignores them and plunges into trouble. Unfortunately the innocent party is often the victim while the culprit gets off with a few bruises.

Knowing the law is one of the most important aspects of safe driving. I was amazed at the number of semi-commercial drivers—their driving is incidental to their business—who do not know the hand signals of their own state. Our studies in Iowa show that the average man can pass only a 40 per cent to 50 per cent test on the motor vehicle code. They do not know their road laws. If a man does not know that it is unlawful to pass on a hill, is in a hurry and uses little judgment at any time, he is likely to forge ahead and meet another car at the brow of any hill. We read of accidents of this type every day. Our highway patrolmen are a strong incentive to sane driving but unfortunately we don't have enough to shadow all the fools on the road.

The final principle of safe driving is to be careful in specific ways. If my brakes are working well and my reaction time is very rapid it is foolish to warn me to make a special effort to stop quickly. The driver behind will be certain to hit me. Rather, I should be warned *not* to stop too quickly. Again if I am "right-eyed" and have always made a point of observing more closely on the right side, the specific way in which I need to be careful is to watch on the left side. If I am color-blind and know about it but always watch the position of the red and green lights, I need instructions on the fact that such lights vary in position from city to city or from one section of a city to another.

In the same way that one who is ill needs to take certain specific precautionary measures in order to regain his health, drivers need to be more specifically careful. The doctor makes diagnoses on the basis of symptoms and prescribes specific treatment. Our efforts have been directed toward the problem of making known to the

driver his specific weaknesses in order that he may become more careful and further reduce his accidents.

If we can consider the problems of safe driving, I believe we will have a better idea of how to avoid accidents. The fundamental principle back of all is to know the dangers of driving in order that one may avoid flirting with hazardous situations. Whether this be increased knowledge of oneself, of the other fellow, the car, the roadway, or what-not, the results are likely to be the same: a gradual reduction in the enormous number of accidents which are today menacing the life and limb of millions of healthy, aggressive American people.

Keeping Truck Accident Prevention on a Practical Basis

By TED V. RODGERS

President, American Trucking Associations, Inc., Washington, D. C.

My hobby has been making truck operators safety conscious. As president of the American Trucking Associations, Inc., I have addressed hundreds of truck owners throughout the country on this subject. In my estimation, there is no problem of greater importance confronting the trucking industry. At our recent annual convention safety occupied a major place on the program. Our directors authorized the ATA to proceed with a comprehensive safety program during the next twelve months.

Our national safety contest, just ended, was held to select the safest operators in each of six classes of operations and encourage them by appropriate awards. The contest included owner-driven vehicles as well as fleets ranging up to 1,800 vehicles. The awards were based not only on the safety records but also on methods employed to promote safety, keep accident records, and educate the drivers. We presented handsome bronze plaques to winning contestants, and in addition, awarded a cup to the association of truck owners, affiliated with the national organization, which had done the most constructive work in promoting highway safety among its members.

Our National Safety committee has recommended the establishment of an Educational Safety Research Fund, to which subscriptions are being solicited; the fund will be used only for safety activities of the national association. We shall not duplicate the safety work being undertaken by other associations and agencies, but want to fit our work into what is now being done, giving it the special treatment that we think is necessary for our industry.

As the shock troops in our army, we are setting up committees in every state, reaching into the counties, making a total of 3,000 active workers in the interest of highway safety. The work of these committees will be coordinated by our National Safety committee. As a preliminary program, we have instructed them to call meetings of truck owners, explain the importance of safety to their businesses, engage competent speakers, show motion pictures illustrating the need for safety, and to instill generally in the minds of owners and drivers the absolute necessity for safe operation on the highway.

During June, the Pennsylvania Motor Truck Association had its annual meeting. We staged a big safety rally, attended by more than 2,200 owners and drivers. I think that meeting was an illustration of the proper way to approach the safety problem in the trucking industry. I mean that the owner must take an active interest in safety if he expects his employees to do so. We are trying to impress upon our members the necessity of personalizing the safety work. It is not sufficient to make speeches, post placards and issue rules. It is up to us to show our men that safety is one of the most important phases of our business and that the employee's job depends on his cooperation in this work.

I am a strong believer in humanizing the contact between the employer and employee. This can be done in all trucking operations. It is up to the employers to take the initiative, and I think more and more of our members are doing that. In my own business, I have my drivers subjected to physical examination. After one of these periodic examinations, I learned that six of them had defective eyesight

and were not fit, for that reason, to drive a truck. I gave them other jobs in the organization and explained why that was being done. On another occasion, I studied the accident record of a man who had driven for me for four years without an accident. I put him on night work. Within a short time, he had four or five minor accidents. I shifted him again to day work, and the accidents stopped. I learned that this man could not sleep during the day and, for that reason, went to his work at night tired and sleepy, which resulted in the accidents. So I kept him on day work and his safety record is just as good as it was before I took him off day work.

I want to tell you a little more about what the national association is doing to promote safety, because I think we have a practical plan. We expect to establish a reporting system of trucking accidents through our 3,000 committeemen. So much of what has been written about truck accidents is misleading that we think it time the trucking industry itself gathered the facts. The figures of the National Safety Council show that the trend of truck accidents over a series of years has been much lower than that for passenger cars, but public sentiment blames trucks for the accidents in which they are involved, regardless of the facts. In all of our work, however, we expect to coordinate our activities with those of the National Safety Council and other national organizations actively working on this problem.

Our committee will also study the drivers standards and education for drivers, with a view to recommending for adoption by all affiliated associations minimum standards of safety requirements for drivers.

All of the 3,000 members of our safety committee will be supplied with badges. They literally will be enforcement officers. They will report any instances of faulty equipment, careless driving, or failure to observe rules of the road on the part of any truck driver. Such reports will be made to the owner of the vehicle, and he will be urged to take proper steps to educate the driver so as to insure that the offense will not be repeated.

ADJOURNMENT

Maintaining Interest in Safety

THURSDAY AFTERNOON SESSION

October 17, 1935

The session was called to order by the chairman, Cyril Ainsworth, assistant secretary, American Standards Association, New York City, who briefly mentioned a few of the problems to be discussed.

The third address, "A Program For Reaching Small Groups in Remote Locations," by Mr. C. L. Hightower, safety engineer, United Gas Public Service Company, Houston, Texas, was also scheduled for the Thursday morning session of the Petroleum Section, and it will be found in this volume of Transactions as a part of the Petroleum Section sessions.

Whom to Discipline and How?

By A. J. MARTINSON

Safety Supervisor, Union Oil Co. of California

The thoughts expressed in this paper are a composite of the experiences and opinions of numerous foremen and supervisors in one industrial organization. We are not attempting to set up a standard for foremen and supervisors, but the opinions of our men on this problem may prove thought-provoking.

Our foremen and supervisors at first had many and very diverging opinions on how discipline should be exercised by themselves. These opinions varied from "fire the bird that pulls a boner" to the other extreme, which considered the foreman a "father carrying the load." We have attempted to clarify these ideas by keeping before the foremen the objectives of discipline.

The objectives of discipline are to secure from every man prompt, efficient, and intelligent job performance, and to arouse, and guide the development of self-discipline in each individual; meaning by self-discipline, the driving urge to do one's best.

The analysis of accidents when honest and thorough always reveals weaknesses of men, equipment, or discipline. The objectives of discipline can therefore best be gained by finding the failures of discipline in the investigation of accidents. A brief outline of how accidents are investigated in our organization, to form the basis on which disciplinary action is to be taken, is next given. This uniform scheme of analysis has not only developed the personal interest of foremen in preventing accidents, but has made each of them see that his accident record reflects the quality of his supervision.

We have adopted the basic cause analysis of H. W. Heinrich of Travelers Insurance Co. for the investigation of all potentially serious or unusual accidents, all fires, and lost-time injuries. The investigation is conducted by a committee of three, comprising superintendent of the department, a foreman from another department, and the safety supervisor.

Let us first consider the basic physical causes of accidents. We must bear in mind that all laws and regulations governing safety and compensation for industrial injury definitely established the legal responsibility of the employer to furnish a safe

place of employment and provide minimum standards for mechanical safeguards and processes.

1. *Physical Hazards*—Mechanical, electrical, steam, chemical, etc. (a) Ineffectively Guarded. (b) Unguarded.

Intelligent management would not consider disciplining a worker for an accident resulting from this basic cause, but would consider a foreman responsible if employees working under his direction failed to use mechanical safeguards provided by employer. Perhaps discipline of foreman is indicated if safeguards provided were not in use.

2. *Poor Housekeeping.* (a) Improperly piled or stored material. (b) Congestion.

Examination of these basic causes precludes discipline of worker but reflects quality of supervision and management.

3. *Defective Equipment.* (a) Miscellaneous Materials and Equipment. (b) Tools. (c) Machines.

These are not within control of workmen but indicate reproof of foreman and criticism of management. (Reproof is used to correct repeated error. Criticism is used to correct unintentional error.)

4. *Unsafe Building Conditions.* (a) Fire Protection. (b) Exits. (c) Floors. (d) Openings. (e) Miscellaneous.

This is definitely the responsibility of top management.

5. *Improper Working Conditions.* (a) Ventilation. (b) Sanitation. (c) Light.

No workman would labor under these conditions from choice. Responsibility for accidents from these basic causes can never be placed on workers. Responsibility is management's except in those instances where foreman has authority to correct.

6. *Improper Planning.* (a) Layout of Operations. (b) Layout of Machinery. (c) Unsafe Processes.

Accidents charged to improper planning, layout of operations, and layout of machinery are managerial responsibilities. At first our supervisors used unsafe practices and unsafe processes synonymously until they learned that in accidents from unsafe processes they shared responsibility with the top management, while unsafe practice indicated an action of employee over which they had a measure of control.

7. *Improper Dress or Apparel.* (a) No Goggles, Gloves, Masks, etc. (b) Unsuitable—Long Sleeves, High Heels, Defective, etc.

Under this basic cause the supervisor recognizes that the burden of responsibility rests on him.

The foregoing basic causes are involved in approximately 10 per cent of all accidents. Discipline of worker is indicated in none of these causes. Possible discipline and reproof of foreman is indicated in some instances. Criticism or reproof of management is indicated in all.

Basic Supervisory Causes

The seven basic causes which follow can be controlled by supervision. Disciplinary action, good or bad, is one of the prerogatives and responsibilities of supervision which should always be exercised by the employee's immediate superior never the safety supervisor.

1. *Faulty Instruction.* (a) None. (b) Not Enforced. (c) Incomplete. (d) Erroneous.

Accidents resulting from any of these causes must be charged not to the workman but to the failure of foreman or supervisor to instruct the worker in the right way of doing his job.

2. *Inability of Employee.* (a) Inexperience. (b) Unskilled. (c) Ignorant. (d) Poor Judgment.

When a foreman must use workers who are inexperienced or unskilled, careful planning of the job and instruction broken up into small parts will expedite job performance and reduce waste.

Ignorant—Webster writes: "Persons are spoken of as ignorant who do not have the knowledge that has generally become diffused in the world." At any rate, this would indicate poor selection, a supervisory matter.

Poor Judgment—We have defined this phrase to mean poor comprehension or lack of capacity for understanding. It naturally follows that selection of this type of employee for any job requiring even a moderate amount of comprehension or understanding is a supervisory error. There is nothing to reclaim or develop in this type of employee. Severing him from the organization's payroll is a blessing to the foreman who is expected to produce results, and likewise to his fellow workers who may be endangered by his lack of comprehension. Working together, the employment manager and foreman can write job specifications on workmen for various jobs, and so avoid errors of judgment.

3. *Poor Discipline.* (a) Disobedience of rules. (b) Interference by others. (c) Fooling.

Poor Discipline. If one of the objectives of discipline is to secure prompt, efficient, and intelligent job performance, and if an investigation of an accident shows that any of the elements of poor discipline are involved, the foreman is in a tough spot.

Disobedience of Rules. We believe that disciplinary action should be taken for disobedience of written or printed rules, of which there should be a minimum. If penalties for disobedience are published they should be lived up to to the letter, although the wisdom of published penalties is questionable. Our preference is for judging each case on the facts surrounding it because men in supervisory capacity then have an opportunity to uncover facts, and by frankness, firmness, tact, and authority, can use the incident constructively for the instruction of others besides the individual involved. Among the facts to be determined are:

Did the Workman—

1. Understand the rule?
2. Understand the reason for rule?
3. Ever have rule explained to him by his foreman?
4. Ever see or hear of anyone in supervisory capacity violating rule?
5. Disobey rule with expressed or implied consent of foreman?

Had the Foreman—

1. Tolerated or encouraged disobedience of other rules?

4. *Lack of Concentration.* (a) Attention Distracted. (b) Inattention.

Accidents from these causes are a real challenge to a wide-awake and competent supervisor or foreman. Before charging the workman concerned with responsibility, the foreman should ask himself the following questions: Have I—

1. Aroused his constructive tendencies by getting him to see that his job, however menial, is essential to "putting over" the big job, or encouraged suggestions from him that would improve quality or job technique?
2. Made him see that his future promotion is based first on how well he does his present job?
3. Ever tried him out on a better job?
4. Ever commended him either when alone or in the presence of others?

When a foreman realizes that increasing the work output of his gang reflects to his credit and that keeping his men interested contributes materially to this, he readily recognizes the necessity of keeping men interested in their jobs. He will also assume responsibility for accidents from these causes.

If inattention was the result of an employee working at a job for which he was not fitted, the cause is subject to correction only by the exercise of supervisory functions, selection and placement.

5. *Unsafe Practice.* (a) Chance Taking. (b) Short Cuts. (c) Haste.

Accidents resulting from unsafe practices, either chance taking, short cuts, or haste, are subject to control by supervision. Where foremen and supervisors are sincere in exercising their supervisory prerogatives, and themselves set the example, accidents from these causes are exceedingly few.

6. *Mentally Unfit.* (a) Sluggish or Fatigued. (b) Violent Temper. (c) Excitability.

The most efficient worker is occasionally sluggish or fatigued while on the job. Here the observing foreman exercises control. He must recognize the symptoms, find the cause, and take corrective measures that are constructive before he can eliminate accidents from this cause. Many foremen make a point of "sizing up" every employee on his first round each day. Sending a man home for a day's rest, who has been up all night with a sick wife or child (or even a sick lodge brother) is an act of consideration by an understanding foreman. Cases of violent temper and excitability can usually be controlled in a constructive manner by a foreman. "Bawling out" the employee produces bad results. A personal talk with the individual gives best results.

7. *Physically Unfit.* (a) Defective. (b) Fatigued. (c) Weak.

Physical unfitness as a basic accident cause is controlled by supervision. Selection and placement of employees being a supervisory function, certainly the defective and weak can be eliminated by supervisory procedure. If physical fatigue results from *long hours*, its cause is subject to supervisory control.

Summarizing the Basic Physical Causes of accidents (involved in 10 per cent of all accidents) we find that top management exercises direct control over many of these basic causes. Through their supervisors and foremen they exercise control over the remaining causes.

A summary of the Basic Supervisory Causes shows that all (88 per cent) are subject to control or regulation by the supervisory forces from management to foremen.

From the above, intelligent management, including foremen, may determine whom to discipline and how.

In the control of these causes management could well afford to give serious thought to the planned development of supervisors and foremen.

Stunts for Keeping a Safety Program Alive

By H. F. WEBB

General Safety Director, West Penn Power Co., Pittsburgh, Pa.

Some of the safety stunts which I have originated during the past twenty years were found to produce the stimulation that our safety program needed and I shall display slides illustrating a few of these and briefly explain them.

Stunt No. 1—Safety Boosters Club

This club composed of keymen, superintendents and foremen, lifted the old Safety Committee plan to a higher plane. At weekly meetings sub-committee chairmen were required to present complete reports of their findings. The slogan of the club was "90 Days or Bust," our goal being 90 days without a lost time accident. The safety engineer was only a "sitter-in." The club idea was later extended to include all 1500 employees by way of—

Stunt No. 2—Loyal Order of Safety Boosters

The "order" was built on an endless chain basis starting with the initiation of one outstanding employee who signed a pledge, for which he received an L.O.S.B. lapel button. He was permitted to recommend on a card three men known to be safe workers. The plan gathered momentum, and in a brief period 1500 pledge cards were filed, and 1500 men were automatically inducted into the order that would tolerate nothing but safe workers!

Stunt No. 3—Safety Booster's Club Bulletin Board

This bulletin board was used to publish club news and safety posters. As a special feature we included a scoreboard which compared the accident standings of eight large construction projects in the manner that baseball scores are posted. Batting averages were based on frequency rates and team standings on severity rates.

Stunt No. 4—Safety Booster's Club Sergeant-of-Arms

A member of the original club occupied this position, and he was furnished with a cap, star badge and oversized club. When unsafe practices were noted by members, the offender was hauled before a board of inquiry by this pompous individual, and usually paraded through the plant in a roundabout way to court. After several such parades you may be sure there was a tightening up on the part of the entire force.

Stunt No. 5—Accidometer

An accident meter was devised to record the number of consecutive days each department had gone without a lost time accident. It was made of wood, glass tubing and rounded wood mercury rods. The slogan on the meter was, "Won't you feel like hell if you spoil your foreman's record?"

Stunt No. 6—Hand Painted Bulletins

These illustrated in a bizarre manner the use of tools which had caused accidents and devices for accident prevention.

Stunt No. 7—Green Hammer Man

The handles of several ordinary carpenter's hammers were painted bright green. The hammers were turned over to a squad of men and water boys whose job was to comb the construction project for upturned nails and bend them down.

Stunt No. 8—Target Score Board

This type of score board came after the accidometer and was divided by departments. An accident meant that a colored metallic disc was attached to an outer circle and this was considered a stigma.

Stunt No. 9—October No Accident Month Calendar

A "No Accident Month" calendar was designed for the campaign period, and the daily sheets on the calendar pad carried different "pep slogans." The pad was stapled top and bottom so that it was not possible to read the slogans in advance. In connection with the campaign, all inter-company letters bore the slogan, "October is West Penn No Accident Month."

Stunt No. 10—No Accident Campaign Board

To stimulate lagging departments to greater effort in the prevention of the time losing accidents, special indicating devices were designed and displayed at strategic spots. Among public utilities "load building" campaigns are sometimes essential in bolstering slipping revenue, and by the same token each of these devices, though simple in operating technique, provided a goal toward which departmental effort was exerted.

(a) A campaign board symbolized strong effort to "ring the bell." Each day accomplished without an accident moved a colored map pin further up the indicator board toward the objective.

(b) Another board was symbolic of electric railways operation. The campaign period over 90 days and small cars were moved one tie forward for each day without an accident.

(c) A campaign indicator recorded the number of consecutive no-accident days each department had accomplished. A good record was something to "crow about," and these boards were proudly displayed by each department head.

Stunt No. 11—Trainmen's Accident Prevention Contest

Another campaign board provided a method by which electric railways trainmen could visualize team progress, similar to the board mentioned above. Each type of accident occurrence was identified by card appendages, and the small toy cars progressed along the track to the car barn goal. Suitable prizes were awarded the winning team.

Stunt No. 12—January Minimum Accident Month Calendar

This series of "no accident" campaigns are for the most part pleasant to look back upon. But some created so much interest that an unnatural tension was observed in the employees. One campaign failed in the final stages when a worker who had apparently been keyed up to a nervous state was involved in a serious accident. Therefore, the next drive against accidents brought a campaign calendar, advertising the new policy which was to reduce accidents to a minimum. This drive was much more satisfactory.

Stunt No. 13—Safety Picture Reel

This stunt provided a means for reproducing a collection of photographs in the company magazine in an unusual and interesting way.

Stunt No. 14—Accident Jinx Cat

The "Accident Jinx Cat" mounted on a base was devised as an award to the group responsible for breaking a departmental "no accident" record. The group to which this "jinx" was awarded was required to hold it until another group took it from them by having an accident, or until the whole department had worked a year with an unblemished record.

Stunt No. 15—Display Boards

Display boards were developed to portray the many methods used to maintain employee interest in safety. On them were various types of educational literature, including letters, posters, blotters, and such awards as watch fobs and keychains.

Stunt No. 16—Safety Dollar

The Safety Dollar plan comprised the distribution of sets of thirteen sheets of papers numbered in series and looking like dollar bills. Every employee received a safety dollar with each pay for thirteen consecutive pay days and was urged to save a complete set for the purpose of winning cash prizes offered to those holding lucky numbers.

Stunt No. 17—Safety Pennants

Safety pennants were awarded to power plants, shops, mines and other departments having large numbers of employees for accomplishing records of 30 days without a lost time accident. A gold star was added to the flag for each additional 30 day no-accident period.

Stunt No. 18—Safety Trolley Car

To stimulate interest in safety on the part of the general public and particularly the car-riding public, slogans were permanently painted on the side of certain trolley cars. These cars attracted much favorable comment and assisted in the reduction of public accidents.

Stunt No. 19—"Safety At All Times"

The slogan "Safety at All Times" was painted in large letters on the face of a building which was perched on the top of a fair sized mountain overlooking a coal mining property. It not only had a visible effect on the 500 mine workers, but advertised to the world that safety was practiced there.

From the foregoing, an opinion may have been formed that I have relied solely on this bag of tricks to bring the accident situation under control—well, perhaps I have, but please keep in mind that these stunts, or special campaigns, should be resorted to only after mechanical hazards have been eliminated, and when employee interest needs a "pepping-up." Also, keep in mind the fact that a special campaign cannot be continued indefinitely. It is for this reason that a safety man must give special thought after the campaign to routine activities. Bulletin board displays should be a little more attractive than usual, to keep up the interest of the committeemen and foremen.

ADJOURNMENT

Occupational Diseases

FRIDAY MORNING SESSION

October 18, 1935

The session was called to order by Mr. W. Dean Keefer, director, Industrial Division, National Safety Council. Dr. C. H. Watson, newly elected President of The National Safety Council and Medical Director, American Telephone and Telegraph Company, New York City, presided.

Present and Prospective Occupational Disease Legislation

By F. ROBERTSON JONES

General Manager, Association of Casualty and Surety Executives

New York, N. Y.

Since the prevention of diseases is, to some degree, a community problem, the state ought to do its part toward the prevention of occupational diseases, along with all others. The public health authorities should study the causes of such diseases, their prevalence, virulence and the means for their prevention. They should advise as to such means of control, and, as a last resort, appeal to legislatures for power to order compliance with their rules. Statutory regulations for prevention, emanating from other sources, such as are common in "labor" or "factory" laws, have too serious drawbacks to be efficient. They are apt to be inflexible and quickly become "out of date"; and they are too apt to be perverted for the establishment of fictitious bases for wasteful and demoralizing damage-suit litigation. Scientific bureaus of occupational hygiene, under direction of public health authorities, are the best public instrumentality. Efficient bureaus of that character are now to be found in several states; but, generally, such public health organizations are inadequately manned and equipped. Therefore the primary need in occupational disease legislation is for measures to improve our public health services.

Emphasis should be placed on prevention, not merely because "an ounce of prevention is worth a pound of cure," but because public measures for the assurance of relief to victims are perilously susceptible of being so perverted that those affected will tend to rely upon and abuse the protection afforded as a substitute for, instead of as a supplement to, means for self-protection.

Expert opinion now calls strongly for the entire elimination of employers' liability for "damages" for occupational injuries—by disease as well as by accident—based upon negligence. That remedy is too uncertain in operation, litigious, demoralizing and wasteful; it furnishes relief to too few of the victims unless it be so liberalized as to be grossly unjust and financially perilous to employers—and thereby harmful to industry and all dependent upon industry.

Losses from ill-health among workmen are primarily subjects for self-providence or for "social insurance"—for "sickness insurance" to help out during brief illnesses, and for "invalidity," "old age" and "widows' and orphans'" insurance where illnesses or infirmities result in long or permanent disability or untimely death. The cost of these insurances against the common misfortunes of life cannot rightly or expediently be imposed wholly upon industry, but needs to be distributed somewhat in proportion

to responsibility. And benefits, at a high scale of maximum earnings, as in workmen's compensation, simply cannot be provided for all such workmen's misfortunes. In invalidity, old-age and life insurance, at least, the benefits must be graded, more or less, in proportion to the individual workmen's contributions to the requisite reserves; and the *right to benefit must be conditioned* upon some minimum number of contributions. It is only for some relatively small proportion of the injuries and physical ills to which workmen are subject that it is reasonable and practicable to impose the full responsibility on industry.

From its beginnings, the workmen's compensation law has covered all injuries to health resulting from occupational accidents. Further it has now, in this country and abroad, been extended to cover many specified diseases, not resulting from accidents, classified as "occupational." And in a few states in this country and Latin America it has been extended indefinitely further to cover "all inclusively" all injuries to health "arising out of and in the course of the employment" or all "occupational diseases," undefined, "arising out of the employment."

In this country there is strong political pressure in favor of this "all inclusive" coverage of injuries by disease based upon the contention that there is no difference in principle between "injuries by accident" and "injuries by disease"; therefore, industry ought to be liable for both classes of injuries on the same terms and conditions. This contention is fallacious. The fundamental principles of the compensation law are that industry shall be held responsible and liable to compensate for the losses from those injuries only which are caused by "trade risks", resulting from employment and which the employer can control; and that the liability for such risks shall be sufficiently well defined as to be insurable at practicable and equitable rates, fixed in advance. The standard compensation laws have been framed to carry out those principles in application to injuries by accident. But the factual conditions relative to injuries by disease are so different from those relative to injuries by accident as to necessitate different treatment.

The crucial difference between accidents and diseases is the time factor. An accident is a sudden event, happening at a definite time and place. Generally the causal relation between the employment and the accident and between the accident and the resulting injury can be traced with reasonable certainty. Generally the employer is automatically identified. And there is a clear-cut event from the date of which time-limits on notices, claims, etc., can be measured. In contrast, many diseases attributable to occupational risks are of slow contraction, and may be of equally slow progress to harmful results. In silicosis there may be an interval of as much as twenty or thirty years between the first exposure and disability or death. In the meantime, many causes for disablement or death, other than the occupational disease may have operated. Often it is a matter of extreme difficulty to determine whether disability or death really has resulted from an occupational disease or from other causes. Medical diagnosis of the mere existence of a particular disease is often uncertain: yet for the proper operation of compensation for occupational diseases it is essential to obtain true medical diagnoses, not merely of the existence of the disease, but also of its causes and consequences.

A further difficulty is that, where the disease is of slow contraction, it may be contracted by a workman under several different employers or insurance carriers. In such cases it is essential for the protection of the workman that some one existent employer or insurance carrier shall be directly liable for the entire compensation. That is a highly vicarious and harsh liability to impose upon an employer or insurer —whether or not accompanied by a right to claim contribution from earlier employers and insurers—and, in all fairness, should be subject to strict limitations.

Moreover there is a difficulty incidental to the provision of new insurance for compensation for such diseases of slow contraction as silicosis. Under such conditions, the liability imposed upon the employer includes a liability for disability or death in the future: in other words, a liability, not merely for future risks but also for the cost of a volume of physical impairments already incurred though the liability therefor is not yet matured. In insurance parlance, these are termed "accrued liabilities." Such accrued liabilities, under a law newly imposing a liability to compensate for silicosis, would, it is estimated, in a state such as New York, aggregate many millions of dollars. This cost is additional to losses from current risks; and how to meet it and how to fix reasonable charges for insuring it is a complex financial problem.

The situation, then, in my opinion, is this: The principle of compensation, regardless of fault, may well be extended to cover those disabling diseases that are characteristic of and peculiar to and have their origin in the occupation or process in which a person is engaged. This would exclude the diseases of ordinary life, and would be applicable only to the specific hazards which arise out of and because of industrial processes and occupations. The provisions for such coverage should be separate and distinct from the provisions of law applicable to compensation for accidental injuries, and these distinctions should be constantly emphasized. The problem of formulating such provisions is relatively simple with reference to those recognized diseases set forth in the older occupational disease laws, since such diseases are reliably diagnosable, of quick contraction and non-progressive. But it is difficult in respect to such progressive diseases of slow contraction as silicosis and asbestosis—now generally regarded as being truly "occupational." Fortunately, however, there are promising models for our guidance in some of the foreign compensation laws, whereas experience under indefinite, "all inclusive" coverage in Connecticut, Massachusetts, Wisconsin and California is helpful with lessons of faults to avoid.

In my opinion, a law for the compensation of occupational diseases should contain provisions to the following effect:

1. Diseases to be made "compensable" should be distinctly specified—by listing in a "schedule" or otherwise. They should include all those diseases, but only those, to be found in the state, which, according to prevailing medical opinion, can be traced, in individual cases, to origins in "trade-risks"—*i. e.*, risks, not of ordinary life, but created by special practices or processes in industrial occupations.

2. There should be a special regime for expert adjudication of medical questions in occupational disease cases.

3. There should be definite periods of exposure required as a condition to the right to compensation for various occupational diseases; the time within which, in order to be compensable, disability or death must follow exposure should be limited; and cases resulting from exposures prior to the effective date of the compensation coverage, or in industries wholly outside the particular state, should be excluded.

4. Prompt notice either of the first manifestation of the disease or of disablement —the time of such event to be determined as a medical question—should be strictly required; and every presumption should be against the validity of a claim not made as promptly as practicable.

5. In case an occupational disease merely aggravates, prolongs or accelerates disability or death due primarily or proximately to a non-occupational disease or infirmity or, above all, to old age, the compensation should be reduced to be proportionate to the degree to which the occupational disease contributes to the disability or accelerates death.

6. The employer, as of the time of the workman's last substantial exposure to hazards of the disease, and the insurance carrier then on the risk should be liable for the entire compensation—with or without right to contribution from earlier employers and insurers. But all such liabilities, whether directly for compensation or for contribution to the compensation payable by others, should be subject to brief time limitations.

7. In incurable diseases, especially silicosis, the obligatory medical benefits should be specially limited in time and kind.

8. In silicosis and other diseases of slow contraction, there should be special provisions for limited compensation to workmen laid off before actual disablement, with the alternative, under some conditions, of waiver of compensation by such workmen for aggravations resulting from being allowed to continue in the hazardous occupation.

9. A law newly imposing liability to compensate for silicosis and other diseases of slow contraction should leave a substantial interval for preparation between the date of its enactment and that when it shall take effect: the compensation for such diseases should be specially reduced and limited below what would otherwise be appropriate until the "accrued liabilities" are worked off.

10. Compensation for occupational diseases should be insurable separately from compensation for accidents; and, in the initial stage, at least, of a regime of compensation for such diseases as silicosis, the rating practices now imposed upon insurance carriers need to be radically modified.

The above program is sound and would be highly conducive to occupational disease prevention. But I am not so confident that it would be safe. The pressure is strong for "liberality" in compensation laws. Merely a few among a large number of probable slight diversions from what I suggest would convert compensation for occupational diseases into indefinite health, old-age and life insurance for workmen in many industries. The cost might ruin the industries, and, at least, would be so incalculable as to make the risks "uninsurable," except on the unlimited assessment plan, with all its financial perils and uncertainties.

In regard to prevention, there are still some practices to be decided upon in perfecting a regime of compensation for occupational diseases about which there remains much doubt. For example: Such a regime will practically compel employers, in giving employment, to discriminate against all the ailing or aging—against all except the most healthy and robust. That seems to be desirable in occupations when the occupational disease hazards are great. But is it desirable otherwise?

Again, an ideal common to those of us who emphasize prevention is to require the prompt removal from exposure of workmen manifesting the first symptoms of an occupational disease. But for the elderly or skilled workman the loss of his trade-job may be worse, in every respect, than the danger of continuing his exposure. How then should such cases be defined and treated and how should the law be framed to effect or induce such treatment?

Political impatience is the chief obstacle to a just and equitable settlement of the occupational disease problem. If those thoroughly informed as to this complex subject who have sincerely at heart the welfare of workers could be delegated the authority to devise a solution, some progress might be made. But when political propaganda is injected into the situation there is little chance for an adjustment satisfactory to all concerned. The greatest need today is the divorcement of occupational disease legislation from politics or political considerations.

Some Practical Considerations in Dust Control

By J. J. BLOOMFIELD

Sanitary Engineer, United States Public Health Service, Washington, D. C.

The prevention of occupational diseases due to the inhalation of industrial dust is primarily an engineering problem. Until recently, however, little attention had been devoted to the control of dust, accounting for the paucity of fundamental data on the subject. The consequences of the neglect to furnish adequate protection from dust hazards are now being felt, and the cost is becoming a serious drain on industry. It is now well established that exposure to certain kinds of dust, such as those containing considerable amounts of quartz, has increased the morbidity and mortality rates from respiratory diseases; while metallic dusts, such as lead and its compounds, have been associated with general systemic poisoning of workers. It is obvious, therefore, that any serious attempt to control the dust hazard should, in time, result not only in the improvement of the health of workers, but also be of definite economic benefit to industry.

The benefits of a preventive program in the field of accidents are well known. Industry is fast realizing the need of a similar preventive program with respect to occupational diseases.

Evaluation of the Dust Hazard

The first step in the evaluation of the dust hazard is the determination of the occupational exposure to the dust in question. A typical example of such a study may serve to clarify the methodology involved.

Table I shows the various occupations in a granite quarry and the number of workers employed in each occupation. Drillers are the only persons using pneumatic tools, known to produce considerable quantities of dust. In other words, 38 per cent of the quarry personnel are shown to be exposed to a potentially dangerous dust hazard. The occupational analysis at once indicates that the dust investigation

Table 1—Occupational Classification of Granite Quarriers

Occupation	Number in Each Occupation
Drillers:	
Leyner	17
Plug and jack hammer	37
Other quarry employees:	
Superintendent	1
Foremen	7
Compressor engineer	1
Hoisting engineers	12
Locomotive engineer	1
Locomotive fireman	1
Steam-shovel man	1
Crane operator	1
Derrick men	24
Muckers	24
Blacksmiths	6
Tool boys	2
Water boys	1
Machinists	3
Air-line repairers	1
Pipe fitters	2
Total	142

Table 2—Occupational Dust Exposure of Granite Quarriers

Occupation	Number in each occupation	Dust counts in millions of particles per cubic foot of air. Weighted Average
Leyner drillers	17	144.4
Plug and jack-hammer drillers (quarry-hole)	37	112.1
Plug drillers (yard)		36.9
All other workers	88	5.8

should especially concern itself with these workers. The next step involves the determination of the occupational dust exposure. Table 2 shows the results of such a study.

It is apparent in this table that the drillers are exposed to high dust concentrations, especially the Leyner and jackhammer drillers working in the quarry hole. From a further analysis of the occupational dust exposure of drillers it is possible to determine which activities are responsible for the dust. For example, experience has taught us that the various activities comprising the processes of most dusty occupations are usually associated with dissimilar dust exposures. For this reason it is essential to estimate the amount of time spent in each activity in any one occupation and to determine the dust exposure for each. Table 3 shows the results of such a study in the case of a Leyner driller.

It will be seen that a Leyner driller has five different dust exposures. A differential analysis, as presented in Table 3, yields several valuable findings. First, it enables one to obtain a true average dust exposure for workers engaged in the occupation of Leyner drilling. (In this case the weighted average is 144.4 as contrasted with 213.4 million particles per cubic foot found during drilling operations only.) Second, it enables one to determine which activity, or activities, contribute most to the

Table 3—Summary of Dust Exposure of Leyner Drillers in a Granite Quarry

Activity	Average dust exposure in millions of particles per cubic foot of air (a)	Number of hours spent in each activity (b)	Particle-hours in millions per cubic foot (a × b)
Drilling	213.4	4	853.6
Changing drills	9.8	1	9.8
Watching drills	8.0	2	16.0
Broaching	6.0	¾	4.5
Blowing off holes	1,085.0	¼	271.3
Total		8	1,155.2

$$\frac{\text{1,155.2 particle-hours in millions per cubic foot}}{\text{8 hours}} = 144.4 \text{ million particles per cubic foot}$$

dust hazard. It is evident that the practice of blowing off holes by means of inserting a compressed air line into each hole is attended with a great amount of dust; and though this activity lasts but 15 minutes of the 8-hour working day, it is responsible for 23 per cent of the total dust exposure. It is evident that 23 per cent of the Leyner driller's dust exposure may be at once eliminated by prohibiting this practice. And lastly, such an analysis indicates the necessity for devoting all one's efforts to the removal of dust during the drilling process, since this activity accounts for 74 per cent of the total dust exposure, although a Leyner driller spends but one-half of the working day at his drill.

So far we have dealt with an industry in which the workers, as a rule, do not change their occupation. Often workers have had several occupations, either in the same industry or in several different kinds of establishments. If the worker has been employed in various occupations in the industry, it is a simple matter to determine his total dust exposure in that industry. This is important from the viewpoint of correlating a worker's dust exposure and his clinical condition. A typical example is shown in Table 4.

Table 4—Total Occupational Dust Exposure of an Anthracite Coal Worker

Occupation	Number of years in each occupation	Dust concentration in millions of particles per cubic foot	Millions of particle-years per cubic foot
Slate picker	2	380	700
Patcher	2	71	142
Mule driver	3	71	213
Miner's laborer	3	480	1,440
Miner	15	480	7,200
Section foreman	5	7	35
Total	30		9,790

$$\frac{\text{9,790 millions of particle-years per cubic foot}}{\text{30 years}} = 326 \text{ millions of particles per cubic foot}$$

In Table 4 the worker's occupations are arranged in the order of employment, the last one being his present occupation. It is obvious that had one considered this occupation only, the dust exposure would not have yielded a true state of affairs,

nor would it have been possible to correlate this dust exposure with the man's clinical picture. In the above technic, correct weight is given to the number of years spent in each occupation and the dust exposure associated with each. Only by such an analysis is it possible to arrive at a fair estimate of a worker's dust exposure and his proper designation. Such an analysis is justified by the fact that results obtained with this technic yield excellent correlations with the clinico-roentgenological studies conducted on anthracite coal miners.[4]

It is thus apparent that there is more to engineering dust surveys than the taking of dust samples and their analysis. Owing to the fact that the making of dust studies is rapidly being adopted in industry, it has seemed necessary to emphasize the important factors in such investigations. Although the making of dust counts, *per se*, is not a difficult procedure, the collection of dust samples in industry and their proper interpretation should be done by a thoroughly trained investigator. The examples just given show the value of this technic in the subsequent steps to be taken in the control of the industrial dust hazard.

General Dust Control Methods

The selection of any method of dust suppression will depend primarily upon its effectiveness in reducing a given hazard and its adaptability. A large percentage of reduction in dust does not necessarily indicate that the method used is efficient, unless the reduction has actually been sufficient to bring the exposure below the safe limit, and does not interfere with the industrial operations involved. In general, there are four methods of dust control: (1) substitution of nondust-producing or harmless substances; (2) isolation of the dusty operation; (3) wetting the dust at its source; (4) local exhaust ventilation. These methods may be supplemented by personal respiratory protection.

The first method has a limited application. One example is the use of a non-silica parting compound for a silica compound in connection with the making of foundry molds. Table 5 shows that although the use of parting compound, in this particular study, only necessitated an exposure of 54 minutes of the 540 minutes of a molder's work day (10 per cent), actually this activity accounted for approximately 58 per cent of the molder's total exposure. It is obvious that the employment of a parting compound, which is not as harmful as one composed of free silica, will lessen the dust hazard in this instance to a considerable extent.

Table 5—Dust Exposure of Molders

Activity	Time of Exposure in minutes (a)	Average Dust Exposure in Millions of Particles per Cubic Foot (b)	Particle-Minutes in Millions (a × b)
Use of Parting Compound	54	63.8	3,445
Remaining tasks in molding	412	4.4	1,813
Pouring	58	3.1	180
Dumping molds ("shake-out")	16	32.5	520
Total	540		5,958

$$\frac{\text{5958 million particle-minutes}}{\text{540 minutes}} = 11.0 \text{ million particles (per cu. ft.)}$$

In the case of abrasive cleaning with steel instead of sand, we have the example of the substitution of a substance involving a lesser dust exposure as well as the use of material not as toxic as sand.[5] Table 6 shows the improvement effected by this type of substitution. Not only is the dust concentration reduced from an average of 969 to 155 million particles per cubic foot, but the potential exposure to quartz dust is diminished from 42·99 to 3 per cent.

Table 6—Showing Reduction in Concentration and Quartz Content of Dust in Sandblast Rooms With the Substitution of Steel for Sand Abrasive

Type of Abrasive	Average dust concentration in millions of particles per cubic foot	Percentage of Quartz
Sand	969	42-98
Steel	155	3

The second method of dust control, isolating the dusty process, possesses many possibilities, but unfortunately is not widely used. The theory underlying isolation is to concentrate the dust sources to one locality or to a single closed space. In this way, a minimum number of employees are exposed. At present, many foundries, during shake-out expose workers who normally are engaged in occupations with low dust concentrations. Thus, molders in a foundry may be exposed to a dust concentration of 3 million particles per cubic foot under normal occupational conditions, but when shake-out operations are carried on close by, their exposure may be increased to more than 50 million. The same condition exists when annealing flasks containing ground slag are emptied in malleable iron foundries, exposing grinders and tumbling barrel attendants at work close by.

Perhaps the best example of isolation of a dusty process is the abrasive cleaning room. This completely encloses a hazardous process and exposes only the blaster who is generally equipped with a protective helmet. The room is also exhausted, which further reduces the dust concentration. Processes which are isolated require good ventilation. Other examples of isolation are the automatic turntable for abrasive cleaning, tumbling barrels, and batch-mixing rooms found in some pottery establishments.

The third method, perhaps the oldest known, is the practice of wetting the dust at its source. In Table 7 an example is depicted in connection with the drilling and loading of rock in anthracite coal mine operations.[3] It is apparent that a tremendous reduction in dust has been effected by this method. However, as already pointed out, unless a particular method is attendant with a reduction of the dust to a safe limit, it cannot be considered successful. In the present instance, the workers engaged in drilling are still exposed to unsafe concentrations of a highly dangerous dust and the more positive method of controlling the dust in drilling operations by dust traps would be indicated. For drilling and loading operations involving an exposure to dusts less toxic than those containing high amounts of free silica, as in the case of coal or certain talcs, the reduction shown by the use of wet methods may be considered effective.

Table 7—Contrasting "Wet" and "Dry" Methods of Rock Drilling and Loading

Processes	No. of Samples	Average dust count in millions of particles per cubic foot "Dry"	"Wet"
Drilling	23	568	33
Loading	10	636	32

The fourth method—exhaust ventilation—is perhaps the most effective, and one with the widest application. We cannot discuss here the details of the theory and design of local exhaust systems, except to point out there is a real need for more fundamental studies of the type conducted by DallaValle with reference to the design of local exhaust hoods, which he has presented in Public Health Bulletin 217. The work of Hatch and his colleagues[4] on the control of the silicosis hazard in the hard rock industries is another example of a scientific approach to the dust elimination problem.

Table 8—Summary of Results Contrasting the Dust Exposure of Mine Workers Under Controlled and Uncontrolled Working Conditions

Operation	Dust Concentration in millions of particles per cubic foot of air Controlled	Uncontrolled	Remarks
Firing charge	40	834	Unless at least 15 minutes elapsed after firing a charge, miners found to be exposed to high dust concentrations.
Loading coal or rock	32	636	By wetting the loaded material the dust count is reduced as shown.
Loading coal	4-26	291-1138*	Mechanical loading decreases the dust exposure as indicated.
Drilling	33	568	Wet drilling is effective in reducing the dust concentration. Further reduction would necessitate exhaust ventilation.
Hauling coal in mines	1.2	17	Wetting coal and empty cars reduces dust in haulageways.
Preparation of coal	24	380	Wet breakers reduce dust counts as shown.

* The lower result is associated with the hand loading of wet coal while the higher average is based on the hand loading of dry coal.

It is apparent that there are no set rules for the mechanical protection of workers from the industrial dust hazard. Specific conditions in an industry, or a plant, will determine the type of protection to be employed. The present discussion has emphasized the importance of approaching the problem from the standpoint of the occupational exposure. Studies in representative plants of an industry often reveal the various methods which may be employed in controlling the dust hazard. The following two examples indicate the value of such investigations.

Table 8 indicates the various control measures which were found in use in the anthracite coal mines investigated in the study referred to earlier. Although no single mine practiced all of the control measures shown in this table, by an occupational study in several representative mines it was possible to show that methods are not known and practiced for the elimination of the dust hazard in this industry.

Another example is indicated in the results of a study now in progress in connection with mercurialism among workers in the hatters' fur cutting industry. Table 9 shows the exposure to mercury dust and vapor of some of the workers in this industry

Table 9—Exposure of Hatters' Fur Workers to Mercury Dust and Vapor Under Controlled and Uncontrolled Conditions

Occupation	Total Mercury Exposure in Milligrams per 10 cubic meters Uncontrolled	Controlled	Method of Control
Blowers	4.6	..	None practiced
Shippers	7.2	..	" "
Cutters	4.0	1.8	Local exhaust ventilation
Sorters	3.8	1.7	"
Brushers	3.1	1.2	"
Drummers	2.5	0.6	Segregation
Clippers	1.5	0.7	"

under controlled and uncontrolled working conditions. It is apparent that where some measure of control is practiced by such methods as segregation or local exhaust ventilation, a material reduction in the exposure to mercury has been effected. It is our belief that in the case of the blowers' exposure, a reduction may be effected by mechanical enclosure and local exhaust ventilation, and that the shippers' exposure to mercury vapor may be lessened by a general system of ventilation sufficient to change the air in the store room frequently enough to bring the mercury concentration to a lower level. Unfortunately, in the present investigation, it has been impossible to find a plant in which an attempt has been made to reduce the exposure for these two occupations.

In some dusty occupations the methods of controlling dust have not been developed. In fact, operations such as removing the cores from very large foundry castings, sand-blasting, handling of used storage battery plates, paint chipping, and cadmium oxide manufacture appear to offer no practical means of adequately controlling the dust generated. In such cases, it is therefore necessary to furnish the worker with personal respiratory protection devices to prevent his exposure to the harmful effects of the dusts present. These devices consist of various types of respirators, masks, and helmets.

It is important to hold in mind the limited use of personal protection devices. Because a worker cannot with comfort wear a mask or helmet continuously, such devices must be employed intermittently. Their use is generally extended to those operations where all other methods have failed or supplementary to them, as in storage battery repair where the exposure to small amounts of lead breathed is known to be detrimental to health.

It should be pointed out that the U. S. Bureau of Mines is equipped to conduct approval tests of respirators used for protection against various dusts and fumes (Schedule 21). These tests are conducted against the dust for which the device is to be used and are rated, not on an efficiency basis, but on the quantity of dust which actually passes the respirator. The results of a study of masks or helmets of the positive pressure type, made during the sandblast investigation conducted several years ago by the Public Health Service in cooperation with the National Safety Council,[1] showed that the only practical safeguard to the worker inside the sandblast room was to provide him with a mask or helmet of the positive pressure type. In studying the efficiency of such devices it was found that a relationship existed between the amount of air supplied to the helmet and the concentration of dust inside the helmet during blasting. To determine the optimum air volume to be supplied to such protective devices, it was necessary to obtain dust samples from inside the helmet while varying the air volume, at the same time maintaining the dust concentration in the sandblast room (outside the helmet) constant. The positive supply of 6 cu. ft. of dust-free air per minute will protect a worker under the operating conditions now in practice in sand-blast rooms. The ultimate criterion of protection, however, is the result of dust determinations of the air within the helmet, that is, the air actually breathed by the worker and not the volume of air supplied.

Too much emphasis cannot be stressed on the necessity of maintaining in good order the personal respiratory devices for the protection of the worker against various toxic dusts. Maintenance of exhaust ventilation systems, and other types of protective equipment, should be a rule in industry rather than an exception. Too often the term "good housekeeping" has been interpreted as signifying only the periodic removal of dust collected on floors, rafters, etc. Although such practice contributes to the general state of cleanliness of a workroom and should always be in force, the time has surely come when serious attention should be given to the installation and rigid maintenance of all types of dust control devices. In every plant there should be some responsible individual charged with the periodic inspection of all workrooms as to sanitation, ventilation, and maintenance of all dust removal and other protective devices. Perhaps the best criterion of the effectiveness of these devices is the periodic determination of the dust content of the air at the workers' breathing zone. Only by constant vigilance and an approach to the problem as outlined in this paper may one hope to make progress in the control of the dust hazard in industry.

Often the benefits of even a most extensive program of dust control are not immediately realized. This is especially true in dealing with fibrosis-producing dusts in plants where some of the workmen have already inhaled sufficient quantities to cause disability. However, in dealing with such dusts as lead, cadmium, and mercury compounds, control measures may produce salubrious results in a relatively brief period. It is difficult, because of lack of sufficient reliable data, to indicate here the economic benefits resulting from a preventive program of dust control. It has been estimated by Dean K. Brundage, statistician of this office, that the minimum expectancy in savings to employer and employee from an indicated reduction of the accident rate and of the time lost on account of illness (or an equivalent reduction in mortality), demonstrated as attainable, is $20,000 per year per 1,000 employees. And this estimate is for plants whose accident rate is considerably below the average, in which there are no occupational health hazards. In plants where hazards are known to exist the savings should be far in excess of this conservative estimate. When one realizes that in this country there are approximately 15 millions of workers engaged in manufacturing, mechanical, and mineral industries, then it is evident that the magnitude of the problem has not been overemphasized.

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Silicosis and Silico-Tuberculosis
Medical Problems of an Important Industrial Disease

By EDGAR MAYER, M.D.

New York City

A hidden element of the cost of production is industrial disease. Industry has reached a stage beyond the concern only of wages and hours. Far more important is conservation of man power by preventive medicine and improved engineering. Disease preventive measures are not a cost, but, in the long run, a great economic saving.

Incidence. In the United States it has been computed that there are from 500,000 to a 1,000,000 people employed in occupations where a silicosis hazard exists. In New York City there are about 65,000 such employees. In a representative group of granite workers in Massachusetts silicosis alone was present in about 15 per cent and silicosis complicated with tuberculosis in almost 8 per cent. Tuberculosis was the cause of death in over one-third of the granite workers which is four times the incidence for males of 20 years and over in this country. In foundry men studied in Massachusetts, silicosis was less frequent (about 9 per cent) and less advanced in degree than in granite workers. The duration of exposure in foundry workers with pneumonoconiosis has averaged many more years than that required to produce silicosis in an industry such as gold mining. The tuberculosis hazard in foundries is nearly as great as that reported for some of the other dusty trades, but the figures are much lower than those of miners of gold, silver, copper and lead, among whom the mortality from tuberculosis is 8 to 18 times the general expectancy. Death rates for all non-tuberculous infections have been reported higher among workers in siliceous dusts than in the general population. It is suggested that the worker in silica succumbs more often to acute pulmonary infections rather than surviving the chronic fibrosis.

Silicosis is defined as a pathologic condition of the lungs due to the inhalation of silica, whether free or combined in such a state as to be capable of setting up its characteristic pathogenic effects. The principal factors that determine the incidence of silicosis are (1) the percentage of free silica in the inhaled dust; (2) the concentration of silica particles less than 10 microns in diameter in the atmosphere; (3) the duration of exposure to the dust, and (4) the susceptibility of the individual exposed as modified by age, complicating infections, etc. The occupational disease resulting from such inhalation has been defined as "morbid results of occupational activity traceable to specific causes or labor conditions and followed by more or less extended incapacity for work."

Metabolism of Silica. Significant amounts of silica are present in all body tissues and fluids. It enters the body through the digestive tract and the lungs. Most of that entering the stomach is eliminated in the stools, but a fairly large amount is absorbed into the blood as shown by the constant excretion of silica in the urine. All vegetable foods contain silicon especially the hulls of grains, hay and straw. The low silica content of the liver, spleen and kidneys indicates the little retention of the absorbed silica in the body. Silica content of the urine of animals may be influenced at will by diet. The body possesses a very efficient mechanism for the disposal of silica because of the low kidney threshhold. Silica entering the lungs in particulate form is expectorated in part with its enveloping cells, but most of it is carried into the pulmonary lymph channels. Many such particles reach the lymph nodes and even the spleen by way of the blood. The finest particles however, may be dissolved in alkaline body fluids and carried away in solution, to be excreted in the urine. There may be a constant drainage of silica from the lung through the inhalation of extremely fine particles of silica in dusty atmospheres, so small that they are not seen under the microscope.

Attempts to influence the absorption of silica from the lungs by administration of alkali have been inconclusive. Elimination of silica by way of the sputum from patients having deposits of silica in their lungs appears to be higher than those having no history of exposure to dust. Only small amounts of silica are in the blood and this level is little different in normals than in silicotics.

Pathology. This disease is essentially a fibrosis of the lungs developing especially in such industries as hard-rock metal mining, granite cutting, metal grinding and sand-blasting. The pathological changes are believed to result from two causes, a blocking of the lung lymphatics by mononuclear cells laden with dust in addition to the action of colloidal silica, the exact nature of which is in doubt. The small particles under 10 microns are the only ones capable of penetrating the lung tissue.

Although silica plays the dominant role in the production of silicosis, the admixture of other dusts tends to modify the pathological changes in the lungs so that these resemble then those of other forms of dust inhalation, and the modification bears some relation to the percentage of free silica in the mixture. Silicates, as in asbestos, produce a definite change in the lung, as well as other dusts such as marble, coal, etc. Such changes are represented by a fibrosis brought about because relatively insoluble minute particles of minerals *in sufficient concentration* have been brought by the activity of phagocytic cells into intimate contact with the pulmonary connective tissue. This fibrosis is a diffuse cellular one that occurs in the walls of the smaller bronchi and of all their finer divisions and extends to involve the supporting connective tissue of the adjacent blood vessels and to some extent also the walls of adjacent air spaces. However, when the great majority of the inhaled particles are composed of or contain silica, there develops, in addition, a specific and localized type of fibrosis called the silicotic nodule—an orderly whorled arrangement of cells and fibres, and with sharp definition from the adjacent parenchyma. Many dusts create a generalized fibrosis but only one, namely one combined with silicon dioxide produces the special fibrosis of silicosis. Sericite, known as white mica, which is a hydrated silicate of aluminum and potassium, has not produced in animal experiments the silicotic nodule, but instead generalized fibrosis resulted.

Dusts must be differentiated into those which are *chemically active* and those which are inert when inhaled into the respiratory tract. Silica is a chemically active dust which must necessarily be *soluble* to a degree in the body fluids and its activity depends on its solubility. This activity which is manifested in the areas where dust particles are carried along the lymph stream by phagocytes, causes lesions of two

types, "toxic" and "sclerotic" both of which have been reproduced experimentally. Toxic lesions depend upon local necrosis and slow death and appear to favor the growth of tubercle bacilli; the sclerotic lesions produce the nodular fibrosis. The *inert dusts* are insoluble in body fluids and cannot exert chemical action in the lung tissue, but if they accumulate to a marked extent their effect is mechanical which may lead to a certain amount of diffuse fibrosis around the dust deposits. Certain dusts, such as carbon, may have physical effects, they may adsorb toxic substances and it has been suggested that on this basis there is a relatively lower incidence of active clinical tuberculosis in silico-anthracotics than in silicotic lungs.

Other dusts may even protect, as in the case of certain clays, gypsum and aluminum oxide. Pure pneumonoconiosis may be only a laboratory disease, as the pulmonary fibrosis of workers in dusty trades probably results from the combined action of dust and infection, whether it be tuberculous or not.

In silicosis it is not the mineral particles that are breathed in during life that record the cause of disease, but the particles that have been dissolved. Risk to work, efficiency and health may be greatly accentuated through the inhalation of finely divided particles even of a chemically inactive dust when there has occurred a lymph stasis which is known to follow exposure to silica. This lymphatic blockage leads to retention and accumulation of the inert dust. In soft coal miners who get what is called "miner's asthma" we have this accumulation of carbon. Such patients are very liable to have a high incidence of bronchitis with mechanical and physical changes due to retention of anthracotic dust. Furthermore, unequivocal cases of silicosis, with or without tuberculosis, can no longer be doubted.

Tuberculosis. Most apical tuberculosis is acquired before the age of 25 and so silicosis at the age of 30 makes a previous tuberculosis more serious. Most workers with tuberculosis going into the mines before the age of 30 die of tuberculosis by the age of 45. The silicotic develops a sputum that contains tubercle bacilli late in life and the children who are contacts with tubercular silicotics develop very little clinical tuberculosis. It is impossible to say definitely that tuberculosis engrafts itself upon the silicotic or vice versa, for we see apical tuberculosis in silicosis that spreads downward, while other silicotics show only the tuberculosis in the lower lobes. It has been found that most silicotics die of tuberculosis.

The diagnosis of silicosis is made primarily on two findings, the proper history of occupational exposure to siliceous dust and the presence of abnormal shadows on the pulmonary X-ray. The physical examination and the patient's symptoms are of less value. There are other diagnostic aids such as the finding of large quantities of silica particles in the sputum, quantitative determinations of silica in urine, and at post mortem, chemical analyses of the lung ash supplemented by petrographic examination, roentgen-ray spectrum analysis and special incinerating studies of lung tissue. We must at times rely on the pathologist to determine the amount and distribution of fibrosis due to silica and from microscopic studies give an opinion on the importance of this fibrosis as the ultimate cause of disease and death.

Lung fibrosis may be present without any silica. Silica may be present in lung tissue or the pulmonary lymph channels without associated fibrosis. Finely divided siliceous particles from lung tissue may contain innocuous silicate which cannot be distinguished from harmful silica particles. Hydrated silica which is not doubly refractive cannot be demonstrated with prisms. Therefore in the pathological section the presence of siliceous fibrosis can be suspected but cannot be specifically identified with the siliceous material that it may contain. Accordingly the microincineration method of Irwin with hydrochloric acid is now included in the microscopic examination of any lung as a means toward a surer diagnosis.

Diagnostic difficulties in clinical medicine may be more obvious if we examine first the occupational history. Quartz grinders working under conditions of massive exposure may develop silicosis in acute form even in a period of months, whereas in other occupations it may take 25 years. Workers in the same industry, indeed in the same room, experience different degrees of exposure dependent upon perhaps the dust-filtering capacity of the nose and functional condition of the lung as determined by constitutional characteristics and antecedent disease. The size and colloidal structure of the particles of silica, as well as the dosage and total amount of silica, will influence the rate of development of the disease. Apparently particles that are larger than 10 microns are not phagocytosed in the lung. So a definite

history of exposure must be established and in general hospitals where patients are migratory, conditions under which they worked are very vaguely described and there are not available data on dust counts and silica concentration, so that the history is often misleading.

As to symptoms, patients can perform strenuous labor despite extensive disease and the symptoms of dyspnea and cough are common to many diseases. Fever is absent unless infection occurs, but most important is the great disproportion between a patient's complaints and what is seen on the X-ray, the latter showing extensive abnormal shadows in comparison with the symptoms.

On physical examination, extensive disease may be present and few abnormal physical signs. The physical signs are merely those of a general pulmonary fibrosis with emphysema, such as restriction of costal and disphragmatic movement, diminution of or intensified breath sounds and a hyperresonant note. Rales are usually absent unless infection is present.

As to the *X-ray*, there are 3 essential types of shadows described, linear strands, small discrete shadows, and homogeneous shadows of varying sizes; these correspond to the fibrous strands, silicotic nodules, and the conglomerate masses of fibrosis. The nodular shadows are usually characteristically around the hilum, or conglomerate nodular shadows of bat-wing appearance extend into both upper lung fields, or nodular shadows may be distributed in the upper two-thirds of the lung fields, perhaps more pronounced on the right side, with the lower third kept clear by emphysema. With infection present, the shadows are less sharp or the linear strands interconnect or fuse. Large conglomerate shadows appearing out from the hilum leaving the periphery of the lung clear throughout because of emphysema. The distribution of some of these lesions may be determined by the posture assumed by the workers, and infection may likewise determine an ultimate atypical distribution. Many variations from these patterns are seen in the X-ray, especially under excessive exposure or when other dusts are inhaled, or in the presence of infection. It is probable that the main source of the diagnostic difficulties is caused by the emphysema which muffles the physical signs and is responsible in great part for the absence of symptoms. It may blot out, even on X-ray, the silicotic lesions of fine size. Examples of such difficulties in diagnosis as encountered by us are the following:

Case I—Mr. T. A forty-five year old man entered the New York hospital complaining of mild cough and expectoration of four months' duration. He appeared acutely ill, his fever was 103 degrees and respiration 28. Rales were elicited over the upper half of both sides of the chest. Examination of his eye grounds revealed bilateral retinal tubercles: his sputum contained numerous acid-fast organisms. The X-ray revealed fine mottled shadows distributed throughout both lung fields and a small cavity at the left apex. A diagnosis of miliary tuberculosis was made. However, after one weeks' stay in the hospital, his temperature and pulse returned to normal and during the following month he gained 18 pounds. The signs in his chest now became confined to the left apex. In view of his unusual progress the diagnosis of miliary tuberculosis was doubted. His occupational history revealed that up until three years before entrance to the hospital he had worked for 20 years polishing leather on a sandpaper wheel. There were numerous machines in the work room and no precautions were observed to clear the very dusty air. His sputum was examined through the kindness of Dr. Burke of Raybrook, N. Y. who found it laden with numerous doubly refractile silica particles. He expressed the opinion that this was consistent with silicosis for he had found such numerous particles only in cases of silicosis. The patient subsequently died of a tuberculous meningitis. Retinal tubercles were demonstrated on microscopic section. The pathologist's report was miliary tuberculosis. Ashing of the lung showed increased silica content, consistent with undue exposure to dust (more than 2 mgm. silica per gram dried tissue).

Case II—Mr. R., aged 54, entered the New York hospital complaining of hemoptyses, dyspnea and chest pain. On physical examination there were rales and dullness over the upper third of the right chest anteriorly. He ran a low grade fever but was robust and felt quite well. The chest X-ray disclosed enlarged hilum shadows, particularly on the right, and diffuse mottled discrete shadows throughout both lung fields with a circumscribed density near the right apex. He gave a history of having worked for twenty-four years as a cutter and sizer of asbestos-containing paper box boards. The rooms were in a continuous cloud of dust. Examination of the dust revealed 5 per cent silica content. The hemoptysis, we felt, was to be explained on the basis of infection or neoplasm, but we did not know whether we were dealing with one of those processes alone or an associated silicosis or asbestosis. A small nodule in the neck was subsequently removed and showed carcinoma. We are inclined to believe that this does not explain the whole process, as the man is still alive and certainly, from the X-ray standpoint, we cannot say that there is no silicosis.

Case III—Mr. C. A dish-washer, aged 46, entered Bellevue hospital because of cough and expectoration, associated with dyspnea. There was some dullness and rales at the right base posteriorly. Chest X-ray revealed a homogeneous shadow at the right base. His sputum contained no tubercle bacilli and lipiodol study revealed no abnormalities. Bronchoscopic examination disclosed a bleeding mass in right main bronchus. Symptoms and disease progressed during the following four years. Discrete mottled shadows first appeared in the upper right lung field and the shadow at the right base cleared somewhat. Three years later extensive abnormal shadows were present throughout both lung fields, particularly on the right. Diagnosis of chronic penumonia of unknown etiology was made. At no time was a diagnosis of silicosis entertained, because as far as could be determined he had no history of exposure. Furthermore if there were silicosis it behaved very atypically having the lesion confined practically to the right base at the beginning and then spreading to the left lung. Autopsy however, revealed a typical silicosis associated with a small degree of tuberculosis. A picture of the lung showed how much more extensive the silicotic process was in the right lung. There was stenosis of the right middle lobe bronchus with bronchiectasis in this lobe. Chronic infection in the lung field probably accounted for the unusual localization. This case illustrates how necessary it is to have the history of dust exposure for without it here we are unable to even suggest a diagnosis.

Case IV—Mr. C., aged 45, complained of cough and dyspnea with slight expectoration and gave a history of having worked for many years repairing tires, using talc powder. It was difficult to obtain accurate details as to the possibility of silica exposure except that the rooms were filled with clouds of dust. Rales were present at both apices and a few tubercle bacilli were found in the sputum. Discrete and stringy shadows were disseminated throughout both lung fields. We know from the positive sputum that tuberculosis is present. The patient has, however, been well for a period of two years. The doubtful history of exposure together with the numerous discrete nodular shadows in his lung, which are consistent with silicosis, makes this patient a problem. Is this tuberculosis alone or is this tuberculosis with silicosis? The patient is still living a year later and working.

Conclusion. Cases such as these are exceptional, but their existence must always be borne in mind. If occupational history is inadequate and X-ray, clinical and laboratory studies prove misleading, the diagnosis may present great difficulty. However, a comprehensive study of all possible data usually clears up the problem with reasonable certainty.

ADJOURNMENT

There is some confusion in the use of the term "respirator," to designate devices for protection against the inhalation of atmospheric particulate matter. Such devices were the first and for a long time were the only respiratory protective devices. They were logically called respirators, and as long as they were the only devices of this kind there was no confusion. The development of other devices of industrial hygienic importance and the development of devices for maintaining artificial respiration over long periods and for enabling men trapped in submerged submarines to reach the surface safely, all called respirators, was responsible for the confusion. The Bureau of Mines suggests that the term "respirator" be retained for all of these devices, but that respiratory protective devices of industrial hygienic importance be called industrial respirators and that the different kinds of industrial respirators be assigned a name which will indicate their operating principle or field of use or both. Satisfactory names in common use should be retained. On this basis, the Bureau of Mines suggests the following classification for respiratory protective devices of industrial hygienic importance:

Industrial Respirators

1. Supplied-Air Respirators
   - a. Self-contained type
     - (1) Oxygen breathing apparatus[a]
   - b. Hose type
     - (1) Hose mask
     - (2) Air-line respirator[b]
     - (3) Abrasive blasting respirator[c]
2. Air-Purifying Respirators
   - a. Chemical filter respirator[d]
     - (1) Acid gas or type A[e] chemical filter respirator
     - (2) Organic vapor or type B[e] chemical filter respirator
     - (3) Ammonia or type C[e] chemical filter respirator
     - (4) Carbon monoxide or type D[e] chemical filter respirator
   - b. Mechanical filter respirator[f]
     - (1) Dust or type A[g] mechanical filter respirator
     - (2) Fume or type B[g] mechanical filter respirator
     - (3) Mist or type C[g] mechanical filter respirator
   - c. Chemical and mechanical filter respirator[h]

Testing and Approving of Industrial Respirators by the U. S. Bureau of Mines

Since its organization the U. S. Bureau of Mines has been interested in industrial respirators as a means of protecting workers in the mineral industry against harmful atmospheric contaminants. To this end the Bureau has developed an approval system, the purposes of which are: (1) To encourage and aid manufacturers in the development and marketing of safe and suitable equipment; and (2) to encourage the consumer to use such equipment, to aid him in obtaining it and to instruct him in its usage. These purposes are accomplished by establishing a schedule of the material and performance requirements that a safe and suitable device should meet; by making approval tests for conformance to such a schedule; and by informing the public of the

[a] Sometimes called mine rescue breathing apparatus.
[b] Sometimes called paint-spray respirator or positive pressure respirator.
[c] Sometimes called sand-blast helmet or hood.
[d] Commonly called gas mask.
[e] Letters assigned to canisters of chemical filter respirators. See U. S. Bureau of Mines Approval Sched. 14D, Procedure for Testing Gas Masks for Permissibility, 17 pp., 1935.
[f] Commonly called respirator. Sometimes referred to as dust respirator or mechanical filter-type respirator.
[g] Letters assigned to mechanical filter respirator filters. See U. S. Bureau of Mines Approval Sched. 21, Procedure for Testing Filter-Type Dust, Fume, and Mist Respirators for Permissibility, 14 pp., 1934.
[h] The devices now referred to as Type N or All Service Gas Mask and the chemical cartridge respirator fall under this heading.

advantages in the use of devices bearing Bureau of Mines approval. If the device is found by examination and test to meet the requirements of the schedule the Bureau of Mines gives the manufacturer a certificate of approval which he may display as evidence of the quality of his product. The approved devices are marked in a manner which clearly distinguishes them and indicates the purpose for which they are approved and the limitations under which they may be used. As an aid to the consumer, the Bureau of Mines periodically issues a list of the devices which have met the requirements.

The submission of equipment is entirely voluntary on the part of the manufacturer. On making application for tests, the manufacturer deposits a fee which is turned into the miscellaneous receipts of the treasury of the United States; none of the money accrues to the Bureau of Mines. The approval system is motivated entirely by the desire of the manufacturers to produce and market good equipment, the interest of the Bureau of Mines in having safe equipment available commercially, and the demand of the consumer for such equipment.

Approval schedules have been issued for oxygen breathing apparatus,[1] chemical filter respirators or gas masks,[2] hose masks[3] and mechanical filter respirators.[4] The schedule covering hose masks is being revised to include the other kinds of supplied-air respirators, namely, air-line and abrasive-blasting respirators. When this revision is completed, the Bureau of Mines will have approval schedules for all types of respirators now in common use. The approval system undoubtedly is largely responsible for the development of fundamentally safe and suitable devices, and the elimination of confusion in their selection and use.

The general plan of the various schedules is similar. The requirements may be divided into 3 parts:

(1) Pre-test requirements, or those with which the manufacturer must comply before examination and test of a device will be undertaken. For example, the respirator must be in a fully developed form ready for market and available for purchase if approval is granted. Also, the manufacturer must be prepared to test and maintain control of the essential characteristics of his device by a method which meets the approval of this Bureau.

(2) Material, construction, and performance requirements which the equipment must meet by examination and test.

(3) Post-test requirements, or those with which the manufacturer must comply after the device is approved. From the viewpoint of the consumer the most important of these concern labeling and marking, provision of adequate instructions for proper use of the device, and maintenance of design and quality of the product marketed under the approval. As a check on the latter, the Bureau of Mines obtains samples of the device on the open market and subjects them to the various inspections and tests of the appropriate schedule. The Bureau reserves the right to withdraw its approval of any device for cause.

Interpretation of U. S. Bureau of Mines Approval Schedule 21, Procedure for Testing Filter-Type Dust, Fume, and Mist Respirators for Permissibility

Among the reasons for the development of Schedule 21, Procedure for Testing Filter-Type Dust, Fume, and Mist Respirators for Permissibility, was the realization by the Bureau of Mines and others that there was a definite need for mechanical filter respirators to protect workers against harmful atmospheric particulate matter in situations where better methods of control of dust production and removal were either not available or practical, the inefficiency of existing mechanical filter respirators, and

[1] Bureau of Mines, Procedure for Establishing a List of Permissible Self-Contained Oxygen Breathing Apparatus; Fees, Character of Tests, and Condition Under which Mine Rescue Breathing Apparatus will be Tested: Sched. 13A, January 21, 1930, 12 pp.
[2] Bureau of Mines, Procedure for Testing Gas Masks for Permissibility: Sched. 14D, May 9, 1935, 17 pp.
[3] Bureau of Mines, Procedure for Testing Hose Masks for Permissibility: Sched. 19, April 28, 1927, 8 pp.
[4] Bureau of Mines, Procedure for Testing Filter-Type Dust, Fume, and Mist Respirators for Permissibility: Sched. 21, August 20, 1934, 14 pp.

requests from manufacturers and consumers that this bureau test and approve such devices.

Schedule 21 follows the general plan of the other bureau approval schedules for industrial respirators; the pre-test and post-test requirements are quite similar, and the general principles of the test requirements are the same. The primary purpose of this paper is to explain the reasons for the various test requirements.

Pre-Test Requirements

The pre-test requirements of Schedule 21 require that the manufacturer submit information, drawings, and samples of the device to be tested. The device must be completely developed and ready for release to the public, and the device when tested by the manufacturer or his agent must have passed tests of the nature described in Schedule 21. The reasons for the third requirement are: (1) To assure the bureau that the manufacturer is prepared to control the filtering characteristics of his respirator; (2) to eliminate any question of competition with private consulting agencies in developing respirators; (3) to furnish evidence that the respirator really is ready *for release* to public market; and (4) to save the manufacturer's and the Bureau's time. After the manufacturer has complied with all the above pre-test requirements he must submit a fee for the examination and test of his device. This fee is turned into the miscellaneous funds of the U. S. treasury and none of the money reverts to the Bureau of Mines.

Test Requirements

In developing the tests for mechanical filter respirators consideration was given first to the general requirements for a safe and suitable device. These requirements are similar for all types of industrial respirators. The respirator must (1) give adequate protection, (2) be reasonably comfortable and physically convenient to wear, and (3) provide an acceptable service life.

Adequate protection implies that the mechanical filter respirator when properly maintained and worn must prevent the wearer from breathing enough particulate matter to cause a *harmful* physiological response under the conditions of occupational exposure for which it is designed to be used.

Comfort and physical convenience factors are equal in importance to adequate protection. Even though aware of the ultimate serious effect which will be produced after prolonged daily exposure, workmen are inclined to be *diffident and unwilling* to suffer much daily inconvenience and discomfort from the respirator.

Encumbrance and discomfort also increase fatigue, cause distraction, and in general handicap the wearer's ability to take care of himself, thus increasing the possibility of accident. Important specific items include the weight of the respirator, its carriage on the face or head, effect on vision, heating of the area of the skin under the facepiece, inability to expectorate, difficulty in talking, and resistance to breathing. The importance of comfort and physical convenience cannot be over estimated.

The service life involves elements of practicability in the wearing and maintenance of the device, and indirectly the safety. This type of respirator is primarily not an emergency device, but a part of the workman's equipment for doing his regular job safely. If the service life is short, the bother of changing of filter elements will be reflected in the workman's attitude toward good maintenance and use.

All mechanical filter respirators are subjected to certain inspections and tests and they must fulfill certain requirements. The general design and construction, particularly as to facial fit, freedom from irritating facial contacts, weight, effect on vision and the wearing of goggles, and ease of changing filter elements, and examined. The materials are examined to determine if they are *obviously suited* for the purpose for which they are designed. Rubber parts which come in contact with the skin must not contain any skin-irritating constituent.

Resistance to Air Flow Requirements

The requirements for resistance to air flow are the same for all approved mechanical filter respirators. At no time during or after the filter efficacy testing period must the resistance to air being drawn through the device at the rate of 85 liters (3 cubic feet) per minute exceed 50 millimeters (1.97 inches) of water column height or the resistance to air being blown through the device at the same rate of flow exceed 25 millimeters of water column height. An air flow of 85 liters *per minute is approximately equivalent to the respiratory rate of a man doing heavy* work. The amount of particulate matter pulled to the device during the filter efficacy tests is roughly equivalent to the amount that would be pulled to the filter by a worker wearing the mechanical filter respirator in a moderately concentrated suspension of the particulate matter during an 8-hour period. Thus resistance to air flow of an approved mechanical filter respirator should not become excessive when worn for an 8-hour period in most suspensions of atmospheric particulate matter encountered in industry. The manufacturer is required to give instructions on cleaning or changing the filter elements when the resistance to air flow noticeably increases.

Direct Leakage and Man Test

All mechanical filter respirators are subjected to a direct leakage and man test to determine facial fit, whether there is any direct leakage of unfiltered air, and to obtain information on the comfort of the device. Three of the mechanical filter respirators are worn for 30 minutes by 3 men with different facial features in an atmosphere containing a heavy suspension of bituminous-coal dust. At the end of the period the respirators are removed and that part of the face covered by the facepiece is examined for evidence of any leak under the edge of the facepiece. Sticks a millimeter thick were wedged under the edges of the facepieces worn by subjects A and C to cause the leaks. The location and approximate magnitude of the leaks are shown by the black streaks on that part of the face covered by the edges of the facepieces. The nasal passages and sputum of the subjects are also examined before and after the tests.

Filtering-Efficacy Tests

In the development of the filtering-efficacy tests, particular attention was given to the physical properties, especially particle size, of the significant kinds of atmospheric particulate matter encountered in industry. Previous studies of filtering *materials had shown that, in general, filtering efficacy decreases with a decrease in* particle size.

It was decided that most of the significant industrially generated atmospheric particulate matter could be classified into the following three groups in accordance with method of generation, physical state, and particle size:

1. *Mechanically generated dusts* resulting from the disintegration of a solid, such as the dust clouds produced in the various processes of mining, quarrying and *tunneling and the grinding*, crushing, and general processing of solid materials. This type of atmospheric particulate matter is referred to as Type A atmospheric particulate matter and mechanical filter respirators designed to furnish protection against these suspensions are referred to as Type A mechanical filter respirators.

2. *Fumes* of various metals (usually their chemical compounds, as oxides or carbonates) such as lead, mercury (except mercury vapor) manganese, magnesium, aluminum, antimony, arsenic, copper, chromium, iron, cadmium, and zinc resulting from sublimation or the condensation of their vapor, or from the chemical reactions between their vapor and gases. This type of atmospheric particulate matter is referred to as Type B atmospheric particulate matter and mechanical filter respirators designed to furnish protection against these suspensions are referred to as Type B mechanical filter respirators.

3. *Mists* as produced by spray-coating with paint and vitreous enamels, chromic acid mist as produced in chromium plating, and other mists of materials whose liquid vehicle does not produce harmful gases or vapors. This type of atmospheric particulate matter is referred to as Type C atmospheric particulate matter and mechanical filter respirators designed to furnish protection against these suspensions are referred to as Type C mechanical filter respirators.

The mechanically generated dusts and fumes consist of solid particles while the mists consist of liquid or liquid-coated solid particles. The particle size of mechanically generated dusts extends over a wide range, in some cases, from particles visible to the naked eye probably down to molecular dimensions. The range in particle size of fumes is much smaller. The upper limit is in the lower microscopic

range (about 0.5 micron), while the lower limit probably approaches molecular dimensions. The particles of some fumes, particularly zinc and magnesium, readily join and form large flocklike clusters. The effect is least pronounced in the case of lead. Mist particles are spherical and probably more uniform in particle size than those of dusts and fumes.

Suspensions of each of the types of industrially-generated atmospheric particle matter were selected for use in the filtering-efficacy tests. These suspensions were chosen on the basis of their industrial hygienic significance and their physical properties, such as particle-size distribution and tendency to aggregate, which have an appreciable effect on filtration. It was desired to test the mechanical filter respirators against the most common or widespread harmful suspensions of each type; the test suspensions to have physical properties, such as particle size and aggregation tendency, which would render them as difficult to remove by filtration as any other suspension of the same type. The test suspensions selected are:

(a) For testing Type A mechanical filter respirators or those designed to furnish protection against mechanically generated dusts a suspension generated from very fine (99+ per cent through 325 standard mesh sieve) silica dust consisting of 99+ per cent free silica (SiO_2) is used. The suspension is generated in such a way that all particles larger than about 3 microns are removed before the suspension enters the test chamber. The particle-size distribution of the test suspension must not exceed a geometric mean of 0.6 micron and a standard geometric deviation of 1.90. The particle-size determination is made by collecting samples of the suspension by the Owens jet dust counter and determining the particle size distribution by a microprojection method developed by the Bureau of Mines.[4]

(b) For testing Type B mechanical filter respirators or those designed to furnish protection against fumes, a lead oxide fume generated by the combustion of natural gas containing lead tetraethyl vapor is used. The particles of this fume are extremely small and have about the least tendency to aggregate of any fume, hence they are very difficult to remove from the air by mechanical filtration. A suspension of magnesium oxide is also used to determine the effect of a fume, whose particles readily aggregate in large clusters, on the resistance to air flow of the filter of the device.

(c) For testing Type C mechanical filter respirators or those designed to furnish protection against mists, three different suspensions are used. Chromic acid mist generated by electrolyzing an aqueous solution of chromic acid, as is done in industrial chromium plating; lead paint mist generated by spray-coating with lead paint; and a water mist carrying silica dust generated by spraying a 2 per cent aqueous suspension of silica dust are used. The water-mist carrying silica dust is used to simulate the mists generated in spray-coating with vitreous enamels.

The concentration of the particulate matter in the test suspensions was chosen to represent more or less the higher concentrations found in industry. Since the concentration of mechanically generated dust found in industry varies over such wide limits it was decided to test Type A mechanical filter respirators against two concentrations; one to represent the more or less average dusty industrial conditions, and the other to represent very dusty conditions.

The complete mechanical filter respirator is tested on a mechanical testing apparatus. The test suspension is pulled through the device at the rate of 32 liters (1.13 cubic feet) per minute, continuous flow. The volume of air pulled through the mechanical filter respirator is 10 cubic meters in all cases except in some tests against particular kinds of suspensions as mechanically generated lead dusts and in the high-silica dust-concentration test and the magnesium oxide test whose primary object is to determine the increase in resistance to air flow of the filter with the amount of particulate matter retained. Ten cubic meters is approximately equivalent to the volume of air breathed by a worker in 8 hours. The samples of particulate matter for concentration determinations are precipitated electrically from the air of the test suspension both before and after it has passed through the mechanical filter respirator. The samples are collected in containers which can be weighed readily on an analytical balance. For reasons of convenience, speed, and accuracy the samples of silica dust are quantitated by weight rather than by count. Samples of the other particulate matter are quantitated chemically.

[4] Brown, C. E. and Yant, W. P. The Microprojector for Determining Particle Size Distribution and Number Concentration of Atmospheric Dusts. U. S. Bureau of Mines Report of Investigations 3289, 1935.

The requirements as to the amount of particulate matter that the mechanical filter respirators must remove from the air pulled through them is based on the best available information on the concentration of the particulate matter that is safe to breathe. These requirements are subject to change with the accumulation of knowledge on the physiological effects of industrially generated atmospheric particulate matter. In other words, the filtering-efficacy requirement is that the air inhaled by the wearer of such a device must be safe to breathe, and not that the device have any particular percentage filtering efficiency.

Mechanical filter respirators are not approved for any substance more harmful than the particulate matter in the test suspension against which they are tested. Thus Type A respirators are not approved for any substance more harmful than free silica (SiO_2) dust. However, Schedule 21 provides for testing and approving mechanical filter respirators against any kind of industrially generated atmospheric particulate matter. For example, Type A mechanical filter respirators are not approved for protection against poisoning by breathing dusts whose main harmful constituents are metals or their compounds. However, two mechanical filter respirators have been submitted and approved for protection against the inhalation of mechanical generated lead dusts.

Table I summarizes the details of the filtering-efficacy tests and lists the mechanical filter respirators which have been approved to date. (Pages 140-141.)

Post-Test Requirements

The manufacturer of an approved mechanical filter respirator is required to mark his device with the name of his company, the name letter, or number by which the type is designated for trade purposes, and the approval number assigned to the device by the Bureau of Mines; and the filter unit must be marked with the approval number and with the type or kind of atmospheric particulate matter for which it is approved.

The mechanical filter respirator and replacement filter units must be provided with substantial and durable containers. Copies of the approval labels issued to the manufacturer by the Bureau of Mines must be attached to these containers. The approval label gives the approval number, shows to whom the approval is issued, states what the device is and is not approved for, and cautions the wearer to follow the manufacturer's instructions for the use and care of the device.

The following is a sample of the required instructions furnished by the manufacturer. These instructions are similar for all of the approved mechanical filter respirators.

Instructions for Use of Mechanical Filter Respirator

1. Respirators will not protect unless placed on the face properly each time they are worn. Carelessness in face-fit means dangerous leakage. In general, a better fit is obtained if the mask is worn not too high on the nose.

2. To fit the respirator to the face hold the respirator, exhaust valve pointing downward, by the metal screw connection with either hand, and hold the headstrap with the other hand. Place the facepiece against the face and hold it in place while pulling the headstrap over the head and below the ears. Then adjust the facepiece until a firm snug fit is obtained. The headstrap may be adjusted while the respirator is in place by holding the metal slide between the thumb and forefinger of one hand and pulling on the proper strap with the other hand.

3. To instruct the wearer in the proper adjustment of the headstraps and position of the respirator on the face a cardboard disc is enclosed. To use this disc unscrew the filter bag, place the disc against the felt washer in the metal connection on the felt bag, assemble the respirator, and put it on. The wearer should not be able to breathe through the respirator or feel any inward leakage of air under the edges of the facepiece.

The presence or absence of dust streaks on the face inside the line of fit of the facepiece after wearing the respirator in a dusty atmosphere can also be used to tell whether a proper fit was obtained.

4. The recommended procedure for cleaning the filter bag is to insert loosely the nozzle of a high-pressure air hose into the bag opening and to blow several

range (about 0.5 micron), while the lower limit probably approaches molecular dimensions. The particles of some fumes, particularly zinc and magnesium, readily join and form large flocklike clusters. The effect is least pronounced in the case of lead. Mist particles are spherical and probably more uniform in particle size than those of dusts and fumes.

Suspensions of each of the types of industrially-generated atmospheric particle matter were selected for use in the filtering-efficacy tests. These suspensions were chosen on the basis of their industrial hygienic significance and their physical properties, such as particle-size distribution and tendency to aggregate, which have an appreciable effect on filtration. It was desired to test the mechanical filter respirators against the most common or widespread harmful suspensions of each type; the test suspensions to have physical properties, such as particle size and aggregation tendency, which would render them as difficult to remove by filtration as any other suspension of the same type. The test suspensions selected are:

(a) For testing Type A mechanical filter respirators or those designed to furnish protection against mechanically generated dusts a suspension generated from very fine (99+ per cent through 325 standard mesh sieve) silica dust consisting of 99+ per cent free silica (SiO_2) is used. The suspension is generated in such a way that all particles larger than about 3 microns are removed before the suspension enters the test chamber. The particle-size distribution of the test suspension must not exceed a geometric mean of 0.6 micron and a standard geometric deviation of 1.90. The particle-size determination is made by collecting samples of the suspension by the Owens jet dust counter and determining the particle size distribution by a microprojection method developed by the Bureau of Mines.[4]

(b) For testing Type B mechanical filter respirators or those designed to furnish protection against fumes, a lead oxide fume generated by the combustion of natural gas containing lead tetraethyl vapor is used. The particles of this fume are extremely small and have about the least tendency to aggregate of any fume, hence they are very difficult to remove from the air by mechanical filtration. A suspension of magnesium oxide is also used to determine the effect of a fume, whose particles readily aggregate in large clusters, on the resistance to air flow of the filter of the device.

(c) For testing Type C mechanical filter respirators or those designed to furnish protection against mists, three different suspensions are used. Chromic acid mist generated by electrolyzing an aqueous solution of chromic acid, as is done in industrial chromium plating; lead paint mist generated by spray-coating with lead paint; and a water mist carrying silica dust generated by spraying a 2 per cent aqueous suspension of silica dust are used. The water-mist carrying silica dust is used to simulate the mists generated in spray-coating with vitreous enamels.

The concentration of the particulate matter in the test suspensions was chosen to represent more or less the higher concentrations found in industry. Since the concentration of mechanically generated dust found in industry varies over such wide limits it was decided to test Type A mechanical filter respirators against two concentrations; one to represent the more or less average dusty industrial conditions, and the other to represent very dusty conditions.

The complete mechanical filter respirator is tested on a mechanical testing apparatus. The test suspension is pulled through the device at the rate of 32 liters (1.13 cubic feet) per minute, continuous flow. The volume of air pulled through the mechanical filter respirator is 10 cubic meters in all cases except in some tests against particular kinds of suspensions as mechanically generated lead dusts and in the high-silica dust-concentration test and the magnesium oxide test whose primary object is to determine the increase in resistance to air flow of the filter with the amount of particulate matter retained. Ten cubic meters is approximately equivalent to the volume of air breathed by a worker in 8 hours. The samples of particulate matter for concentration determinations are precipitated electrically from the air of the test suspension both before and after it has passed through the mechanical filter respirator. The samples are collected in containers which can be weighed readily on an analytical balance. For reasons of convenience, speed, and accuracy the samples of silica dust are quantitated by weight rather than by count. Samples of the other particulate matter are quantitated chemically.

[4] Brown, C. E. and Yant, W. P. The Microprojector for Determining Particle Size Distribution and Number Concentration of Atmospheric Dusts. U. S. Bureau of Mines Report of Investigations 3289, 1935.

The requirements as to the amount of particulate matter that the mechanical filter respirators must remove from the air pulled through them is based on the best available information on the concentration of the particulate matter that is safe to breathe. These requirements are subject to change with the accumulation of knowledge on the physiological effects of industrially generated atmospheric particulate matter. In other words, the filtering-efficacy requirement is that the air inhaled by the wearer of such a device must be safe to breathe, and not that the device have any particular percentage filtering efficiency.

Mechanical filter respirators are not approved for any substance more harmful than the particulate matter in the test suspension against which they are tested. Thus Type A respirators are not approved for any substance more harmful than free silica (SiO_2) dust. However, Schedule 21 provides for testing and approving mechanical filter respirators against any kind of industrially generated atmospheric particulate matter. For example, Type A mechanical filter respirators are not approved for protection against poisoning by breathing dusts whose main harmful constituents are metals or their compounds. However, two mechanical filter respirators have been submitted and approved for protection against the inhalation of mechanical generated lead dusts.

Table I summarizes the details of the filtering-efficacy tests and lists the mechanical filter respirators which have been approved to date. (Pages 140-141.)

Post-Test Requirements

The manufacturer of an approved mechanical filter respirator is required to mark his device with the name of his company, the name letter, or number by which the type is designated for trade purposes, and the approval number assigned to the device by the Bureau of Mines; and the filter unit must be marked with the approval number and with the type or kind of atmospheric particulate matter for which it is approved.

The mechanical filter respirator and replacement filter units must be provided with substantial and durable containers. Copies of the approval labels issued to the manufacturer by the Bureau of Mines must be attached to these containers. The approval label gives the approval number, shows to whom the approval is issued, states what the device is and is not approved for, and cautions the wearer to follow the manufacturer's instructions for the use and care of the device.

The following is a sample of the required instructions furnished by the manufacturer. These instructions are similar for all of the approved mechanical filter respirators.

Instructions for Use of Mechanical Filter Respirator

1. Respirators will not protect unless placed on the face properly each time they are worn. Carelessness in face-fit means dangerous leakage. In general, a better fit is obtained if the mask is worn not too high on the nose.

2. To fit the respirator to the face hold the respirator, exhaust valve pointing downward, by the metal screw connection with either hand, and hold the headstrap with the other hand. Place the facepiece against the face and hold it in place while pulling the headstrap over the head and below the ears. Then adjust the facepiece until a firm snug fit is obtained. The headstrap may be adjusted while the respirator is in place by holding the metal slide between the thumb and forefinger of one hand and pulling on the proper strap with the other hand.

3. To instruct the wearer in the proper adjustment of the headstraps and position of the respirator on the face a cardboard disc is enclosed. To use this disc unscrew the filter bag, place the disc against the felt washer in the metal connection on the felt bag, assemble the respirator, and put it on. The wearer should not be able to breathe through the respirator or feel any inward leakage of air under the edges of the facepiece.

The presence or absence of dust streaks on the face inside the line of fit of the facepiece after wearing the respirator in a dusty atmosphere can also be used to tell whether a proper fit was obtained.

4. The recommended procedure for cleaning the filter bag is to insert loosely the nozzle of a high-pressure air hose into the bag opening and to blow several

TABLE 1. DETAILS OF FILTERING EFFICACY TESTS AND LIST OF APPROVED MECHANICAL FILTER-TYPE RESPIRATORS

Kind of mechanical filter-type respirator	Industrially generated atmospheric particulate matter against which the device is designed to furnish protection	Test suspensions used	Concentration of test suspension, milligrams[a] per cubic meter[b] of air	Volume of test suspension pulled through the device, cubic meters[c]	Maximum amount of particulate matter permitted to pass through the device: Milligrams	Maximum amount of particulate matter permitted to pass through the device: Milligrams per cubic meter of air	Name and manufacturer of mechanical filter-type respirators approved to date, September 25, 1934
Type A	Mechanically generated dusts resulting principally from the distintegration of a solid, such as the dust clouds produced in mining, quarrying and tunneling, and the industrial operations of grinding, crushing, and processing of minerals	Air-suspended ground flint, which consists of 99+ percent free silica (SiO_2). Over 99 percent of the dust passes through 325-mesh standard sieve	(a) 50 ± 10[d]	2.86	4 mg. for any 1 of 3 devices, or an average of 3 mg. for each of the 3 devices	1.0[d]	M.S.A. Comfo Respirator. Approval No. 2101, issued to Mine Safety Appliances Co. Willson Bag Respirator No. 300. Approval No. 2102, issued to Willson Products, Inc.
			(b) 5 ± 2[d]	9.98	12 mg. for any 1 of 3 devices, or an average of 10 mg. for each of the 3	1.0[d]	Willson Bag Respirator No. 100. Approved No. 2103, issued to Willson Products, Inc.[e] Pulmosan M-15 Pouch-Type Filter Respirator. Approval No. 2104, issued to Pulmosan Safety Equipment Corp. Biever Respirator. Approval No. 2105, issued to Standard Safety Equipment Co.
Type B	Fumes of various metals (usually their chemical compounds, as oxides or carbonates) such as lead, mercury (except mercury vapor), manganese, copper, chromium, iron, cadmium, zinc, magnesium, aluminum, antimony, and arsenic resulting from sublimation or condensation of their vapor, or from chemical reactions between their vapor and gases	(a) Lead oxide fume produced by the decomposition and combustion of lead tetraethyl	15 ± 5 of lead	9.98	1.5	0.15	Willson Bag Respirator No. 4. Approval No. 2106, issued to Willson Products, Inc.[e]
		(b) Magnesium oxide fume, freshly produced by burning magnesium ribbon	100 ± 25	2	—	—	
Type C	Mists as produced by spray coating with paint and vitreous enamels, chromic acid mist as produced in chromium plating, and other mists of materials whose liquid vehicle does not produce harmful gases or vapors	(a) Chromic acid mist produced by electrolyzing an aqueous solution (200-500 grams of chromic acid per liter) of chromic acid	15 ± 5 of chromic acid	9.98	1	0.1	M.S.A. Comfo Respirator. Approval No. 2101, issued to Mine Safety Appliances Co.[e]
		(b) Lead paint mist produced by spraying a paint having the following composition: white lead (paste having approximately 91 percent white lead and 9 percent linseed oil by weight), 100 grams; linseed oil, 50 cubic centimeters; and steam-distilled turpentine, 25 cubic centimeters	300-600 of lead	9.98	1.5	0.15	M.S.A. Comfo Respirator not approved for lead containing mists.
		(c) Mist produced by spraying a 2 percent aqueous suspension of ground flint, air-floated (99+ percent through 325 standard mesh sieve). The ground flint consists of 99+ percent free silica (SiO_2).	10 ± 5[d] of silica dust	9.98	5	0.5[d]	M.S.A. Comfo Respirator. Approval No. 2101, issued to Mine Safety Appliances Co.[e]
Mechanically generated lead dusts	Mechanically generated dusts whose main harmful constituent is lead, such as lead dusts generated in manufacturing storage batteries; enameling; pottery making; rubber compounding; sandpapering and chipping painted surfaces; *paintmaking*; preparing litho-transfers; and mining, milling and processing lead ores	Mixture used in making negative plates of lead storage batteries. Contains 72 percent litharge, PbO; 25 percent red lead, Pb_3O_4; and 3 percent lampblack	15 ± 5 of lead	2.88	0.43	0.15	M.S.A. Comfo Respirator with special filters for lead dust. Approval No. 2107, issued to Mine Safety Appliances Co.[e] Willson Bag Respirator No. 400L. Approval No. 2108, issued to Willson Products, Inc.[e]

[a] One milligram = 0.0154 grain.
[b] One cubic meter = 35.315 cubic feet.
[c] Rate of sampling = 32 liters (1.13 cubic feet) per minute.
[d] One milligram of this silica dust contains approximately 300 million particles as determined by the impinger method as described by the U. S. Public Health Service. Hence, 1 milligram per cubic meter of this dust is approximately equivalent to 8.5 millions of particles per cubic foot.
[e] See previous listing of company for complete address.

short blasts of air into the bag. This procedure removes from the bag dust and grit which clogs the pores of the filter and makes breathing difficult. The proper time for cleaning the bag is when the wearer experiences discomfort in breathing. When compressed air is not available some dust may be removed by tapping the bag lightly and brushing the outside of the bag.

5. To prevent irritation of the skin and for general sanitary purposes the respirator should be cleaned after each day's use. The rubber and metal parts may be cleaned with soap and water, and for general sterilization they may be dipped in a 3 per cent solution of carbolic acid, a 2 per cent solution of lysol, or a 70 per cent solution of denatured alcohol, then rinsed with water, assembled, and hung up by the loop in the felt bag to dry. The filter bag and headstrap always must be removed before the respirator is washed or sterilized.

6. While not in use the respirator should be kept in a dust-free place, preferably in the original container.

The manufacturer is required to maintain the quality of his product and to see that each mechanical filter respirator in all its parts is constructed according to the drawings or records that have been accepted by the Bureau for this device and that are in the Bureau's files. Mechanical filter respirators that exhibit changes in design or include any parts that have not been approved are not permissible respirators and must not bear the Bureau's approval label. Schedule 21 provides for the manufacturer to apply for an extension of approval on any change in the mechanical filter respirator which does not affect the filtering characteristics of the filter. Changes in the filter require the application for a new approval.

The Bureau obtains information on the maintenance of design and quality of approved mechanical filter respirators by testing samples of the devices obtained on the open market. The Bureau reserves the right to rescind for cause any approval issued.

A Safety Style Show

By E. J. SMITH

Safety and Health Director, Western Electric Company Hawthorne Works, Chicago

For the purpose of assisting our foremen in the selection of the proper safety equipment we have standard specifications and every foreman has a copy. In it he will find the protective equipment required for any class of work.

Molders, cupola tenders, furnace tenders and helpers in foundry and forge are equipped with heavy duty metal or composition cup goggles with hardened lenses. The lenses in the furnace tender's goggles are of a forge and furnace shade. Electric furnace tenders, however, wear a welder's goggle, described later. When a goggle is equipped with clear lenses, it is used for such operations as breaking defective castings, cleaning castings with compressed air, grinding castings to remove gates or fins, pounding on castings to remove sand cores, pouring molten metal into molds with hand or bull ladles, removing gates or fins from castings with air chisels, or hand chisels and hammers, and working in vicinity of chipping hammers.

Leggings are of the non-lacing, non-buckling and snap buttoning type held in place by hidden steel springs similar to the old bicycle pants guard. They will come off instantly from a tug at any point. There are no gadgets to confuse you or those who are trying to help you in an emergency. Just one simple thing to remember—grab anywhere and pull.

Men wear safety hats when chipping slag out of cupolas. Our construction crews of masons, carpenters, millwrights, and so on, wear them whenever they are engaged in work where there is the slightest chance of objects falling from overhead.

Our employees wear "Congress" safety shoes for their protection in addition to the leggings.

We use a leather steel faced glove when charging a cupola or handling pig iron.

Full leather palm gloves with band top are used in chipping casting fins, loading and unloading tumbling barrels, and removing castings from sand.

For the protection of health, workers in the brass foundry are provided with overalls and undershirts with full length sleeves. This is in accordance with Illinois

labor laws. At the termination of a shift molders take shower baths on company time. Workers in this classification are provided with two lockers, one for working clothes and the other for street clothes.

For protection against solid non-volatile particles suspended in air men cleaning inside of a cupola are provided with respirators.

Incidentally, our supervisors make periodic inspection of respirators and other safety equipment to insure that they have not become worn, damaged, or deteriorated to such an extent that they no longer provide adequate protection. Special precautions are also taken to see that cracked, broken, or pitted lenses in goggles are not used, leggings are not worn threadbare nor with torn places so as to permit molten metal to get into the upper portion of the shoe and Congress shoe soles are not worn through, nor upper torn outside the area covered by leggings.

Employees operating woodworking machines are required to wear goggles, when, in the opinion of the supervisor there *is* the slightest eye hazard present. Goggles are mandatory on all tool grinding operations.

The hands of all employees handling rough lumber on machines such as swing saws, rip saws, molders, automatic and glue jointers are protected against cuts, scratches, and slivers with leather-palm canvas gloves.

Those engaged in shellac dipping operations are supplied with rubber gloves.

The fingers of employees gluing wooden parts are protected with finger cots.

The personal clothing of employees dipping parts in shellac or spraying parts is protected with overalls.

In the manufacture of rubber and in other operations our supervisors instruct employees in the proper manner in which equipment is to be worn to insure the greatest possible protection.

When mixing rubber compound, sifting or handling sulphur or powdered shellac, cleaning dust collectors, sacking powdered rubber, breaking rubber scrap, blowing soapstone and sandblasting rubber parts, our employees wear heavy duty cup type goggles. They protect against large heavy particles, severe impacts and high dust concentrations.

When handling india-rubber yellow or vermilion, or cleaning brass equipment in an acid dip tank our men wear light acid gloves

Gauntlet gloves are worn when mixing shellac or rubber compounds containing poisonous substances on milling rolls. They are also used in handling hot molds subsequent to vulcanizing operations.

The type of respirator, named before, is also worn when mixing rubber compound containing a high percentage of hard rubber powder, handling sulphur, sifting powdered shellac and in the performance of other work, where harmful kinds of dust and material are encountered.

A special goggle is used to protect against sprayed or splashed corrosive solutions and irritating liquids.

Undershirts and overalls are also furnished for platers and acid dippers. Protective clothing is laundered weekly.

Rubber gauntlet gloves are worn by those engaged in all plating and dipping operations.

Wooden soled shoes are well known in plating circles. The kind we use, however, are equipped with safety toe caps.

Rubber aprons are worn whenever acid is changed or tanks are cleaned.

All arc welding at Hawthorne is performed inside special enclosures. Welders, helpers, and others in the welding booth are provided with eye and face protection and safety clothing which, with their personal apparel, affords complete protection from the heat and the rays of the arc.

Protective goggles are worn under the helmet. They protect the eyes against an unintentional flash which sometimes occurs while men are arranging their work with the helmet in the up or overhead position.

The arms, hands, body, and feet of welders are protected with such clothing as tanned leather gloves, tanned leather sleeves, chrome leather aprons, chrome tanned leather leggings, jumpers.

Periodic inspection is made of this equipment too. Special precautions are taken with masks to insure that they do not leak light, cover glasses are not broken or cracked, colored lenses are protected by cover glasses, cover glasses are replaced

if burned or pitted so that vision is affected, and fibre is not bruised nor broken.

In lathe, millings, shaping, and similar machine operations our employees wear the light duty type of goggle. When side protection is required from materials thrown from neighboring machines goggles with side screens are worn.

When acetylene welding or cutting, a goggle with shade No. 8 is generally used. It is also equipped with a cover glass.

Although shoes are not furnished by the company, every effort is made to encourage employees to wear safety shoes. This shoe is equipped with a safety steel toe cap which will withstand 1,950 pounds before deflecting one-quarter of an inch.

Rough chrome soles are worn in our rod mill and other places where drawing compounds or oil are encountered.

Sandblasters wear the same white acid gloves as that worn by platers. Incidentally, we stock and order the right and left as separate items because the right hand glove wears out much faster.

They also wear flame proof sleeves.

On most grinding operations we use a goggle with screened sides. On lighter operations, where no side protection is required we use the light duty goggle.

All men at Hawthorne working at a height of ten feet or more above the floor are required to wear life belts. For seven years not one occasion occurred to bring a life belt into play. In the eighth year, however, a 210-pound apprentice, equipped with a safety belt and life line, was working on a scaffold twenty feet above the ground dismantling a gas holder when one of the hooks failed. His body dropped a matter of inches when his safety belt came into play.

To prevent callouses forming on fingers men who lay out the lines or form the harness for switchboards wear special gloves. To facilitate dexterity the glove fingers are cut off wherever protection is not needed.

We use a canton flannel glove for removing hot work from plastic material molds and die casting machines.

Rolling mill operators in our copper rod mill wear puttees for protection against hot rod stock. The copper sheathing on the inner side is put on by us. It affords additional protection when men straddle the rod as it comes through the rolls.

Where men lift heavy objects such as pig load from one pit to another or load them on to a truck, foot guards are provided.

Because of the tripping hazard presented by the foot guards themselves, their use is restricted to operations entailing a minimum of walking.

We find coveralls which fit over ordinary spectacles, quite useful on certain jobs where goggles are required less than 50 per cent of the time. However, they are much too heavy for constant use. In cases where goggles are required more than 50 per cent of the time for operators who wear spectacles in every day life prescription lens goggles are furnished free of charge.

I want to go back to the subject of goggles to tell how we sold our employees on goggles. We found that most of the complaints were relative to discomfort. After consulting several optical concerns we found that goggles could be fitted to give as much comfort as a pair of spectacles. So we set up a goggle-fitting section in our storeroom and placed in charge an expert who had been trained by one of the optical companies. Our present practice is for the individual to visit the storeroom himself and have them fitted by this expert. Our complaints now are few.

We ran into another snag when we tried to put goggles on our girls, but here we found that the main objection was appearance. There were some complaints on discomfort too. So, in addition to fitting the goggles we designed a different type. It was made much lighter in weight and a forty-two millimetre lens was used with smaller frames. This goggle has a pleasing appearance and has overcome objections. This goggle could not be assigned to our men operators, however, because the male orbit requires at least a forty-six millimetre lens for adequate protection.

The same safety rules apply to women as to men, keeping in mind that we do not employ women on operations entailing contact with acids, oils, or other materials requiring protective clothing. It is an iron clad rule, however, that they must wear goggles on all jobs where there is the slightest eye hazard present. Women working around any kind of revolving machinery are required to wear hair nets.

ADJOURNMENT

Safety in the Small Plant

TUESDAY AFTERNOON SESSION

October 15, 1935

The discussion of safety in the small plant was called to order by Mr. W. Dean Keefer, Chairman, chief engineer and director, Industrial Division, National Safety Council. A small plant was classified as one not employing a safety director. Discussion touched on the following questions:

1. Do we agree that one of the leading plant operating executives must assume leadership in preventing accidents—that he must, among his other duties, perform the duties of a safety director?
2. Who is the best man for the duty of safety director?
3. What are the initial steps in attempting to prevent accidents?
4. If you were limited to one or two accident prevention activities, which one of the following would produce the best results and why? (a) Study of accident records; (b) Inspections; (c) Safeguarding; (d) Safety committees; (e) Posters; (f) Distribution of safety literature; (g) Other employee educational activities; (h) Contests; (i) Rule Books; (j) Discipline; (k) Housekeeping; (l) Fire prevention.
5. What results have been achieved in your plant?
6. How did your plant get started in safety?
7. What point or points would you stress in selling safety to another small plant?

Ten well-known safety engineers led the discussion. These were:

W. J. Brennan, safety engineer, Department of Labor and Industry, Augusta, Maine.

R. A. Bullock, employment manager, Corduroy Rubber Company, Grand Rapids, Mich.

H. T. Howsam, superintendent, Hubbard Spool Company, Chicago.

George W. John, assistant superintendent, Petoskey Portland Cement Company, Petoskey, Mich.

G. A. Kuechenmeister, personnel manager, Dominion Forge and Stamping Company, Walkerville, Ontario, Canada.

J. H. Maguire, works manager, Haynes Stellite Company, Kokomo, Indiana.

Robert L. Schmitt, secretary, Louisville Car Wheel & Railway Supply Company, Louisville, Ky.

H. E. Seely, Insurance Department, the Brunswick-Balke-Collender Company, Chicago.

Carrol Tillotson, machine shop superintendent, Outboard Motor Corp., Milwaukee, Wis.

F. E. Town, superintendent, Manitowoc Portland Cement Company, Manitowoc, Wis.

It was agreed that any small plant starting a safety program should follow some such plan as this:

1. The highest official of the plant must be sold on the value of accident prevention.
2. Someone of high operating authority must take over the responsibilities of safety director in addition to his other duties.
3. A mass meeting of all employees should be held, at which time the highest operating authority should make known the steps that are to be taken to eliminate all accidents in the plant.
4. A safety committee composed of both supervisors and workers should be formed.
5. A safety inspection should be made either by the safety director or by the safety committee and suitable recommendations should be made for the elimination of the hazards found.
6. Past accident experience of the plant should be analyzed for the purpose of ascertaining the number of past injuries, their causes, and methods suitable to prevent their recurrence.
7. Adopt a safety educational program which may include one or more items, such as:
   a. Perfect a method for detecting and correcting unsafe practices of employees.
   b. Preparation and adoption of suitable rule books for the guidance of employees.
   c. Make sure that foremen give verbal instructions to all workers on production and safety.
   d. Hold meetings for the discussion of accident hazards in a given department.
   e. Hold mass meetings for the discussion of accident hazards in the plant as a whole.
   f. Instruction of employees in first aid treatment of injuries.
   g. Proper supervision of workers by their supervisors.
   h. Adoption of suitable means of discipline for violation of safety measures.
   i. Hold safety contests between departments.
   j. Adoption of visual means of safety education, such as posting of safety bulletins, display of photographs of accidents and conditions before and after certain accident prevention measures have been adopted, distribution of safety literature, etc.

ADJOURNMENT

Safety Training

WEDNESDAY AFTERNOON SESSION

October 16, 1935

The session was called to order by the Chairman, C. M. Allen, Staff Supervisor of Safety and Training, The American Rolling Mill Company, Middletown, Ohio, who presided.

Training the Man for the Job

By GEORGE H. FERN

State Director Vocational Education, Austin, Texas

There are but two agencies in which the worker may receive sound training: the school and industry itself. The function of vocational guidance is to assist the individual in ascertaining the type of work to which he is best suited and to select a vocation that is not overcrowded. This selection of the proper life work is highly important and the contented worker is a safe worker. He has no accidents caused by maladjustment. A mind at peace directs rythmic actions. Warden Lewis E. Lawes says that of all the men in Sing Sing, less than 5 per cent have received vocational training. Every mal-content is a potential danger, both to himself and to society.

There is barely a shade of difference between assisting a man to his proper niche in life, and in making him see that that niche, instead of a mere hole in the wall, is the toe-hold by which civilization climbs to undreamed of heights. Two generations ago this problem of personal significance did not exist. A skilled craftsman was himself creator and producer. The cobbler envisioned the shoes he was to make. Under his hands the dream became reality. Now the machine and mass production have reduced much labor to a repetitive process of deadly monotony. Unless a man can envisage the various processes of labor as a whole and see in that whole his contribution to human progress, to the service of mankind, his work will have no purpose, his life no motivating and unifying force. In vocational schools we develop this social-consciousness; we teach the student not only the principles and practices of his trade but the relationship that his trade has to all the arts and sciences.

After this we come to the actual developing of his manipulative skill. In classroom and school shop, there is no pretense made of being able to turn out a highly skilled mechanic. Job experience is necessary to the development of the finished craftsman.

As each step in the manipulative processes of his craft is taught, the student is instructed in the safe way of performing those operations and the dangers to be avoided. He does not advance to a more complicated step until he has mastered the right way and the safe way of doing the simpler steps. Safety is taught not merely as an adjunct to the proper performance of a task, but as an integral part of this performance. No manipulative method is a correct one until it is accomplished with all

possibility of hazard eliminated. Safety is inculcated as a habit and is always incident to good workmanship.

We come now to the part industry plays in the training program. Industrialists are becoming increasily aware of the obligations imposed upon them by a rapidly changing social order and are constantly assuming greater responsibility in regard to the human welfare of their employees. The industrialist of vision knows that the success of his business will be in direct proportion to the developed ability of his workers.

Another logical reason for industry's maintaining its own training programs is one mentioned above, viz., the schools can not graduate skilled mechanics.

Before a man begins his training, he must be selected for a type of work. Here the employment office, by careful selection, can start a man on a trade for which his natural capabilities have fitted him. After he has once started training, if it is discovered that he has little talent for the work, it is wiser to place him immediately into a more suitable trade than to bear the cost of an inefficient and maladjusted worker.

After the man has been selected for training, a few days elapse before he actually begins work. During this interval, the induction period, the first step in training should begin. To the employment officer in larger corporations and the foreman in smaller, is given the responsibility of adjusting the new worker to his environment. This is best begun with a personal interview at which time any printed matter the company may issue relative to working hours, pay days, sickness, accidents, etc. is given. The official may explain, suggest or emphasize whatever is unfamiliar or difficult to the new man. After this he is taken on a tour of the plant that he may know the character of the organization, its departments, processes and products. He is then ready to begin work in his own department, where he is introduced to his fellow workers.

The initial cost of such a procedure is high, but it pays enormous dividends in reducing the hidden cost of errors, loss of time, turnover, confusion and dissatisfaction, as well as the tangible cost of accidents.

The training of the worker has now begun. There are, however, two classifications for training. One is apprentice training; the other is training an employee not under an apprentice contract.

The methods of training an apprentice under contract are identical with those used in training a new worker in regular employment. Experience has proved the best results are obtained from the establishment of the following conditions:

1. Selection of one person definitely responsible for the training. Usually the foreman is the logical choice, but in some cases it may be the superintendent, personnel officer, or some other qualified person.
2. The trainer must be qualified to do the training. He must know how to do the work he is to teach; and he must know how to train the worker efficiently.
3. An organized plan. There must be no haphazard method of teaching, but a definite scheme by which the worker masters the various processes in steps best suited to his learning ability.
4. Adequate time for training. Sufficient time should be given the worker to learn to perform the manipulative processes to meet production requirements.
5. The work to be taught should be ascertained. In case the worker has had some previous experience, he need not go over what he already knows.

Any training program may be divided into three distinct classes: 1. the training of the novice; 2. the training of a man with some job experience; 3. the training of employees for self-improvement or training in modern methods.

Let us assume that the foreman has been selected as the trainer for the first two groups. How shall he go about imparting to the worker the knowledge and skill he himself has already acquired. He first analyzes the methods by which he learned the various processes of his trade. He will discover that he has formed the habit of performing each process with a minimum of time and effort and a maximum of result in both product and safety. If the formation of such work habits has culminated in craftsmanship, then it is highly desirable that these habits be formulated in the worker. How shall these habits be inculcated? Habit formation always follows some very simple rules. These rules may be summarized as follows:

1. The worker must understand just exactly what he is to learn to do.
2. He must know how to do the work and why he does it that way.
3. He must practice the operation correctly from the beginning and never be allowed to do it in any other way.
4. He must be watched so that any fault in his performance may be corrected.
5. His work may be checked from time to time, but from the angle of the learner's performance. A perfect product will not be obtained until he has mastered the process.
6. He must be kept under supervision until the proper work habits become so fixed that they are automatic.

If we regard more closely these habit forming devices the foreman has employed, we can see that he has outlined them according to preparation, presentation, application, and test; or, in the words of the foreman, "tell, show, do, and check". There is no more efficient way yet devised to train a worker in any form of manipulative process and safety is always in direct proportion to proper training. While the training process is being carried on, the foreman must avoid doing a good deal of talking. Too much talking results in confusion. On the other hand, if the foreman neglects to tell all that is necessary to know, much valuable information is lost to the learner. A good trainer tells what he thinks is essential, then gives the worker the opportunity of asking questions.

Every industrial trainer will need some assistance. The imparting of working knowledge to another is an art. The foreman may receive instruction in methods of teaching through Instructor Training conferences, evening classes in Better Foremanship or methods of teaching, or through correspondence courses. The vocational education departments of each state have specialists on their staff to assist.

The only difference between training a new worker and one who has had job experience is that the experienced worker does not need to learn any process he already performs correctly. The obligation, then, of the foreman is to ascertain what habits of skill the worker has that can be utilized on the job; what habits have been weakened from lack of use; what habits have been incorrectly formed and must be relearned; and what habits he lacks that must be learned.

Extension work, the third type of training, is for those trained employees who desire to equip themselves for promotion or to acquaint themselves with new or improved industrial processes.

As extension work is intended for groups of employees, it is taken out of the hands of the individual trainer and put into classes. Several of the larger corporations maintain such classes in their own plants, but in the main, the worker must rely on the classes operated by public school authorities.

These classes are held in public school buildings, in the industrial plant, or wherever facilities for training are available. The classes are organized on a short unit basis and are usually given in the evening. They are so arranged that a series of units will give a complete course covering an occupation or industry. The worker may select an entire course or he may pick what he needs, cafeteria style.

An example of this type of program is found in Texas within the Petroleum industry. This program has been developed by the State Department of Vocational Education in co-operation with the Topical committee of the American Petroleum Institute and the local public schools. A number of unit courses within the production division of the Petroleum industry have been organized and text books prepared. During the past year 5,000 oil field workers, representing 153 different companies, have attended evening classes. This represents 248 separate classes taught by 220 instructors selected from the Petroleum industry.

There is no proper training either in school or in industry which does not involve safety training. The safety director can direct a program of safety, but it is the responsibility of the man training the worker to inculcate such work habits as will preclude risk of accident. Whenever a physician administers a drug, he knows that that drug will have an additional effect upon the body aside from the one for which it was given. This extra effect is called the side-action of the drug. The proper training of the worker likewise has a side-action. Its name is safety.

Training Foremen in Safety

By M. A. CLARK

Manager, Public & Industrial Relations, U. S. Rubber Products, Inc., Detroit, Michigan

The speaker said in part: No two individuals or students or foremen have the same capacities or the same reactions. Therefore, the first principle in developing foremen must be a process of *individual education*, based upon the individual's ability to assimilate, which in turn, is guided somewhat by his previous experience or lack thereof.

The Industrial Relations Director or the Safety Supervisory should work with each foreman as an advisor. Appeals must be made to individuals on the basis of their own characteristics. *These appeals, however*, should not be made first by the Safety Superintendent, but by the Production Superintendent, or the one next in line above the foreman in the organization.

Money and time might well be spent by any superintendent if he would devote an hour a week to every one of his foremen in an informal chat right on the job, discussing *with him accidents that have recently occurred* and studying every job, operator and piece of equipment. He could suggest ways of improving working conditions.

The next step might be made by the Safety Superintendent, who might talk to the foreman of the possibilities of making further improvements in equipment, methods and practices.

The second phase of foreman development is conference and discussion. Accidents, like diseases, respond favorably only to a true diagnosis or analysis. Such diagnosis can best be performed in small groups by those who are directly interested and have first hand knowledge of the industrial conditions within a plant. Most industrialists are today sold on this idea of the conference method of discussion. However, such conference should not be on the general subject of safety, but on a specific type or series of accidents of a recurring nature. As an example, if statistics show that there have been a large number of accidents from falling objects, the conference might devote itself entirely to that subject for one or more meetings.

Each *individual* in the conference should be invited by the chairman to express himself freely and frankly on the subject under discussion. Every effort should be made to analyze not only the cause but also the effect of such accidents and the remedy.

The third phase, that of contact with the employee and with the representative of the factory council, is worthy of thought and consideration. In these days of collective bargaining practically every industry now has some type of workers' committee with which the management deals, and it is around such a plan of employee representation that safety and development of the *supervisory forces in safe practices* can be centralized. The elected American worker who represents his fellowmen can take a great interest in the jobs in which they are engaged; so great, in fact, as to concentrate upon the saving of the lives of those who elected him to his position. Much good has been accomplished and still will be accomplished, by the appointment of safety committees.

Training the New Employee

By G. O. LOCKWOOD

Safety Director, The Empire Companies, Bartlesville, Okla.

I know this training is an important problem to us as safety men from my *own experience* after seeing our safety records ruined for two months by men with less than one month's employment with the company.

Before going into the actual problem of training there are two factors that must be considered. First, the right type of men must be employed; second, foremen must be trained to train. Without good material and without good trainers, no matter how sound the principles upon which our training program is founded, it cannot succeed. In the past when new men were employed, we found that they had possibly more enthusiasm for their work than men with more experience. The problem then was to link this enthusiasm with the proper consideration of safety *and working methods*. I have heard, that this period of unemployment, with its many problems of morale, has dampened this attitude of men towards work. However, in the last few months we have not found this to be true in very many cases.

Working on the assumption that any man who will be given employment within the next few months will be enthusiastic and want to hold his job, the first thing we must consider is *his proper introduction* to the company. This is training. Some of you may have employment or personnel departments charged with this responsibility. With many of us, due to scattered operations, it is impossible for one department to accept this responsibility. In this case it is the duty of the foreman to see that any man new to his group is properly introduced to his job and fellow employees and that he knows something of the workings of the company and the company problems. I believe that before any man goes to work he should know what his company is producing and the place this product has in serving the American people.

And above all, the policy of his new employer on safety should be explained. If there are any safety rules published, these should be given to him with the admonition that they must be studied and analyzed so that they can become a part of his working knowledge when he reports on the job. If the violation of these rules warrants the discharge of an employee *this should be explained completely*. He should not be handed a group of rules and told to read them. The important ones should be explained and emphasized, and in the explanation there should be included the reason for these rules. I know of one company which, in their meetings for new employees, not only explain, but demonstrate the reasons for their fire prevention and accident prevention rules.

If this new man is employed by a personnel or employment department there is another introduction that should be made to the man who will be actually in charge of his work—his new boss. This new boss should tell him what his duties will be, the date of pay day, and what assistance will be given him in learning the *requirements of his job*.

In other words, a new employee should be so introduced and started on his job that he will, at least mentally, fit into the gang. This will tend to raise his immediate efficiency.

If a man is properly introduced to his job and fellow workmen the immediate problem of his morale will be in a great measure solved. Please note "immediate problem." A man's morale is a changeable condition governed by many changing factors and must always be considered as a safety problem. However, this introduction should answer many of the questions common to a new employee and so build up morale.

Sound *judgment* is dependent on the other three factors of the efficiency equation—manipulative skill, job knowledge and related information. Since many accidents are caused by errors in judgment the next problem is improving the employee in these three qualities.

If the three factors—manipulative skill, job knowledge, and related information are to be *continuously developed on the job* there are four teaching steps that should be followed in the following sequence: *telling, showing, testing* and *supervising*.

Telling to give the necessary information to enable a man to understand the demonstration; *Showing* or *Demonstrating* in "slow motion" so that each step will be observed; *Testing* to see that the instructions have been understood and that the practices as demonstrated are remembered; *Supervising* continuously to see that this information is being used and these practices are being followed.

Our experience with training new men has been that the first three steps should be undertaken only by foremen and that the fourth may be executed by an experienced worker, if he is the proper type. Supervising is one of the chief duties of a foreman and if the training through supervision of a new man's work is delegated to an experienced employee the foreman must supervise not the new man so much as the methods used and the habits started by the "Old Head." We have

tried, somewhat successfully, the practice of assigning each new employee to a "buddy." This is a good theory. We all learn, whether or not we are conscious of it, by imitation. By assigning "buddies" we gave this man one man to imitate, one pattern to follow. The chief difficulty in practicing this theory was in finding employees whose working methods could be imitated and at the same time who could and would explain what was going on.

While these four steps are being properly executed we should not lose sight of one question any intelligent and experienced workman will have. This is "why." At the same time the "how" of the job is being demonstrated the "why" should be explained. Without this explanation much of the "how" (manipulative skill and job knowledge) will not be thoroughly appreciated. The "why" corresponds to "related information" in our efficiency equation. The answering of questions of this nature will build up a man's confidence in his instructor and at the same time create a greater interest in his job.

It has been my experience that a large majority of the accidents arising from the actions of new employees were caused by faulty workmanship or errors in judgment and those causative factors that result from a lack of interest. Many of us, I know, have preached safety to deaf ears because we did not excite our hearers with interest. When we give the complete background of safe practices or demonstrate the need of rules these cease to be taken as "edicts of the management," because we have built up employee interest. On the other hand they appeal to the employee concerned as good common sense. This especially applies to new men who are striving to fix new concepts in their minds. The "why" not only makes the "how" more reasonable but helps make the "how" as taught become practical and so more easily remembered.

Another very interesting result, that has been repeated in my experience with new employees, is that due to the supplying of the "why" safety was taken to the job and not to some meeting place.

There is another principle that we should consider and that is that enforcement must back up education. Sometimes it is necessary to impress on the human mind the necessity for the proper use of information through the use of some type of penalty. In our operations the man who does the enforcing is the foreman. If a man is to be laid off or fired the foreman is the man with the authority to take this action. Obviously, if enforcement is a part of education, the enforcer must be the educator. For this reason, as well as others, we rely almost entirely on our supervisory forces to carry on our training program.

In discussing this principle with some other men the statement was made that all foremen are not qualified to serve as trainers. This may be a fact. If it is, one of two conditions prevail, either this man is not fitted to be a foreman or someone, possibly the safety director, has fallen down on the job. We in the Empire Companies have spent considerable time and money in training foremen and are continuing to do so. This is one of the most important of my duties. Our accident record shows that this is as it should be. Where it has been possible to train foremen our accidents have been continuously decreasing. Our trouble, particularly with "green men," has been where we have not been able to include all foremen in the training program organized for them.

What part does the safety director play in the training of men? Again referring to my limited experience I would say that the safety director plays the same part in an industrial training program that the high school principal does in formal educational institutions. His job is not to instruct but to see that the proper methods of instruction are used by the teachers or, in the industrial program, by the foreman-trainers. In addition he must analyze the duties of the various jobs for the purpose of finding the danger points and then work out new methods to eliminate, in so far as possible, these hazards. If this is done in cooperation with the foremen much time will be saved and safety will have an important place in the training and supervising activities.

ADJOURNMENT

Accident Prevention Equipment Manufacturers' Section

Officers 1934-35

Chairman—IRWIN W. MILLARD, President, Industrial Gloves Corporation, Danville, Ill.
Vice-Chairman—GEORGE SHULL, President, Safety First Supply Co., Pittsburgh, Pa.
Secretary—WILLIAM WAHLERT, Pulmosan Safety Equipment Corporation, Brooklyn, N. Y.
Treasurer—L. E. DICKSON, Vice-President, Standard Safety Equipment Company, Chicago, Ill.
Members at Large—
J. T. RYAN, Vice-President, Mine Safety Appliances Co., Pittsburgh, Pa.
F. R. DAVIS, President, Davis Emergency Equipment Co., New York City.
R. T. SOLENSTEN, Vice-President, Elliott Service Co., New York City.
B. W. NUTT, President, Safety Equipment Service Co., Cleveland, Ohio.
Executive Secretary—A. O. BONIFACE, c/o W. J. Parker, Inc., 7 East 44th St., New York City.

BUSINESS SESSIONS

October 13, 1935

The Executive Committee of the Accident Prevention Equipment Manufacturers' Section held its first session during the Congress with I. W. Millard, Chairman, Industrial Gloves Corporation, Danville, Ill., presiding. Following the presentation and acceptance of reports, it was announced that a previously appointed nominating committee had been unable to function, and that the Chairman had appointed a new nominating committee, consisting of: Buell W. Nutt, Chairman, C. H. Galloway, and G. M. Glidden.

This committee presented a slate, and new officers for the Section were elected as follows:

General Chairman—T. A. Willson, Willson Products, Inc., Reading, Pa.
Vice-Chairman—I. W. Millard, Industrial Gloves Corporation, Danville, Ill.
Secretary—F. R. Davis, Davis, Davis Emergency Equipment Co., New York City.
Treasurer—Ed. Wheeler, F. H. Wheeler Manufacturing Co., Chicago, Ill.

It was the consensus of this meeting that there should be coordination between the Accident Prevention Equipment Manufacturers' Section and the Industrial Safety Equipment Association in order to avoid duplication of effort and omission of important activities.

Meetings of October 15 and 16, 1935

With the newly elected chairman, T. A. Willson, presiding, the Executive Committee read and approved the minutes of the last meeting.

C. H. Galloway, B. W. Nutt, J. T. Ryan, George Shull, and R. T. Solensten were appointed directors.

The Secretary was instructed to prepare a simple set of by-laws supplementing the general by-laws to govern the procedure of the Executive Committee—said by-laws to provide that four members shall constitute a quorum.

The following chairmen of committees were appointed to retain office:

Exhibits—B. W. Nutt, Chairman.
Publicity—R. T. Solensten, Chairman.
Safe Practices and Safety Codes—J. T. Ryan, Chairman.
Membership—George Shull, Chairman.

The following additional committees were created and chairmen were appointed as follows:

Activities—I. W. Millard, Chairman.
Programs—C. H. Galloway, Chairman.
Finance—E. L. Wheeler, Chairman.

It was voted to request the Industrial Safety Equipment Association to provide the Section with secretarial services, these services to be paid for quarterly.

ADJOURNMENT.

Accident Prevention Equipment Manufacturers

Who Made Exhibits at the Twenty-Fourth Annual Safety Congress and Exposition

Louisville, Kentucky, October 14-18, 1935

Industrial Exhibit—Brown Hotel

American Abrasive Metals Company, Irvington, New Jersey.
Abrasive Treads for Walkways.

American Air Filter Company, Inc., Louisville, Kentucky.
Air Cleaning and Dust Control Equipment.

American-La France and Foamite Industries, Inc., Elmira, New York.
Fire Protection Equipment Devices.

American Optical Company, Southbridge, Massachusetts.
Head and Eye Protection Products.

Arntzen, Inc., Chicago, Illinois.
Auxiliary Emergency Stretcher and First Aid Equipment.

Barrett-Cravens Company, Chicago, Illinois.
Materials Handling Equipment.

Robert A. Bernhard, Rochester, New York.
Antiseptic Applicators and Liquid Adhesive.

Bishinger-Koehler Manufacturing Company, Inc., Pittsburgh, Pennsylvania.
Breathing and Resuscitation Apparatus and Safety Devices.

Bradley Washfountain Company, Milwaukee, Wisconsin.
Group Washing Fixtures.

Brown Shoe Company, St. Louis, Missouri.
Men's and Women's Safety Shoes.

R. H. Buhrke Company, Chicago, Illinois.
Safety Equipment for Construction and Maintenance.

E. D. Bullard Company, San Francisco, California.
Industrial and Mining Safety Equipment.

Burroughs Wellcome & Co. (U. S. A.) Inc., New York, New York.
First Aid Kits and Medical Equipment.

Chicago Eye Shield Company, Chicago, Illinois.
Head and Eye Protection and Toe Guards.

Davis Emergency Equipment Co., Inc., New York, New York.
First Aid Kits and Safety Equipment.

Elliott Service Company, New York, New York.
Elimination of Waste, Promotion of Efficiency and Safety.

Fairway Laboratories, Inc., Belleville, Illinois.
Anti-Fatigue and Heat Exhaustion Antidote Tablets and Dispensing Equipment.

Hynson, Westcott & Dunning, Inc., Baltimore, Md.
Mercurochrome Antiseptic for First Aid Application.

Industrial Gloves Corporation, Danville, Illinois.
Steel Grip Gloves and Safety Apparel.

International Shoe Company, St. Louis, Missouri.
Safety Shoes.

Invincible Vacuum Cleaner Mfg. Co., Dover, Ohio.
Industrial Vacuum Cleaners.

Junkin Safety Appliance Company, Louisville, Kentucky.
Guard Controlled and Multiple Controlled Safety Guards.

Walter Kidde & Company, Inc., New York, New York.
Fire Extinguishing Systems and Portable Extinguishers.

Lehigh Safety Shoe Co., Allentown, Pa.
Leather and Rubber Safety Shoes and Pacs.

Lima Cord Sole and Heel Co., The, Lima, Ohio.
Non-Slip Soles and Heels.

Liquid Carbonic Corporation, The, Chicago, Illinois.
Fumigant for Investation Control.

Macwhyte Company, Kenosha, Wisconsin.
Wire Rope and Braided Slings.

B. F. McDonald Company, Los Angeles, Calif.
Protective Hats and Safety Appliances.

Metropolitan Life Insurance Co., New York, New York.
Insurance, Industrial Group, Etc.

Mine Safety Appliances Company, Pittsburgh, Pennsylvania.
Safety Appliances and First Aid Materials.

National Safety Council, Inc., Chicago, Ill.
Poster, Library, Research and Education Divisions.

Patent Scaffolding Company, The, Chicago, Illinois.
Ladders and Scaffolds for Industry and Construction.

Protective Equipment, Inc., Chicago, Illinois.
Ladders and Personal Protective Equipment.

Protectoseal Company, Chicago, Illinois.
Safety Devices for Hazardous Liquids.

Pulmosan Safety Equipment Corp., Brooklyn, New York.
Respiratory Protection and General Safety Equipment.

Safety Clothing Company, The, Cleveland, Ohio.
Safety Clothing and Equipment and Asbestos Specialties.

Safety Equipment Service Co., The, Cleveland, Ohio.
Goggles and All Types Accident Prevention Equipment.

Safety First Shoe Company, Holliston, Massachusetts.
Safety Shoes.

W. H. Salisbury & Co., Inc., Chicago, Illinois.
Linemen's Rubber Protective Devices.

Sleepsafe Industries, Inc., New York, New York.
Fireproof Mattress.

Standard Safety Equipment Co., Chicago, Illinois.
Dust Protective and Safety Equipment.

Stonehouse Signs, Inc., Denver, Colorado.
Accident Prevention Signs and Tags.

Strauss Company, Inc., The, Pittsburgh, Pennsylvania.
Belts, Foot Guards, Safety Hats.

Surety Rubber Company, The, Carrollton, Ohio.
Linemen's Safety Equipment and Synthetic Rubber Industries Equipment.

Surty Mfg. Co., Inc., The, Chicago, Illinois.
Dust Control Systems and Mechanical Safety Equipment.

Willson Products, Inc., Reading, Pennsylvania.
Eye, Head and Respiratory Protection Equipment.

Wil-X-M'f'g Corporation, Brooklyn, New York.
Fire Extinguisher Products.

Public Safety Exhibit—Seelbach Hotel

Automatic Crossing Gates, Inc., Louisville, Kentucky.
Automatic Railroad Grade Crossing Gates.

Bendix Products Corporation, South Bend, Indiana.
Automotive Testing Equipment.

Eagle Signal Corporation, Moline, Illinois.
Traffic Signals, Pre-timed and Demand Controllers.

Evans Products Company, Detroit, Michigan.
Railroad Grade Crossing Barrier and Traffic Signals.

Harley-Davidson Motor Co., Milwaukee, Wisconsin.
Police Motorcycles and Equipment.

John C. Hoof Company, Chicago, Illinois.
Motor Vehicle Speed Control Governors.

Indian Motocycle Company, Springfield, Massachusetts.
Police Motorcycles and Equipment.

Martindale Electric Co., The, Cleveland, Ohio.
Roadway Safety Signal Stands and Signs.

Peerless Manufacturing Corp., Louisville, Kentucky.
Reflector Buttons and Signs and Railroad Crossing Signals.

Safety Signal Devices, Inc., Chicago, Illinois.
Safety Signals for Automobiles, Trucks and Buses.

United Motors Service, Inc., Detroit, Michigan.
Precision Testing Equipment for Automotive Headlights.

United States Steel Corp. Subsidiaries, Chicago, Illinois.
Steel Products and Cement.

Victory Methods, Inc., Wellsburg, West Virginia.
Traffic Signal Systems.

Weaver Manufacturing Company, Springfield, Illinois.
Automotive Testing Equipment.

Wig-Wag Safety Signal Co., Chicago, Illinois.
Safety Signals for Automobiles, Trucks and Buses.

Aeronautical Section

Officers 1934-35

General Chairman—P. A. WRIGHT, United Air Lines Transport Corp., Chicago.
Vice-Chairman—CAPT. E. V. RICKENBACKER, Eastern Air Lines, New York City.
Secretary—W. DEAN KEEFER, National Safety Council, Chicago.

Officers Elected for 1935-36

General Chairman—P. A. WRIGHT, United Airports Company of California, Ltd., Burbank, Los Angeles, Calif.
Vice-Chairman—CAPT. E. V. RICKENBACKER, Eastern Air Lines, New York, N. Y.
Secretary—W. DEAN KEEFER, National Safety Council, Chicago, Ill.

THURSDAY MORNING SESSION

October 17, 1935

The Aeronautical Section sessions were called to order by Mr. Hainer Hinshaw, General Manager, United Air Lines Transport Corporation, Chicago, who presided, and introduced the speakers as follows:

Modern Aircraft Radio

By W. E. JACKSON

Chief, Radio Development Section, Bureau of Air Commerce, Department of Commerce, Washington, D. C.

Radio has contributed a great deal toward the safety and maintenance of scheduled air transport operations by providing pilots with meteorological information, directional guidance, and two-way communication. In the future, radio will unquestionably play an even greater role in making air transportation safer and more reliable through the establishment of:

(1) Vertical tower radiators at all radio range stations for eliminating course variations at night.
(2) A-I cams at all radio ranges enabling simultaneous visual and aural indications.

(3) Improved radio range and radio telephone facilities permitting simultaneous reception of voice broadcasts and radio range signals.
(4) Ultra high frequency markers for positively identifying radio range cones of silence.
(5) Radio compasses on aircraft as an aid in navigating.
(6) Radio aids permitting instrument landings under conditions of fog, low ceiling, and poor visibility.

One of the most outstanding improvements in the radio range has been the development of the tower radiator antenna which replaces the old loop type radiators and practically eliminates the so-called "night effect" observed by pilots as a swinging of the radio range courses. In addition, the field strength of the radio range stations has been increased by 73 per cent, corresponding to an increase in radiated power of three times that obtained with the loops. Approximately 72 stations are now equipped with tower radiators.

It is anticipated that eventually visual means of radio range course indication will be adopted, thereby reducing the nervous strain resulting from the continuous reception of aural signals. This was originally accomplished by the double modulation principle of modulating one figure of eight pattern at 65 cycles and the other pattern at 86.7 cycles. However, this system has never been adopted, due probably to the fact that the aural system was originally installed and changing from a system with which pilots were thoroughly acquainted to a visual system was too great a change for cautious pilots to accept. With this in mind, it is believed that the transition from aural to visual indication must of necessity be gradual to be successful. A means of accomplishing this rather difficult problem has been developed which enables the pilot to use the aural signals to actuate a visual indicator, thus giving simultaneous visual and aural indication.

A further development now undergoing tests at Pittsburgh is the simultaneous radio range and broadcast transmitter. To obtain such a service, it is necessary to separate the radio range tone frequency from the speech frequencies. Speech frequencies generally range from 200 to about 3,500 cycles. However, if all frequencies below 500 cycles are removed, the intelligibility of the voice is practically unimpaired. Hence, voice broadcasts from a simultaneous station contain no frequencies below 500 cycles. The range tone frequency is 300 cycles and operates continuously without interruption. For aural reception the 300 cycle tone is rather low, often in the range of the engine noise, and to make it readily distinguishable, a small rectifier is used in the airplane receiver to double the frequency before it is heard in the pilot's headphones. The tone he then hears is 600 cycles, which is about the same pitch as a large number of the present A-N radio ranges. To obtain full benefit from the simultaneous system, a filter unit is added to the visual indicator on board the aircraft. The function of the filter is to separate the voice frequencies from the range tone frequency, and by a turn of the switch, the pilot can listen to the voice broadcasts while his visual indicator is operating continuously, or he may switch his headphones for aural reception of the range. Thus a pilot flying "over the top" within 15 or 20 miles of his destination may receive uninterrupted range signals to enable him to locate the airport and start his landing without delay; whereas a pilot who at the same time may be 50 to 100 miles away from the terminal may frequently be more interested in receiving a weather report or special broadcast without interruption by the radio range.

The "cone-of-silence" which is observed by the pilot when flying over the radio range station is sometimes difficult to identify. Therefore, an ultra-high frequency station locator marker beacon has been developed which projects a large cylinder of energy vertically from the range site to positively mark the station location. When a plane approaches the radio range station a lamp on the instrument board lights, indicating that the plane is over the radio range station.

Recent developments in airplane direction finders indicate that this device will also assist materially in air navigation, serving as a "homing" device when used with either commercial broadcast stations or the radio range, and as a position finder when bearings are taken on two or more stations. The compass further aids in enabling the pilot to properly orientate his plane at a terminal before making a landing.

Although radio navigational aids have made it possible to fly "blind" and "over the top" between any two points with a much greater degree of precision than by

any other means, the problem of making a safe landing by means of instruments is considerably more difficult. To do this, it is required that the plane follow a given path which must be accurate in both the vertical and horizontal planes. This path must be in line with a clear approach to the field.

A system of instrument approach which partially fulfills these requirements has been developed by the U. S. Army Air Corps, and is now being installed by the Bureau of Air Commerce at a number of airports. The aircraft equipment consists of a radio compass, an ultra-high frequency receiver which flashes a light when actuated by the signal of a radio marker beacon on the ground, a sensitive altimeter, and a directional gyro, together with the usual flight instruments.

On the ground, there are two low frequency compass marker stations operating on different radio frequencies and modulated at 400 and 800 cycles respectively. One marker station is located 1,500 feet from the edge of the airport and the other 2 miles from the airport. Both stations are in line with a clear approach to the field. At each station, there is also an ultra-high frequency marker beacon, which flashes the light on the airplane instrument board whenever the plane passes over either station. In addition, there is a chain of lights on the ground along the approach to the field and down the runway itself, to further facilitate landing under conditions of poor visibility.

To use this method of approach, the radio compass receiver is tuned to the inner marker station and the pilot flies toward the station. Upon arrival over the inner marker station, as indicated by the flash of the light, the pilot tunes the compass to the outer marker station and flies toward it. His arrival over that station is again indicated by the light. At this point, he drops down to an 800 foot altitude, executes a 180 degree turn, flies back over the outer marker by using the radio compass and observing the light flash. At this moment, he retunes his compass receiver to the inner marker, kicks rudder to bring the radio compass on course, sets his gyro to zero, throttles the engines down, and glides down to 150 ft. altitude, maintaining his course to the inner marker station by means of the radio compass. At the moment the light flashes over the inner marker station he corrects his course by kicking rudder until the gyro reads zero and continues his glide holding the gyro on zero. The pilot glides on down until he breaks through the low ceiling and can see the chain of lights leading toward and along the airport runway. From this point he completes the landing in the normal manner.

The major advantages of this system are the ease with which the compass may be flown and the ease with which the runway may be lined up. The major disadvantage is that the altimeter may read incorrectly by as much as plus or minus 40 feet and also has a lag error. Another disadvantage is that under conditions where the ground stations cannot be readily moved, due to an inadequate number of suitable approaches, a cross wind will cause the plane to approach the inside marker at an angle to the runway, thus making it difficult to execute a turn and set the "gyro" on zero after the inner marker has been passed.

The most important link which is missing in instrument landing systems is an accurate altimeter or equivalent device. This need is fulfilled by the ultra-high frequency guide path which has been developed by the Bureau of Standards. The glide path consists of an ultra high frequency beam operating on 91 megacycles and modulated at 60 cycles, which is concentrated in both the vertical and horizontal planes. The glide path receiver has a fixed sensitivity and operates an output meter, i.e., the horizontal pointer of the cross-pointer visual indicator instrument. The output meter is held at a fixed level, which means that the plane must fly closer to the edge of the beam as it approaches the landing field along the glide path. It is only necessary to fly the plane to keep the horizontal pointer of the cross-pointer instrument in a fixed horizontal position, to fly the same guide path down to the landing field. Pulling back on the "stick" causes the pointer to rise, pushing forward causes the pointer to drop.

In addition to the glide path, there is a miniature radio range runway beacon, which is located adjacent to the glide path transmitter and operates on the A-1 interlock principle. One of the courses is projected across the field in line with the runway which has a clear approach to the field. The vertical pointer of the cross-pointer instrument is used to give visual indication of the radio range course. Thus, it may be seen that both lateral and vertical indications are given to the pilot in a single

cross-pointer instrument. The intersection of the two pointers gives the pilot his relative position with respect to the center of the glide path. For example, if the pointers intersect in the upper left hand corner of the instrument, the plane is above and to the left of the proper glide path, etc. At a distance of 1,500 feet and two miles from the edge of the field, respectively, and in line with the runway are two ultra high frequency marker beacons, operating on 75 megacycles and modulated at 800 cycles, which simultaneously flash a light on the instrument board and give aural indication in the headphones. Tuned audio transformers are used in the glide path and marker beacon receiver to insure a high degree of radio frequency selectivity.

To use this system, the pilot tunes the compass receiver to the miniature radio range and flies the visual indicator until an "on course" is indicated. He then kicks rudder until the compass indicates he is headed toward the station. At this instant both indicators will read zero and his gyro course will be established. From this point he will approach the field at approximately 1,000 feet altitude and observe his glide path pointer, which will gradually rise to the horizontal position. When this occurs, the pilot will throttle down his motors and maneuver the plane to keep the two pointers crossed in the center of the instrument. When at two miles from the station, the plane will be approximately 400 feet above the outer marker station which will give simultaneous aural and visual indications. As he continues his glide another marker 1,500 feet from the edge of the field indicates his position visually and aurally. The pilot continues to descend along the glide path maintaining his gyro course and checking against the visual range indicator until he makes his landing. A string of lights along the approach from the inner marker to the edge of the field further aids in the landing. The miniature radio range beacon operates on the simultaneous principle previously described and may be used to give the pilot additional landing information by voice without interrupting the range service.

The Business of Aviation

By P. A. WRIGHT

Assistant to the President, United Air Lines Transport Corporation, Chicago, Ill.

After the war, aviation developed in rather a hit or miss fashion—popularly called the barnstorming days—with no particular objective in view—no definite program advancing toward a given goal.

Shortly after the Lindbergh flight, however, the money vaults of the world almost literally opened up to aviation. Money for development was plentiful—too plentiful, for it gave birth to some promotions not founded on workable principles, but with it all the aviation business, as a business, was born. Air transport lines sprang up all over the country, some routed between important cities, others just going anywhere, but none with a coordination established between them. In the manufacturing field there were some 230 companies at one time manufacturing airplanes and engines. Expensive mistakes were made—many companies had to close up their affairs and quit—others coordinated their activities and merged with their fellows.

Excess capital structures either disappeared or were revamped to fit the jobs which they found they had to do—and so today you find four or five large systems established and functioning where a few years ago some 35 small units tried to struggle along independent one of the other.

Through all this period the U. S. Government was the best customer of the airlines. In fact, without the patronage of the Post Office Department through the medium of air mail contracts, no airline could have achieved the high standard of service now being delivered. In the midst of this phase of the development, however, there came a change in the federal administration followed by the well known cancellation of the air mail contracts—and the industry was thrown bodily into a state of chaos and uncertainty. Immediately it can be seen that the efficiency of management became all the more vital in the conduct of these enterprises, and the *business* minds in the industry became the bulwark for the salvation of the whole project.

This business of aviation moves rapidly in its economic development. Great progress has been made in ships as well as in flying. Public acceptance of air transport is assured. Just now the biggest problem facing the larger air lines is the matter of equipment. In this industry the depression was felt more acutely in the engineering department than in any other. Money, and plenty of it, is needed for aeronautical engineering, research and experimentation. A new airplane cannot be put into scheduled service until it has been tested and retested. Unlike a new model of automobile which is quickly accepted, an airplane must be proven in many ways before it can be put into active service on the lines. The result today is manifest in that, except for slight enlargement of already accredited designs no new airplanes are immediately available. It will take from one and one-half to two years to engineer, build and test the new transports of the air, while the operating companies are even now ready to advance to that next phase, the use of larger ships—and no such equipment is available.

This business of aviation—i. e., the transport phase which is most familiar to me—is divided into three distinct departments—each separate, yet each closely correlated with the other. First administrative and finance, which I have just discussed; second, functional or operations—and third, educational.

Of the functional or operations department, I shall say very little,—you are all more or less familiar with the fact that the average speed of the modern airliner has been increased to approximately 200 miles an hour. You have heard others tell of the developments aerodynamically which have gone into the modern airliner—instrument flying, radio, etc. But the third or educational department of the business is something to give real thought to.

Every manufacturer must have a sales department to market that which he manufactures. All our finance, administration and operations would mean but little if we could not sell what we create—air transportation. There is no mystery about it—no enigma—it is an out and out selling problem—a great deal more complex than selling shoes or safety pins—but a selling problem nevertheless. Complex because we must educate you as individuals to the use of the product of our labors—and through you reach that vast untapped majority who hesitate to accept anything new. Further, we must depend upon each person who accepts aviation for what it is—the finest mode of modern transportation—to make a reticent and uninformed public conscious of the miraculous advancement being made here and now in the field of transportation.

Despite the handicaps, harassments, losses and discouragement, aviation has so proven itself in the minds of the American people that we believe nothing can really stop it—it is so vital, so sound and so necessary—it has withstood the handicaps of misunderstanding; it has come through the throes of the depression and the trials of the times, and yet we believe in its ultimate success. It may be retarded temporarily, but I confidently look forward to the year 1945 when we shall look back on our troubles of today with a smile.

The Airplane of the Future

By R. F. NORRIS

Vice-President, National Acoustical Society, and Acoustical Expert, Burgess Battery Co., Madison, Wis.

The airplane has progressed rapidly, probably because it has had the experiences of railroad and automotive transportation as a background, and has avoided some of the errors made in both of these fields. The first planes which were not of the purely experimental type were relatively slow and noisy with no provision for comfort of the occupants or operators. The present transport plane, to compete with other types of transportation, had to be made comparable in comfort. The speed of transport plane service is being stepped up rapidly and will probably reach a maximum which will be faster than is economically desirable. It will then drop back to some speed which balances service with economic operation.

When this speed has been obtained, different air lines will vie with each other in providing more and more luxurious accommodations for their patrons and greater safety. The present transport plane is very comfortable and pleasing from some aspects. It is tastefully decorated, has soft, comfortable seats, and from these standpoints little improvement can be expected. However, on the average, it is poorly ventilated, so that the passenger's feet may be very cold, while his head is warm; or if he wants to cool his face, he has to blow a blast of cold air directly on his head, making a draft which is uncomfortable in the extreme, and even dangerous to health. Its seating arrangement is crowded and the aisle is narrow, with limited head room.

In the matter of noise, the modern transportation plane is a very great offender. Until recently, apparently no thought was given to noise in the plane and even the best planes which are advertised as quiet are so noisy as to make conversation extremely difficult. This is an improvement, since originally conversation was impossible. However, the plane of the future will have to be a material improvement from a noise standpoint over the present planes.

In the early days of the railroad, relatively few passengers were carried, and trains usually consisted of two or three cars. As traffic increased, the number of cars per train was increased, thus making the railroad a rather flexible transportation unit. As the load decreased, the cars hauled could be decreased in proportion, but it became economically unsound to run many small trains. Consequently the schedules were reduced to a minimum per day and larger trains were run. It is this fact that makes the railroads so vulnerable to motor bus competition. A motor bus will carry from 30 to 40 people and hourly schedules can be maintained. This makes bus transportation particularly convenient for short hauls. The added comfort that can be had on a railroad train has, however, kept the motor bus from encroaching on long-haul traffic to any great extent. The airplane is practically a short-haul traffic proposition, not because the distances covered are short, but because the time it takes to cover long distances is short.

For this reason it looks reasonable to predict that although the future transport plane will be considerably larger than the present planes, it will probably not carry more than between 30 and 40 passengers. With planes of this size frequent schedules can be maintained, and if traffic increases at certain times, more planes may be put into service as second and third sections of the same schedule.

There is no doubt that the present transport plane is extremely noisy. A great deal of criticism has been aimed at our transport lines because of this fault. In the history of transportation, new modes have always excited a certain amount of fear in the public. This, in all probability, is coupled with the noisiness of the undeveloped transportation means. When the railroads were first introduced, they caused a great deal of fear because of their mechanical nature and noisiness. The same was true of the early automobiles, and the legislation against open mufflers and outboard motors indicates that public opinion is still on the side of quiet. This also is true of transport planes, and undoubtedly if they were made so that they operated quietly, they would attract many people who instinctively fear them now.

From the above considerations, it would seem that the transport plane of the future will have a passenger capacity of from 30 to 40 people, a cruising speed considerably higher than the present cruising speed, possibly 300 miles per hour; it will be more roomy, that is, it will have more cubic foot capacity per passenger than the present planes, and will be provided with more passenger comforts, such as broader aisles, more head room, more comfortable toilet facilities. It will not only be so quiet that ordinary conversation between the passengers as a group will be possible, but it will also operate so quietly that except when flying at extremely low altitudes, it will be inaudible while in the air. It will be air-conditioned, so that the passengers will be perfectly comfortable in their normal clothing, and there will be a complete absence of the drafty conditions which so universally prevail in transport planes at present.

In addition to the above qualities, it will undoubtedly be provided with superchargers so that higher altitudes will be possible with comfort, and the pilot's compartment will be as quiet and as comfortable as the passenger compartment.

Air Transportation and the Public

By C. A. RHEINSTROM

Traffic Manager, American Airlines, Chicago, Ill.

The big development in air transport, at least as far as the public is concerned, has all taken place since Lindbergh, and these last eight years have seen the progress with which most of us are familiar. Most everyone thinks of aviation as airplanes, pilots, mechanics. Few people understand it as an integral part of our national transportation system, as a business where operations, maintenance, and sales all have places of importance.

Some folks just can't decide to get off the ground. They remind us of those who still aren't convinced that the horse is gone. Perhaps it is a little harder to imagine one's self in the air for the first time than it was to anticipate a thrilling dash down Main Street in an automobile at 20 miles an hour—but then, this is 1935, and things are different. Many people haven't even seen a modern airplane—I say "modern" because there's a vast difference between the airplane of today and a few years ago—and we are doing our best to get them out to our airports to look things over. If a tour of inspection is convincing, we usually sell our prospects a flight somewhere, if it's only for the ride. We think that no one can know about something he hasn't even tried.

The salesman in air transportation is the key to its future. He is the fellow who is going to put this business over. We are planning itineraries for many, showing them how they can cover more cities in less time and economically, and we are getting the business. A sample does the job. A smooth flight high above the earth in a comfortable cabin where there is plenty of room, and where a person can read and enjoy himself, sells the passengers on this means of transportation.

A few years ago night flying was taboo. Transcontinental passengers traveled by train at night, and by air in the daytime. It was considered hazardous to fly after dark. Now at least half of all flying is at night. Many people think it's even more enjoyable than in the daytime. Of course, night flying saves a lot of time, particularly on long journeys, and it's possible to fly from Los Angeles to New York in about fifteen hours.

There was a time when the airlines were concerned primarily with the development of air mail. All our sales effort was calculated to encourage the sale of stamps, and in cooperation with the Post Office Department, we have created enough business so that right now it's often somewhat of a problem to find space on our planes for all the mail.

Air express is one of our biggest opportunities for the future. Even though the rates for this expedited service are several times greater than rail rates, we frequently are obliged to reserve weight space ordinarily available to passengers, so that we may take care of the shipments offered us. There are now two air express systems. The airlines are committed to shortly join together in a nationwide air express system, which, by the coordination of air and rail services, will reach every city in the United States, and provide direct service to Canada, Mexico, Central and South America, and the West Indies, and soon to Hawaii and the Far East, and then to Europe.

The greatest concern of our sales department right now is the development of passenger traffic. People who travel by air will ship by air, and people who fly will send their correspondence by air mail. We believe that the person who is familiar with air transportation by actual experience as a passenger is more than ever a prospective user of air mail and air express.

Our biggest job among non-air travelers is perhaps an educational one. We must prove that the airplane is a helpful vehicle and a necessary part of the transportation picture. We must show the individual what air travel is—remove the mystery and make him accept it for himself. It is not enough that we tell the public about our speed, the comforts of air travel, the beauty of flight. We must break down the habits of a lifetime—turn folks from other ways of travel and show them by actual demonstration that air travel can save them time which they can use for other things. How cool and restful a plane can be in the summer time—how comfortably warm in winter. How there are no extras when you travel by air, where delightful meals are

a part of the service, where tipping is unnecessary, and where even newspapers and magazines are furnished without charge. How, when everything is considered, air travel is actually economical. That is one of the most difficult things to put across—I mean, until we demonstrate.

Insurance, too, is frequently mentioned as a reason why some prospective air traveler feels that he must not fly. Even though a man needs the airplane in his business, and even though he is thoroughly sold on it in every other way, he sometimes hesitates to fly because he thinks it will invalidate his policies. Most policies which have been in force for a year or more are incontestable, and therefore not affected, but the average person doesn't know that.

Safety is the very keynote of our operations. Everything we do is first determined to be safe, partly because we want to protect our equipment and our own skins, but most of all because the one thing that keeps more people out of the air than any other, is fear—fear of the unknown perhaps, but fear just the same, and the best way to overcome fear is to demonstrate the security of air travel.

We never expect to completely eliminate all hazard from air transportation, any more than it has been eliminated from other means of travel, and it looks as though the fellow was right who said, "The trouble with aviation is that people are not accustomed to dying in an airplane. When people begin to die in airplanes like they have in automobiles, trains, and boats, and other vehicles, they won't mind it, and your business will boom."

ADJOURNMENT

American Society of Safety Engineers--Engineering Section

Officers 1934-35

General Chairman—A. S. Regula, Industrial Relations Counselors, Inc., New York, N. Y.

Vice-Chairmen—
E. F. Blank, Jones and Laughlin Steel Corp., Pittsburgh, Pa.
C. W. Smith, Standard Oil Co. (Ind.), Chicago, Ill.

Secretary—W. Dean Keefer, National Safety Council, Chicago, Ill.

Members at Large—
Cyril Ainsworth, American Standards Association, New York, N. Y.
C. B. Auel, Westinghouse Electric and Manufacturing Co., East Pittsburgh, Pa.
J. I. Banash, Consulting Engineer, Chicago, Ill.
E. W. Beck, United States Rubber Products, Inc., New York, N. Y.
H. R. Bixler, Union Carbide and Carbon Corp., New York, N. Y. (Metropolitan Chapter.)
C. B. Boulet, Wisconsin Public Service Corp., Milwaukee, Wis.
G. E. Clarkson, Western Pennsylvania Safety Council, Pittsburgh, Pa. (Western Pennsylvania Safety Council Chapter.)
R. E. Donovan, Standard Oil Company of California, San Francisco, Calif.
W. M. Graff, National Bureau of Casualty & Surety Underwriters, New York, N. Y.
Harry Guilbert, Pullman Company, Chicago, Ill.
R. McA. Keown, Industrial Commission of Wisconsin, Madison, Wis.
Alexander Lackey, Consolidated Expanded Metals Companies, Somerville, Mass. (Boston Chapter.)
M. G. Lloyd, United States Bureau of Standards, Washington, D. C.
W. S. Paine, Aetna Life Insurance Co., Hartford, Conn.
C. E. Ralston, Pittsburgh Plate Glass Co., Pittsburgh, Pa.
D. L. Royer, Ocean Accident and Guarantee Corp., New York, N. Y.
G. E. Sanford, General Electric Co., Schenectady, N. Y.
H. S. Smith, Union Carbide and Carbon Corp., New York, N. Y.
W. R. Smith, United Engineers and Constructors Inc., Newark, N. J. (Northern New Jersey Chapter.)
R. C. Stratton, The Travelers Insurance Co., Hartford, Conn.
R. F. Thalner, Buick Motor Company, Flint, Mich.
S. E. Whiting, Liberty Mutual Insurance Co., Boston, Mass.

Officers Elected for 1935-36

General Chairman—C. W. Smith, Standard Oil Co. (Ind.), Chicago, Ill.

Vice-Chairmen—
C. B. Boulet, Wisconsin Public Service Corp., Madison, Wis.
D. L. Royer, Ocean Accident and Guarantee Corp, New York, N. Y.

Secretary—W. DEAN KEEFER, National Safety Council, Chicago, Ill.

Members at Large—

CYRIL AINSWORTH, American Standards Association, New York, N. Y.
C. B. AUEL, Westinghouse Electric and Manufacturing Co., East Pittsburgh, Pa.
J. I. BANASH, Consulting Engineer, Chicago, Ill.
E. W. BECK, United States Rubber Products, Inc., New York, N. Y.
H. R. BIXLER, Union Carbide and Carbon Corp., New York, N. Y. (Metropolitan Chapter.)
W. F. BOEHNER, J. B. Stetson Co., Philadelphia, Pa. (Philadelphia Chapter.)
E. W. BULLARD, E. D. Bullard Co., San Francisco, Calif. (San Francisco Chapter.)
R. E. DONOVAN, Standard Oil Company of California, San Francisco, Calif.
W. M. GRAFF, National Bureau of Casualty & Surety Underwriters, New York, N. Y.
R. McA. KEOWN, Industrial Commission of Wisconsin, Madison, Wis.
EVERETT F. KING, Lever Brothers Co., Cambridge, Mass. (Boston Chapter.)
E. J. KREH, Philadelphia Co., Pittsburgh, Pa. (Western Pennsylvania Safety Council Chapter.)
THOMAS E. LIGHTFOOT, Koppers Coal Co., Pittsburgh, Pa.
M. G. LLOYD, National Bureau of Standards, Washington, D. C.
W. S. PAINE, Aetna Casualty & Insurance Co., Hartford, Conn.
GEO. F. PRUSSING, Union Oil Company of California, Los Angeles, Calif.
C. E. RALSTON, Pittsburgh Plate Glass Co., Pittsburgh, Pa.
A. S. REGULA, Industrial Relations Counselors, Inc., New York, N. Y.
JOHN RUSSELL, JR., Public Service Electric & Gas Co., Newark, N. J. (Northern New Jersey Chapter.)
G. E. SANFORD, General Electric Co., Schenectady, N. Y.
H. S. SMITH, Union Carbide and Carbon Corp., New York, N. Y.
R. C. STRATTON, The Travelers Insurance Co., Hartford, Conn.
R. F. THALNER, Buick Motor Company, Flint, Mich.
S. E. WHITING, Liberty Mutual Insurance Co., Boston, Mass.
WILLIAM P. YANT, U. S. Bureau of Mines, Pittsburgh, Pa.

WEDNESDAY LUNCHEON SESSION

October 16, 1935

The annual meeting of the ASSE Engineering Section of the National Safety Council followed a luncheon and convened with A. S. Regula, General Chairman, presiding.

All reports had been mimeographed and copies were distributed at the luncheon tables.

Other sessions sponsored by the ASSE Engineering Section included those on "Fire Prevention in Industry," "Safety in the Small Plant," "Safety Training," "Maintaining Interest in Safety," "Heat Exhaustion," "Finding and Correcting Accident Causes," and "Occupational Diseases." (Reports of these sessions are found on other pages of these Transactions.)

Dr. Morris S. Viteles, Assistant Professor of Psychology, University of Pennsylvania, and Director of Personnel Research, Philadelphia Electric Co., Philadelphia, Pa., delivered an interesting address on "Industrial Safety in Russia." Dr. Viteles spoke extemporaneously, and no manuscript record is available for these transactions.

Mr. S. E. Whiting presented the report of the Nominating Committee, the personnel of which included S. E. Whiting, Chairman, C. B. Auel, J. I. Banash, R. McA. Keown, and R. F. Thalner. The committee's list of officers was elected, and will be found accompanying this record.

ADJOURNMENT

Automotive and Machine Shop Section

Officers 1934-35

General Chairman—MERLE C. HALE, Director of Industrial Relations, General Motors Corporation, Detroit, Mich.

Vice-Chairman—C. T. WINEGAR, Dodge Brothers Div., Chrysler Corp., Detroit, Mich.

Secretary—M. A. CLARK, Mgr. Industrial Relations, United States Rubber Products, Inc., Detroit, Mich.

News Letter Editor—W. H. FRATER, Personnel Director, Cadillac Motor Car Co., Detroit, Mich.

Engineering Committee Chairman—G. E. SANFORD, General Electric Co., Schenectady, N. Y.

Health Committee Chairman—DR. A. L. BROOKS, Medical Director, Fisher Body, Detroit Div., General Motors Corp., Detroit, Mich.

Membership Committee Chairman—C. W. BISHOP, Personnel Director, Lycoming Mfg. Co., Williamsport, Pa.

Poster, Slides and Safety Kinks Committee Chairman—NELSON KISER, Studebaker Corporation, South Bend, Ind.

Program Committee Chairman—MARVIN A. HEIDT, Budd Wheel Co., Detroit, Mich.

Publicity Committee Chairman—C. A. DEMONCE, Kelsey-Hayes Wheel Corp., Detroit, Mich.

Statistics Committee Chairman—R. F. THALNER, Buick Motor Co., Flint, Mich.

Members at Large—

L. E. AVERILL, C. H. Dickson Co., Detroit, Mich.
C. M. DOTTERWEICH, Revere Copper & Brass, Inc., Detroit, Mich.
H. L. FISCHER, Detroit Steel Products Co., Detroit, Mich.
M. J. MCCARTHY, Fisher Body, Detroit Div., General Motors Corp., Detroit, Mich.
R. A. SHAW, The Murray Corp. of America, Detroit, Mich.
CARL L. STORCK, Delco Products Div., General Motors Corp., Dayton, Ohio.

Officers Elected for 1935-36

General Chairman—C. T. WINEGAR, Chrysler Corporation, Detroit, Mich.

Vice-Chairman—MARVIN HEIDT, Budd Wheel Co., Detroit, Mich.

Secretary—M. A. CLARK, U. S. Rubber Products, Inc., Detroit, Mich.

News Letter Editor—W. H. FRATER, Cadillac Motor Car Co., Detroit, Mich.

Engineering Committee Chairman—G. E. SANFORD, General Electric Co., Schenectady, N. Y.

Health Committee Chairman—DR. A. L. BROOKS, Fisher Body Detroit Div., General Motors Corp., Detroit, Mich.

Membership Committee Chairman—L. R. JUDSON, Timken Detroit Axle Co., Detroit, Mich.

Poster Committee Chairman—C. W. BISHOP, Lycoming Manufacturing Co., Williamsport, Pa.

Program Committee Chairman—H. W. BOULTON, Murray Corp. of America, Detroit, Mich.

Publicity Committee Chairman—NELSON H. KYSER, The Studebaker Corp., South Bend, Ind.

Statistics Committee Chairman—W. W. JANZER, Seaman Body Co., Milwaukee, Wis.

Members at Large—
L. E. AVERILL, Chicago Eye Shield Co., Detroit, Mich.
C. M. DOTTERER, Revere Copper and Brass, Inc., Detroit, Mich.
HOYT L. FRACHER, Detroit Steel Products Co., Detroit, Mich.
MERLE C. HALE, General Motors Corp., Detroit, Mich.
M. J. MCCARTHY, Fisher Body Corp., Detroit, Mich.
R. A. SHAW, Murray Corp. of America, Detroit, Mich.
CARL L. STORCK, Delco Products Corp., Dayton, Ohio.
R. F. THALNER, Buick Motor Co., Flint, Mich.

MONDAY AFTERNOON SESSION

October 14, 1935

The opening session was called to order by General Chairman Merle C. Hale, General Motors Corporation, Detroit, Mich., who presided. He called attention to the efficient work of the chairmen and members of the sectional committees.

Report of Statistics Committee

By R. F. THALNER

Assistant Personnel Director, Buick Motor Co., Flint, Mich.

One item in which we are all interested, is the cost of accidents. It is astonishing to note that accident costs last year were practically two-thirds of the total amount of the Work Relief Fund of $4,880,000,000.00.

Inasmuch as we are primarily interested in automotive and machine shop safety, it is interesting to determine where we stand with respect to other industries. The automobile industry is in 23rd place, with a frequency rate of 22.24, the average for all industries being 15.29.

A comparison of frequency and severity rates for all industries shows that a reduction was made in all of them except the automotive industry, which shows an increase in severity for 1933 and 1934 over the low point of 1932.

Taking into consideration the various types of industrial accidents, the one which accounts for the highest percentage is "handling objects," with 29 per cent of the cases, while falls come second with 22 per cent of the cases and machinery third with 12 per cent.

It is also interesting to note at which particular location on the body injuries strick most often. Hands and fingers comprise 32 per cent of the cases, while legs and feet get almost the same proportion or 24 per cent. Injuries occurring to the eyes indicate only 3 per cent of the cases, proving that the use of eye protection in industry has reduced the number of eye accidents.

Personalities in Safety Work

By W. H. FRATER

Cadillac Motor Car Company, Detroit, Mich.

Big business today, forgetting the problems of production, accounting and selling, and thinking of it only as something made up of people, divides itself into four fundamental elements. First, in order to establish a corporation we have to have capital. Capital is furnished by people whom we may refer to as stockholders; their rewards are dividends. Next, we must have managers to direct the activities of the business; their reward comes in the form of salaries. Third, we must have a working force, whose function is to produce; and their reward is in the form of wages. And last comes the public whose function is to buy and consume or wear out the product, and whose reward is the acquisition of a product of high dollar value.

If we ask any one of these groups to fix the amount of his reward, you will find that what he really wants is all he can get. The stockholder wants large dividends, the managers want large salaries, the worker wants big wages, and the consumer wants a quality product at a minimum cost.

Now, no matter what your conception of capital, profits or wealth may be, all of the people who make up the elements of business are looking for their reward to come from the same fundamental source; and therefore, inevitably, our rewards will be measured by the degree of cooperation existing between all groups. Cooperation will reach its highest point only by a proper fitting together of the personalities and viewpoints involved.

Although the American Constitution says we are born equal, this is a true statement only in one thing. We are born equal in opportunity. All the differences that exist in us must be overcome if we are to work and live together, partly by tolerance of the other fellow's shortcomings and appreciation of his talents, and partly by recognition of the fact that his rewards for daily work may strike a different balance than the balance we strike for our individual selves. The problem then becomes one of education, cooperation and human understanding. Human understanding rests on a knowledge of psychology, the science of human behavior.

May I draw a comparison between the psychology of the average person of 1929 and the average person today, as a means of illustrating what I mean by human understanding? The workman of 1929 drew his reward for his efforts in wages, and in addition, due to the prevailing philosophy of our whole business fabric, felt that greater comforts and luxuries for himself and family were "just around the corner." Things that he wanted and things that his neighbor had were things that would be his within a year or two. It was a psychology of hope.

The workman of today, even though his reward in wages may have the same purchasing power as in 1929, is not as happy as he was then. His hope of obtaining things he wants for his family, and that his neighbor may have, is gone. The philosophy of business is of a different texture. The psychology of the workman is all too frequently one of hopelessness or even despair.

As a result, while he may be just as well off, from a purely physical standpoint, he now finds it difficult to get himself into the cooperative frame of mind necessary to the mutual benefit of all groups who are drawing their financial rewards from the same source.

This analysis of the psychology of a workman applies also to members of all other groups, and even though safety work is universally classified as a non-controversial activity, it behooves us to approach our problem, which is largely a matter of improving the individual attitude toward a greater safety consciousness, from all of the new angles that present day psychology would suggest.

The need for technical knowledge on the part of a safety man is as great as ever, but his success will not be measured by the number of mechanical guards he applies, no matter how ingenious they may be. Rather, his success will be measured by the ability he possesses, based on his human understanding of the other fellow, to put over his safety program as if it had originated with the other fellow.

Safety programs in industry too often have been pushed to one side by the busy supervisor, because those in charge of safety have failed to teach the essential fact that principles of safety and orderliness are essential elements of economic high production.

To accomplish these results the safety man must have courage, imagination and self-sacrifice. He must be selected for his capacity to analyze for himself some of the psychological problems, for his capacity to adapt himself to a changing viewpoint, for his ability to hold his own as a leader of thought in a time when the thinking of every one is being stampeded from one side to the other by the avalanche of pressing business problems and wide swings in governmental and social trends.

It is my belief that today there are more people earnestly and sincerely trying to think things out for themselves, and less of the old time happy-go-lucky, take-things-as-they-come, attitude; and if this is so, it presents a glorious opportunity for the safety movement to take its rightful place and intrench itself as one of the basic ideals of the new day thinking.

Regardless of what your attitude may be for the evolution of business and industry into a new order, or its return to the old order, the present fluxing state of mass thinking is an opportunity that the safety man of today must not overlook. In fact, he cannot overlook it and be a modern safety man.

Modern Machine Shop Methods

By H. W. BOULTON

Director of Personnel, Murray Corp. of America, Detroit

The surest and most effective way to prevent accidents is also the surest and most effective way to eliminate poor workmanship. The Safety Engineer must be armed with shop or job knowledge if he is to do his work effectively.

To get results from men, they must know what results you are after, how you expect them to help and why they must get results in a certain way. This calls for a practical knowledge of how to instruct workers and the ability to do that instructing effectively.

A recent re-print from *Management Information* published by the Elliott Service Company entitled "How To Instruct" is one of the most practical and concise general treatises on the subject that it has been my pleasure to read.

Here are a few items under the heading of "What to Teach About Safety."

1. That safety is as important a factor in workmanship as quality or quantity.
2. That the violation of standard safe working practices is just as serious as the violation of any other company policy or regulation.
3. That every mechanical safeguard must be kept in place and properly used.
4. That accidents are caused and that the causes can be eliminated.

These four items clinch the statement that the surest and most effective way to eliminate accidents is through good workmanship, education and discipline. Let us discuss briefly these three items:

Good Workmanship—The workman must have the proper tools and materials. His equipment must be in adjustment. His attitude toward his job must be right and his environment conducive to good workmanship.

Education—Job knowledge as well as safety mindedness must be accurately imparted. The man must know the limitation of the tools and equipment used. He must understand the art of cutting metals.

Discipline—An unsafe worker should be removed from the job. Every worker has a responsibility for the safety of his fellow workers, as well as for his own personal safety. Investigate all accidents, determine the cause, and follow through with discipline. The careless worker is a dangerous worker. Employers and other workmen do not want him around.

For seven years your speaker directed and trained apprentices to the machinist's trade. During this time approximately two hundred young men were given four years or less of training on production without experiencing one accident other than minor lacerations or bruises. In my opinion this negligible accident experience was due almost entirely to the instruction given in the proper care and operation of machine tools. In training employees the safety engineer should—

1. Realize that the workman's knowledge of the job in question is extremely limited, then plan the instruction in clear, simple terms.
2. Review all the danger points about a job which must be passed along to to the worker.
3. Make sure that you have the facts about the proper care and operation of equipment, tools and material which the worker must be taught.
4. See that everything around the worker is in the condition in which the worker will be expected to keep it.

Safety Through Job Knowledge

A brief analysis of the fundamental machine shop knowledge required to operate machine tools intelligently will serve to show what constitutes safety in the machine shop through job knowledge.

Belting

1. Eliminate, wherever practical, exposure to open belting.
2. Inspect all belt lacings, all belts that are likely to be shifted by hand should be laced with rawhide and not wire.
3. Belt shifters other than the hand, should be used at all times.

Oiling

1. Inexperienced workmen should not be permitted to oil line and counter shafts.
2. Machine tools must be at rest when oiling.

Grinding Wheels

1. Eye protection—goggles or shields should be used when grinding.
2. Wet vs. dry tool grinding—wet grinding will eliminate dust hazard.
3. Proper mounting of emery wheels to prevent breaking.
4. Dressing of grinding wheels—hand and machine.
5. Safe speed and feed for machine grinding.
6. Proper wheel for job—grade and grain.

The Drill Press

1. Loose clothing will be caught in drill.
2. Clamping of work to prevent slipping.
3. When to use coolant or lubricant.
4. Proper grinding of drills to prevent excess wear on machine and breaking of drills.
5. Correct speeds and feeds.
6. Use of lead or brass hammer when wedging drill in spindle socket.

The Shaper

1. Clamping and blocking of work.
2. Work too high, too low—too high will be hit by ram, too low will necessitate too long a tool projection.
3. Stops in proper place on ram.
4. Clamping of tool in clapper box tool post.
5. Grinding of tool.
6. Cutting speeds and feeds.
7. Brushing away of chips with brush *not hand*.
8. Flying bits of metal or scale.

The Lathe

1. Flying chips.
2. Grinding of tools to avoid long curling chips.
3. Precautions when filing—center and chuck work.
4. Setting of tool.
5. Loose tool post—compound rest.
6. Allowing tail stock center to become dry.
7. Feeds and speeds.

Safety Engineering means the planning of safe methods for production. A designer of lifting devices considers the load to be lifted and designs accordingly. There are many eye-bolts, chains, ropes and hooks used in the machine shop. Since some of these are home-made, it becomes the duty of the safety engineer to be the

designing engineer. Similarly, if machine operation is to be on the safest plane then those responsible for safety must know what constitutes safe practices.

Economical or profitable production is the result of knowing the limitations of the equipment and material used and then working up to these limitations.

(A report of the joint session with the Power Press Section, held Tuesday morning, October 15, will be found in this volume in the division devoted to the Power Press meetings.)

WEDNESDAY MORNING SESSION

October 16, 1935

Some Aspects of the Dust Problem from a Mechanical Viewpoint

By M. I. DORFAN

Manager, Dust Collecting Division, Blaw-Knox Co., Pittsburgh, Pa.

It has not been many years since the average engineer discovered that a micron is a unit of measurement and not a "microbe" misspelled. Due, however, to the insistence of our medical friends, we have been forced to familiarize ourselves with this term and some other medical language, and even to adopt such medical tools as the Sedgwick-Rafter blood counting cell in our chase after micronic-sized dust particles. This is as good an opportunity as any to thank medical science for showing us the significance of the extremely fine dust particle, at least from a hygienic point of view, and further to thank them for teaching us how to use their tools, at least to find and measure dust particles.

Now, that the engineer is being called on for mechanical solutions for such problems as dust creates, he naturally wishes to evaluate his problem and the results of his solution with the type of measurement facilities and terms with which he is familiar. He understands terms such as thousandths of an inch and millimeters, and he is accustomed to working with gauges and the like. The time has now come to determine whether the means that the industrial hygienist uses to measure dust and evaluate its effects on industry have the dependability and accuracy of the means that the engineer normally employs.

In the automotive industry and in the machine shop, dust is an enemy, even when the kind, size or quantity has no pathologic significance. Stray particles of lint may ruin a fine body job, a piece of air-borne fly-ash may ruin a close limit lapping job, almost invisibly fine dust, such as is discharged by cyclones, may ruin dust-tight bearings.

From that valuable new publication of the United States Public Health Service, Bulletin No. 217, entitled "The Determination and Control of Industrial Dust," by Bloomfield & Dallavale, I have culled the following information concerning the size frequency distribution of various industrial dusts compared to outdoor dust.

	Less Than 1.0 Microns	1.0 To 4.99 Microns	5.0 Microns and Larger
Outdoor Dust	97.0	3.0	....
Sandblasting	21.1	78.5	0.4
Foundry Parting Compound	22.5	77.5	....
Soapstone	17.2	68.8	14.0
Aluminum Dust	11.0	72.0	17.0
Bronze Dust	13.0	87.0	....

Now, it must not be inferred that there are no coarser dust particles found in industry. What these authors intend to convey is that the dust particles generally found floating in industrial air are of the size order above outlined.

They continued to say, "Practically no dust particles larger than 1.5 microns were found to exist in outdoor air. * * * In contrast it is found that only three per cent of the industrial dust particles are less than 0.5 microns and but 32 per cent less than 1 micron. The average (medium) size of these particles was found to be 1.4 microns."

They go on to say, from the results of their more extensive table that it is evident that the majority (60 per cent) of the dust particles present in the industrial atmospheres by them investigated were found to be between 1 and 3 microns in diameter with but seven per cent of the particles exceeding 3 microns.

Now that you have a quick view of what industrial dust may be like, I quote from some remarks made by Donald E. Cummings, assistant director of the Saranac Laboratory for the Study of Tuberculosis, who, during a conference held by the Industrial Commission of the State of Wisconsin in November, 1932, said: "It can also be stated quite definitely that the really hazardous particles are probably not much more than 5 microns."

At this point you should know that some investigators hold that particles finer than 0.5 microns are not important hygienically. However, since we are more concerned with the mechanical aspects of dust particle size and prevalence, you must bear in mind that any particle of dust that can affect an operation or get into a piece of machinery is important, and that we cannot neglect it because it happens to be less than 2 microns or less than 0.5 microns.

There are available, devices of various kinds, for sampling and measuring dust. The best known are the Owens jet counter, the Palmer apparatus, the Konimeter and the Impinger. These devices are described briefly in the aforementioned Bulletin No. 417 and a more detailed description with comparisons of performance may be found in United States Public Health Bulletin No. 144.

In this country the Impinger, in various modified forms (such as, for example, those described by Hatch, Warren & Drinker, in the Journal of Industrial Hygiene, Vol. 14, 1932, page 301, and the technique laid down by Greenberg & Bloomfield, in Vol. 47, Public Health Reports of 1932, page 654), has come to be considered an almost standard device. That it has what appears to be governmental approval, however, is to me a source of genuine alarm.

I submit to you that the Impinger, nationally handled by men of experience and judgment, in sampling dry atmosphere containing dust of such character as can be precipitated and affected by impingment, is probably a good indicating device. It is not, however, an accurate measuring device, nor is its technique practical or adequate for the engineer.

Let me illustrate. It has been pointed out above, that significant dust particles might be those between 0.5 micron and 1.5 microns. If a microscope is used, having a 7.5 eye-piece and a 16 mm. objective, it will not resolve objects of less than one micron—hence, there might be two particles, each being .5 microns, adjacent to one another, with a space between them of 0.5 microns, and it would appear as a single particle of 1.5 microns in length. On page 51, of Bulletin 217, the statement is made, "The dust may be measured * * * at a magnification of 1,000 diameters. * * * With this magnification it was found possible to measure particles as small as 0.5 microns in size, while particles smaller were easily distinguished." It must be borne in mind, however, that this is not the standard technique, and that this also does not take into account the question of the ability of the Impinger to catch and hold for examination all particles of important size.

Nevertheless the insurance carriers of at least one state, have written into their rules a test for dust collecting devices based on the use of the Impinger, according to the technique mentioned above. In these rules they measure particles from 2 to 10 microns, completely ignoring the importance of the particles between 0.5 and 2 microns.

Now, very frankly it must be stated that the designers and advocates of the Impinger are surely not to blame for its abuse. I merely point out that governmental sponsorship is a very important trust, and that publications of methods of technique should be kept right up to the developments of practice with any device.

Recently at a meeting the use of various methods for testing dust collectors

was under discussion. One gentleman told of using a small quantity of oil (I believe it was pine oil) in the water in his Impinger bottle, inferring that thus was his Impinger efficiency raised, forgetting, until it was brought to his notice, that he might also agglomerate his particles and probably obtain a lower count of apparently larger particles.

Somewhere, some time, we have got to start with accurate measuring sticks to determine what constitutes an individual dust problem and how accurately is it being solved. Those measuring sticks may not necessarily be universally applicable to every dust problem. When measuring dust which is dry, we may require a different device than when measuring the dust in air or gas which is moisture saturated. When seeking to measure the kind and quantity of one dust which is soluble as compared with one which is not soluble, when measuring dust that is wettable as compared to dust that is not wettable, we may require a different device.

The Medical Research Council of the English government, in their special report No. 199, by Green & Watson, entitled, "Physical Methods for the Estimation of the Dust Hazard in Industry," offer a new device called a Thermal Precipitator, developed by Prof. R. Whytlaw Gray and Dr. R. Lomax. In their summary they say: "This device enables a measured volume of air, slowly streaming past an electrically heated wire to deposit particles uniformly on cover slips in a very convenient way for mounting and subsequent counting and measurement. It is 100 per cent efficient." What makes this remark important is that, to quote again from their summary: "Three types of *instruments, the Greenburg-Smith Impinger,* the Konimeter and the Owens jet dust counter were selected for tests. Previous work had shown that dust sampling instruments should be accurate over a range of particle size between 0.2 and 5 microns diameter. As the three instruments had never been adequately standardized, their efficiency in precipitating dust clouds, containing this range of particle size, was determined, the ultra-microscope and sedimentation cells being used to determine, as nearly as possible, the absolute number of particles in the clouds.

"For these clouds, it was shown that the Greenburg-Smith Impinger, when used according to standard United States practice, had an overall efficiency of 40 per cent, and that particles smaller than 0.8 microns diameter were not revealed. A circular Konimeter, used according to South African practice, had an efficiency depending on number and size of particles in the clouds, varying under favorable conditions from 64 per cent to 50 per cent for clouds containing between 500 and 2300 particles per cc.; for clouds from sandstone, containing numbers of coarse particles, it was not possible to use the standard dark ground illumination, owing to the aggregating and scattering of light from the larger particles. The Owens jet dust counter was 41 per cent efficient against the flint dust clouds. It was found that none of these instruments was suitable for the estimation of size frequency, and that the Impinger was the only one which would allow estimations to be made over long periods of time."

There is considerable work under way in this country to probe the contention and claims of these authors. If their work can be verified, we probably have at hand an instrument of *engineering* accuracy. *I urge the consideration* of dust measurements in the light of their demonstrable accuracy.

ADJOURNMENT

Cement Section

Officers 1934-35

General Chairman—J. B. Zook, Great Lakes Portland Cement Corp., Buffalo, N. Y.
Vice-Chairman—W. W. Hamilton, Alpha Portland Cement Co., Easton, Pa.
Secretary—A. J. R. Curtis, Portland Cement Association, Chicago, Ill.
News Letter Editor—Jack Dempster, Canada Cement Co., Ltd., Port Colborne, Ontario, Canada.
Engineering Committee Chairman—Frederick B. Hunt, Nazareth Portland Cement Co., Nazareth, Pa.
Membership Committee Chairman—H. A. Reninger, Lehigh Portland Cement Co., Allentown, Pa.
Poster Committee Chairman—M. P. Greer, Marquette Cement Manufacturing Co., Cape Girardeau, Mo.
Program Committee Chairman—D. B. Coleman, Missouri Portland Cement Co., St. Louis, Mo.
Members at Large—
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E. Posselt, International Cement Corp., New York, N. Y.
C. E. Ralston, Pittsburgh Plate Glass Co., Pittsburgh, Pa.
F. E. Town, Medusa Portland Cement Co., Manitowoc, Wis.
H. Vanderwerp, Medusa Portland Cement Co., Cleveland, Ohio.

Officers Elected for 1935-36

General Chairman—D. B. Coleman, Missouri Portland Cement Co., St. Louis, Mo.
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E. Posselt, International Cement Corp., New York, N. Y.
C. E. Ralston, Pittsburgh Plate Glass Co., Pittsburgh, Pa.
F. E. Town, Manitowoc Portland Cement Co., Manitowoc, Wis.
H. Vanderwerp, Medusa Portland Cement Co., Cleveland, Ohio.
J. B. Zook, Great Lakes Portland Cement Corp., Buffalo, N. Y.

TUESDAY MORNING SESSION

October 15, 1935

The first session of the Cement Section was called to order General Chairman J. B. Zook, Great Lakes Portland Cement Corporation, Buffalo, N. Y., who presided. Chairman Zook welcomed the delegates and presented the reports of sectional committees, emphasizing the good work done during the year. The following resolution was adopted regarding the death of Mr. W. W. Hamilton:

Resolution

WHEREAS: In the passing of W. W. Hamilton, safety director of the Alpha Portland Cement Company, the Cement Section of the National Safety Council has lost a leader who gave himself generously to the humanitarian cause of safety in its broadest respects, and

WHEREAS: W. W. Hamilton, by his sincere devotion to his chosen work, by his personal characteristics of loyalty, modesty, congeniality and integrity, won the respect and endeared himself as a friend to those whose life he touched, and

WHEREAS: Mr. Hamilton served with distinction as vice-chairman of the Cement Section of the Council for the past two years and as a member of its Executive Committee for many years previous, as a member of the Accident Prevention Committee of the Portland Cement Association, and in important capacities in safety organizations in his home community, therefore, be it

RESOLVED: That the members of the Cement Section, National Safety Council, in annual meeting assembled, record our gratitude to Mr. Hamilton for the inspiration of his work and our deep appreciation for the spirit of cooperation and friendliness which typified his contact with us, and for the intelligent counsel he brought to our common problems, and be it further

RESOLVED: That we extend to Mrs. Hamilton and to other members of his family, and to former associates in the Alpha Portland Cement Company, our profound sympathy in their great loss. Be it further,

RESOLVED: That this action be inscribed on the minutes of this meeting, in tribute to the memory of William W. Hamilton.

Report of General Chairman

By J. B. ZOOK

Great Lakes Portland Cement Corp., Buffalo, N. Y.

As I look at each one of you assembled at this annual meeting of the Cement Section I feel that you are all leaders in this great work of the prevention of injuries and death. Many of you have made it your life's work. Unquestionably, every year you have tried to show some improvement in safety accomplishment over its predecessor.

But let us be frank about this matter and turn our eyes inward upon ourselves. Are we making the best use of our leadership?

Leadership differs greatly today from that of the past. Whatever the success of the old domineering attitude, the overbearing exercise of authority, it is certain it does not produce today the same results as the leadership which develops a harmonious, willing and unified spirit.

Leadership is that combination of qualities which enables us to get something done by others. But the best leadership is the ability to inspire others to devote all their energies, both mental and physical, toward the desired objective.

You and I are chiefly concerned with personal leadership, or leadership indirectly through lesser leaders. We must possess the vision, intelligence and persistence to supply the stimulus for these lesser leaders. It is our job to encourage them and provide contructive ideas for them to work with. The notion that leaders

are born and not made has been proven false. If we know how to handle the human material available to us, there is no doubt that highly efficient and willing men will be developed among our plant personnel to carry out our accident prevention plans.

The particular thing which distinguishes leaders is the special quality of their attitude toward those whom they lead. We must be interested in people; we must be sympathetic with people; we must like people. We must be warm hearted while remaining cool headed. If you ask how this desirable combination of characteristics can be cultivated, I tell you that the most important thing is to want to improve. Let yourself go. Forget yourself by reaching out among the interesting, attractive and even pathetic individuals with whom you have to associate in carrying on the safety work. By such association you can build up your own personality and efficiency in carrying out your program.

It is the common custom to take inventory of the physical properties of our plants at least once each year. Why is each National Safety Congress not a splendid time for us to take inventory of ourselves? When you are alone and without anyone else being the wiser, ask yourself these questions, which summarize the attributes of a safety leader:

1. Have you forcefulness enough to put across the safety ideas which you believe to be right, and persistence enough to stay with your plans until they succeed?
2. Are you dependable in safety matters for which you are responsible?
3. Have you the critical attitude that enables you to see things that are not right and still be fairminded about hazards?
4. Are you constructive enough to suggest practical safety methods to remedy the things you criticize?
5. Have you a real kindliness of spirit as a background for all your contacts with people?

It Is a Long Road Back!

By A. J. R. CURTIS

Assistant to General Manager, Portland Cement Association, Chicago, Ill.

A year ago we were facing a rapidly increasing accident rate, but the upward trend has apparently stopped. The records for the first nine months of this year, compared with the same period of 1934, show a 22 per cent reduction in accidents. In actual number there were 185 temporary and permanent disabilities and 12 fatalities in the 1934 period, compared with 147 non-fatals and 7 fatalities for this year. Whether or not there will be an actual improvement in rates will depend of course on the exposure.

Pleasant as this picture may be on the surface, there is little point in dwelling on it when we know well that our safety work is not up to par. Last year in analyzing the situation we found that the accident "base" had broadened considerably over previous years; more plants were reporting accidents. This seemed to confirm the opinion that plant safety organizations were not functioning, that all through the industry there was a tendency to "coast" in deference to other problems which demanded time and attention.

The accident "base" this year is just as broad as it was a year ago. There are just as many one and two-accident plants and almost twice as many three-accident plants. Our improvement lies in the smaller number of plants and fewer total accidents in plants reporting more than three accidents.

This year, the group of plants having one, two or three accidents each, amount to 88 per cent of the total of all plants reporting. In this group are 56 per cent of the accidents. Last year only 38 per cent of the accidents occurred in this group. The remaining 62 per cent of the total number of accidents occurred in the four or more accident plants.

This means, of course, that some of the plants with a previous very bad experience have shown some improvement. It is a hopeful sign.

Now we find ourselves right back where we started. Too many plants are having accidents and plant safety work has not undergone a much needed vigorous awakening. Glance at the frequency rates of a few years past and see where we are headed. Of 96 plants reporting for three consecutive years, only 42 showed improvement or held their own in 1934. It is difficult to find any mass consistency in the records of the industry, such as there was in the days when the big majority of plants were reducing their accident rates. As an industry we are not geared together for safety.

On analyzing our statistics for last year we found that 52 plants of the 127 reporting had an exposure of less than 200,000 man-hours each, only 20 per cent of the total man-hours for the industry. Yet this group accounted for 28 per cent of the accidents and had a frequency rate 41 per cent higher than the industry's average. The remaining plants, with an exposure more than 200,000 man-hours, had a frequency rate well below the average. Does that suggest a place for concentrated activity?

We must not overlook the implications in our severity rate. That rate tells the real story of human suffering and grief, and, incidentally, of cost. Our rate last year was 4.26, compared to the average rate for all industry of 1.70. There is no denying the challenge of that rate and it can be brought down by classifying mill and quarry hazards to guide safety activity.

Now, what can we do? Let me repeat a statement made last year:

"We will have little to worry about as an industry if we start on the individual plant problem. This plant problem has undergone no essential change in the past few years and a resolve to start an organized, planned program for the coming year will again give us a grip on accident control.

"What do we have to do?

"In general, we must make an appraisal of our past activities and compare them with a complete, well rounded program to determine the weakness, if any. We must set up a definite schedule of safety activities and then follow through to see that each activity is carried out."

After One Thousand Days—Then What?

By E. P. NEWHARD

Superintendent, Pennsylvania-Dixie Cement Corporation, Plant No. 2, Clinchfield, Georgia

Accident statistics in the cement industry during the past ten years furnish striking proof of the value of organized accident prevention. Contrast the year 1924, when as many as 315 accidents were reported by 105 plants in one month, with conditions in 1934 when a total of only 241 accidents occurred in the entire year in 127 plants.

Ten years ago the winning of a safety trophy in recognition of going a full calendar year without a disabling accident was a conspicuous achievement, attained by only two plants. To-day 112 plants are in possession of these trophies. As a result the Thousand Day Club was inaugurated as an incentive for plants to preserve unbroken records through 1,000 consecutive days. Gradually but steadily membership in this club is growing.

It is a fine experience to help win such a safety trophy. The achievement of membership in our Thousand Day Club, as well as other outstanding records of five, six and eight years without an accident, can be attributed to certain definite influences.

The prime mover has been the Portland Cement Association, working in conjunction with the National Safety Council. Methodically its Accident Prevention Bureau has functioned in driving home the safety idea, reaching every employee either directly or indirectly through many channels. The inspiration derived by us through the Bureau's publications and its direction of safety effort in special campaigns have all been factors in preserving our record.

Enthusiasm and interest in safety are contagious. It is also true that indifference can quickly spread until some safety rule is violated—or an accident results through some laxity. The plant safety organization must be an unbroken chain linking together executives and employees in a common cause. A successful mill record therefore reflects the interest and cooperative efforts of all, and this has been an important influence in the attainment of our safety record at Clinchfield.

Our Central Safety department acts in an advisory capacity and as a clearing house for all information relating to accident prevention: for coordination of effort and contact with the Association Bureau and the industry at large.

The Plant Safety committee is composed of all foremen and subforemen. We also regularly assign committees from the rank and file of employees to attend the meetings and report hazards found by them.

The activities of the plant safety committee stimulate interest among our foremen, which in turn is transmitted to every employee. The contact between the general committee and the individual through the foremen is one of the most important factors in our accident prevention. It involves ability of a high order in handling men and winning them to safety cooperation.

Trends in the attitude of employees toward accident prevention can generally be detected and a weakening in safety mindedness is often indicated by an increase in the number of minor accidents and minor infractions of safety rules. At such times, to restore interest, mass meetings have been called and a short talk given on individual responsibility. On one occasion, each department was visited on every shift and a three minute talk given on safety observance.

One special feature consisted of taking a snap shot of every employee on the job and obtaining from him an expression on safety. The photographs were exhibited in groups of three or four on the plant bulletin board, together with what each man said. This idea had a good psychological effect and revealed a very loyal attitude among the men.

Posters for bulletin board displays, as furnished by the National Safety Council, are indispensable, and the Safe Worker pamphlet published by the Council is also effective in stimulating interest of individual employees.

During the first year of our no accident record, much interest was aroused by a mock court trial staged by employees with "Old Man Accident," a weird dummy, as the culprit. A verdict of guilty in the first degree resulted.

The first reaction in achieving any safety goal is a feeling of pride in accomplishment. This state of mind is usually accompanied by a false sense of security. After One Thousand Days, then, it becomes important to adjust ourselves at once to the thought that we have not reached a destination but merely a mile post. An appraisal should be made to determine whether safety activities are adequate to preserve the Thousand Day record.

We believe that our plant safety committee represents a very satisfactory type of organization. This committee is entrusted with full responsibility for safety observance. It is also given considerable latitude in the conduct of accident prevention work and in making recommendations for physical changes to make the plant safe. The workmen's inspection committee is a valuable feature because these men will usually discover details that are passed unnoticed by employees in daily contact. By rotating these committees, practically all employees at some time are given an opportunity to attend the plant committee meetings.

Our plant safety committee is divided into four subcommittees, with duties as follows:

Subcommittee A: Regular inspection of entire plant with respect to elimination of hazards and unsafe practices. Reports of these inspections must be submitted monthly as made either by the committee itself or by workmen's committee under direction of Subcommittee A, at their option. This committee may invite employees other than foremen to attend the general safety meetings from time to time. In case of an accident Subcommittees A and D under the general chairman will act as a fact finding group to determine both immediate causes and all underlying causes.

Subcommittee B: This committee is charged with regular monthly inspection of sanitary conditions of the plant and premises of company houses. It also provides first aid instruction to an organized class of not less than six men to include representatives of both day and night crews. Instruction in resuscitation is especially stressed. The first aid squad will be called at regular intervals to give demonstrations before the general committee.

Subcommittee C: The duties of this committee include regular monthly inspection of all fire apparatus and follow up of necessary maintenance to conform with

rules of Underwriters Association. Inspections include both plant property and dwellings at Perry and Clinchfield. Fire hazards or recommendations considered by this committee in connection with the coal mill, especially, should be made a part of their report.

Subcommittee D: To this committee on publicity and education is delegated the *important task of disseminating accident prevention information to employees.* This is done (1) Through papers or abstracts read before the general committee; (2) By displays on the bulletin board. All safety publications received at the plant pass through the hands of this committee, to be made available to members of the general committee with attention called to features of special interest. In case of an accident this committee assembles the facts as determined by the joint efforts of Subcommittees A and D under the general chairman, prepares a description of the accident—its direct and contributing causes—with steps to prevent a recurrence—and publishes this on the bulletin board, a copy being submitted to the next meeting of the general committee.

The duties assigned to our general chairman and safety director are as follows:

Duties of the General Chairman: To preside at meetings of the general committee and see that these are held at designated times; prepare programs in advance; and supply accident statistics and other information to make the meetings interesting and profitable.

Duties of Safety Director: To keep the safety spirit alive at all times through contact with employees, and keep the general chairman informed of the need for special effort on individuals or departments where any laxity is apparent. To keep all safety records including minutes of all committees. To make up accident reports and keep in close touch with cases where injuries require medical attention. To render first aid in minor accidents and enforce strictly the rule requiring employees to report for first aid. The safety director coordinates the activities of all subcommittees and assists subcommittee chairmen in arranging monthly meetings.

In addition to plant inspection, for which Subcommittee A is responsible, the safety director will determine whether additional guarding, improved physical conditions, or better housekeeping methods are needed. He will photograph the hazards, where possible; also, by posed photographs, show both safe and unsafe methods for exhibition to the general committee and on bulletin boards. He is authorized to stop any work immediately where unsafe tools or faulty equipment are being used, until replacement or satisfactory tests have been made. Likewise to correct unsafe practices.

In carrying on beyond the Thousand Day record, we do not see the need for modifying or amplifying this form of organization. But we do believe that it is necessary to stimulate the work from time to time and intensify our efforts.

All safety recommendations submitted at Clinchfield are studied by the committee and our records show that 75 per cent have been adopted. In every department there is evidence of the work of inspection committees and results of suggestions from individuals. We give careful attention to this phase of accident prevention because of its effect generally. To disregard any reasonable safety suggestion might destroy the confidence of an employee in the sincerity of the work.

No Thousand Day Club can long survive without attention to good housekeeping. The spirit of safety is reluctant to dwell in disorderly surroundings. Men react unconsciously to their environment. At one time during our Thousand Day Period we established competition between departments by making regular inspections and rating each department on a point system, starting with 100 per cent and deducting for every evidence of uncleanliness or disorder. This method is quite effective.

Safety observance depends upon another factor of prime importance—that of the health and physical condition of employees. We have had all employees undergo a complete physical examination, conducted at the plant by our regular physician. No tubercular cases were found or other contagious diseases. We found one outstanding case of high blood pressure in an electric crane operator who was immediately relieved and given work as watchman. Other cases of high blood pressure were not serious but required treatment which otherwise would have been neglected. In another case, defective heart action was found in a rather young employee who also was relieved of his job in the coal mill. These cases demonstrate the value of periodic health examinations. It is possible they might have been responsible for some serious accidents. The Clinchfield plant is situated in a malarial region and blood tests were made a part of our examinations. Approximately 20 per cent of the tests showed malarial infection and the men were given treatment. It is customary, however, to dispense quinine to all employees the year around.

Our subcommittee on publicity has stressed at different times both safety on the highways and in the home; particularly the former. Posters have been displayed and at least one address has been made in the community school by one of the plant force. In keeping with the movement to utilize the experience of industrial safety organizations in communities, we plan to extend these efforts as a member of the Thousand Day Club. Through influences set up in the homes of the community, direct benefits will accrue to the safety spirit within the plant.

Our subcommittee on sanitation has performed good work in the plant and company villages. Special attention has been given to conditions breeding mosquitos. Drainage has been provided where possible and oil films placed on pools of water around the quarry or elsewhere.

In mentioning the value of good housekeeping, it is also true that the approach to the plant exerts a definite influence on the minds of employees. Reconcile, if possible, the effect of coming to work through plant grounds that are *unkempt* and generally unsightly, while at the same time adjusting one's self to the idea of good housekeeping within the plant. There is some element of insincerity in such a condition and we have given this factor serious attention at Clinchfield. The plant surroundings, especially the approach, have been improved by landscaping and we could hardly contemplate a good safety program without the benefit of these improvements.

The Elimination of Unsafe Practices

By RAYMOND STONER

General Quarry Foreman, Louisville Cement Co., Speed, Ind.

The causes and results of accidents are not as a rule difficult to ascertain, but the prevention of practices that result in accidents is quite another thing. This is the axis around which the entire safety problem revolves and the most important element is the individual.

In surveying the reports and other statistics of the cement associations, why is it that we do not find more accidents occurring on jobs which everybody knows are inherently dangerous? It is not logical that where there is an increase in danger there is less cause for accident. The only plausible answer seems to be that the men engaged in such work are more expert. Assuming this to be true, then why not, as nearly as possible, make every employee a specialist in his own line, whether it be in the operation of a complicated machine or the proper use of a shovel?

We must develop the highest degree of coordination between the mental and physical in the men. How can this be done?

The problems of unsafe practices, or rather the cultivation of safe practices, should go hand in hand with the other lessons taught in early childhood. As soon as the child is old enough to understand we begin to stamp on his mind a code of moral and spiritual decency that will enable him to distinguish right from wrong. Days and years are spent in training boys and girls to meet the temptations of life in order that they may arrive at manhood and womanhood with high character. We exert every effort to broaden their intellect so that they will not only be able to occupy the more important positions, but will also be capable of enjoying the bigger and better things of life.

Conceding the fact that the youth of our country have been given all the advantages of modern training and arrived at manhood equipped with a high standard of morals, a fine physique and a strong mentality, yet there seems to be one thing overlooked in his training. We have failed to impress on him the very first law of nature, self preservation.

Have we allowed him to go forth into the world without the only instrument that will protect him, and the absence of which will make him a menace to those associated with him in their daily work? No one knows where a young man's future will be cast. It matters not whether it be the cement industry, a bank, or if he is the town loafer, he should at all times be conscious of the responsibility involved in protecting himself from injury. It is an *impossibility for a man* to disregard his own safety without being a menace to the public in general.

When people begin to realize that it is a serious duty to eliminate unsafe practices and not a matter left to their own discretion, they will have gone a long way in the prevention of accidents. The most positive way to drive this home, to future generations, is to begin the instruction at mother's knee.

May the time soon come when the error and folly of unsafe practices will be driven into the mind with such force that man will have a safety conscience comparable to that which now constantly reminds him of moral transgressions. Every time we are guilty of an unsafe practice and survive or escape uninjured, it will be well to remember that the law of averages will sometime call for an accounting and the penalty will surely have to be paid.

Safe habits should be followed until they become instinctive. When emergencies arise, sometimes reason deserts us and instinct must step in. We should at all times be obedient to safety rules; reading them is not sufficient.

We should never lose sight of the ultimate objective, namely; to promote and advance practices and ideas that will leave safe habit-forming tendencies and always keep in mind that to have our own conduct and behaviour well regulated is the best safety example we can afford others.

WEDNESDAY MORNING SESSION

October 16, 1935

A Safe Driving Program in the Cement Industry

By M. A. KOFFMAN

Secretary, Southwestern Portland Cement Company, Los Angeles, Cal.

The undertaking of a safe driving program in any industry is worthy of every effort necessary to make it a success. My company adopted a safe driving program *on June 15, 1935, first compiling a booklet of sixteen pages*—"Safe Driving Facts"—and distributing these booklets to some 90 employees driving company owned automotive equipment, including sales representatives, truck drivers and executives. The insert sheet was a detachable receipt for the booklet.

The employee also received in the booklet a personal letter from our president, Mr. F. H. Powell, who said:

"In an effort to eliminate automobile accidents, thereby saving possible injury or death, and to avoid unnecessary suffering to employees of this company, or others, the following SAFE DRIVING FACTS are prescribed for those who drive company owned equipment in the pursuit of their several duties or at any other time, and who are expected to observe these SAFE DRIVING FACTS. As a matter of policy the Southwestern Portland Cement Company deems it necessary to do what it can in the interest of public safety and to suggest that all of its employees and members of their families observe these SAFE DRIVING FACTS when at the wheel of an automobile.

"Your cooperation is asked to the end that this company will proudly point to your record of safe driving which we MUST establish and which we know CAN be done.

"All company owned equipment will be identified by means of an insignia fastened to rear number plate, or on car where it may be easily identified when on the road. Any infractions of SAFE DRIVING FACTS, if observed, will be reported to the head of the Safe Driving Department and the violator will be informed.

"Each employee driving company owned equipment will be provided periodically with a record of his history in connection with his automobile driving, which will include an analysis of cost of operation, miles traveled, safe driving and accident record, condition of car, etc. Each one will be provided with a key number known only to himself, and the record with which he will be provided will not only show the history of the equipment he drives, but also a record of every piece of equipment driven by every employee driving company owned automotive equipment.

"Periodically, as and when it is practical and possible, all of our salesmen and others driving company owned equipment will meet at their respective headquarters, Osborn, El Paso, Los Angeles or Victorville, where discussions, talks and instructions in connection wth SAFE DRIVING FACTS will be the subject.

"Contests will be held from time to time, and suitable prizes will be offered. May we at this time point out that the greatest prize for which anyone should desire and strive, is the reputation of being the SAFEST DRIVER. We now leave the matter in your hands with the feeling that you will not fail to observe the wishes of this company in asking that you fulfill the purpose and requirements of SAFE DRIVING FACTS."

The following is an outline of the material contained in this booklet—"Safe Driving Facts":

A—THE DRIVER—YOU—

1—DON'T think about other things when driving—drive your car SAFELY.

2—DON'T exceed the speed limits prescribed by law. SPEED causes one-FIFTH of ALL traffic accidents.

3—DON'T violate the rule of right-of-way. ONE out of every THREE accidents is caused by someone violating this rule. Give way, even though you may be right.

4—DON'T drive close to the car ahead. Keep at least *three car lengths* behind the car ahead.

5—DON'T drive to the left of the center of the road. Always keep well to the right.

6—DON'T stop without giving proper signal.

7—DON'T pass another vehicle without sounding horn. When passing a vehicle traveling in the same direction, turn out at least 100 feet before passing, after you have made certain the way is clear; pass to left of vehicle, and sound horn before passing. DON'T cut in too short after passing. Give at least 150 feet clearance before turning back to right side of highway. Be doubly cautious on narrow roads or streets.

8—DON'T pass another vehicle on curve, at intersection, top of hill or at ANY PLACE WHERE VIEW IS OBSTRUCTED.

9—DON'T pass street cars while loading or unloading passengers. Give pedestrians the right-of-way so they may cross from walk to street car, bus or safety zone. Keep a sharp lookout for pedestrians crossing from behind street cars, automobiles, busses or trucks.

10—DON'T take chances with pedestrians, equestrians or bicyclists. ALWAYS give the right-of-way.

11—DON'T drive through stop signs. DON'T jump signals. Don't be in a big hurry to start when signal changes to "Go." Don't speed in order to beat a signal.

12—DON'T cut corners. Before making a left turn, drive to right of center line of road or street, at least 200 feet before approaching intersection; hold out your left forearm horizontally; slow down; observe cars approaching from, and on your left and right; cautiously make a left turn to the right of the CENTER OF THE INTERSECTION. Before making a right turn, drive to extreme right of road or street, at least 200 feet before approaching intersection; slow down; hold out your left forearm up in a vertical position, your left forefinger pointing to the right; cautiously make a right turn, first observing traffic approaching from the left. NEVER turn left ahead of a vehicle traveling in the same direction and on your left; likewise NEVER turn right ahead of a vehicle traveling in the same direction and on your right. NEVER TURN AROUND IN THE MIDDLE of a block or between street intersections.

13—DON'T *speed through* an intersection or railroad crossing. Slow down at all intersections, particularly on narrow highways and where vision is obstructed. ALWAYS REDUCE TO A LOWER GEAR when crossing railroad tracks. DON'T TAKE CHANCES.

14—DON'T park your car wrong. Never park double, unless directed by traffic officer, marked traffic lines or signs. Observe state, county and city restrictions in parking your car. NEVER turn out or back out until you are sure the way is clear so you may safely enter the line of traffic.

15—DON'T drive late at night when tired. Your company does not expect this, and requests you NOT to. Driving at night, particularly for long distances, after a full day's work, makes you a potential hazard to yourself and other cars.

16—DON'T drive if you have been drinking. Gasoline and alcohol do NOT mix.

17—DON'T start your car in a closed garage. FIRST see to it that window and door are open. BE CAREFUL and prevent carbon monoxide poisoning or death caused by inhaling motor exhaust fumes. Windows in automobiles and truck cabs should always permit of proper ventilation.

18—DON'T crank car the wrong way.

19—DON'T be discourteous on the road or in case of accident. Your conduct while driving, or in case of an accident, reflects upon the reputation of YOUR company.

B—THE EQUIPMENT—

1—DON'T drive with bad brakes. Keep your brakes in good condition.

2—DON'T drive with poor lights. ALWAYS keep all lights on your car in good condition.

3—DON'T drive with loose steering gear.

4—DON'T drive on BAD tires. Keep your tires inflated properly at all times.

5—DON'T drive without chains on slippery roads or streets.

6—DON'T drive with obscured windshield. Keep your windshield wiper in good condition. An obscured windshield or rear window, particularly at NIGHT, is dangerous.

7—DON'T drive without your First Aid Kit. Keep it properly filled in accordance with First Aid instructions.

8—DON'T forget to have your car and equipment inspected. The company requires a quarterly inspection on the first days of January, April, July and October of the following: 1—BRAKES, 2—LIGHTS, 3—STEERING GEAR AND FRONT WHEELS, 4—TIRES, 5—TIRE CHAINS, 6—WINDSHIELD WIPER, WIPER KIT AND REAR VISION MIRROR, 7—FIRST AID KIT. Adjustments and repairs must be taken care of at the time of inspection.

C—THE OTHER DRIVER—

1—DON'T do to the other driver that which you would NOT want him to do to you.

D—THE ROAD AND WEATHER CONDITIONS—

1—DON'T use narrow roads unnecessarily. Keep on the main roads and thoroughfares.

2—DON'T drive fast on narrow roads. Drive carefully, especially when passing cars, and at intersections and when crossing tracks.

We have purposely refrained from using "Rule" or "Rules" in SAFE DRIVING FACTS, because after giving the matter considerable study we concluded that "Facts" are understood more easily than "Rules."

Our safe driving department functions in somewhat the same manner as safety committees do in our plants. This department is made up of safe driving committees at each headquarters, with our president as department chief, and our general manager, department general manager, administering the safe driving department from our general headquarters. From here each month one of our very capable young women edits monthly bulletins, with appropriate cartoons drawn by an artist of ability—one of our repairmen. This monthly bulletin is sent to each employee operating company owned automotive equipment, a suggestion blank being attached to each bulletin.

Many excellent suggestions have been developed in this manner, and our president reads and acknowledges each one personally. Intelligent inquiries and ideas are developed from safe driving committee meetings held periodically. Copies of the minutes of each committee are exchanged among the three committee groups.

Our safe driving program began June 15, 1935. Since then we have had four minor accidents, with no injuries, and comparatively slight damage.

In every case when an accident is reported, we write a letter to the one who was driving, and make further inquiry, asking questions—for example: "Was any safe driving fact violated?"—"What recommendation do you offer to prevent a similar accident?" In this way we maintain direct contact from our general headquarters and every driver knows that making out an accident report does not mean that the investigation is completed.

We have adopted a means of recognition of no-accident safe driving, in the form of a bronze pocket piece, the size of a half dollar, suitably inscribed, and when an employee turns in the bronze pocket piece showing five yearly inscriptions, he receives a silver one.

The Cause and Prevention of Injuries from Machinery in Operation

By W. M. CABANISS

Asst. Supt., Signal Mountain Portland Cement Co., Chattanooga, Tenn.

In the early days of accident prevention work, steps were taken to guard exposed moving parts of machinery, but the number of accidents was not reduced to the extent expected. Of course, the first mechanical guards were clumsy and in many cases hazardous in themselves, and they often interfered with operation and maintenance. As time went on the guards and machinery were improved. Today machinery comes from the manufacturer guarded. In fact, machinery of today is not modern unless it is fully equipped with safety devices.

In the case of the early guards, and some modern guards, it is easy for maintenance men to leave them off after a repair job and this is done if the maintenance man, operator, foreman or management is not sold on the safety idea. Safety, like water, will not run up hill; therefore, the management must be sold first; then safety will come down the line to the worker. This fact has gained such recognition that today safety is as important as any other factor in management. However, it is the practice of safety that prevents accidents and a good operator will refuse to start a machine unless the safety appliances are in place. Since all operators have not yet become impressed with this phase of accident prevention, here lies the cause of the majority of accidents attributed to machinery in operation.

In 1934 approximately 12 per cent of all lost time accidents in industry were charged to machinery. In the cement industry 12¼ per cent of all lost time accidents were charged to machinery in motion, while in the quarrying industry only 5.8 per cent of its total lost time accidents were so charged. The causes of these accidents will come under such headings as forgetfulness, neglect, carelessness, lack of good housekeeping, inexperienced operators, etc.

In many plants we find an operator who is anxious to show a good production record but gives very little thought to safety. He will make minor repairs while his machine is in operation successfully for a time, but sooner or later something will slip. One should always stop a machine before reaching into it.

Another common type of accident is caused by trying to put a belt or drive chain on without stopping the motive power. As a rule the victim is an old employee who is reluctant to admit the danger in such practice. With the increase of direct connected units the opportunity for such accidents is being reduced.

A careless workman is a bad risk at best and the habitually careless worker should be weeded out. You may have a safe organization but with a slight let-down in safety work carelessness will spring up. The best incubator for maturing this bad germ is the lack of good housekeeping. When housekeeping is neglected, habits become sloppy and accidents occur. Good housekeeping breeds safety, curtails waste, and improves morale.

The foregoing causes of accidents can be corrected by safety education. Safety education is not easy to put across due to the vast differences in employees. To some the bulletin board makes a lasting impression; to others this must be supplemented by safety meetings; while to still another group it is necessary that they be the victim of an accident themselves to drive the idea home. A real program requires a set of safety rules that are workable and that will be adhered to. Discipline is essential.

The inexperienced workman is not as dangerous as he was once thought. It is when he has reached the point where he thinks he has mastered the situation that he will bear close watching. Proper training of an understudy is thorough training.

In conclusion, I would say, sell the management the safety idea, guard all dangerous points and follow up with a convincing safety education.

Review of the Best Educational Features Used by Ten Cement Plants

By R. H. MacFetridge

Supt., Lehigh Portland Cement Co., Birmingham, Ala.

Early experience in accident prevention work by the Portland Cement association demonstrated that guarding machinery, while essential, was not the most important phase of a successful safety program.

The work of safety is very broad; yet in a cement plant it can be divided into two fundamental factors, safe guards and safety education.

It is conducive to sound progress, in discussing the best safety educational features used in cement plants, to analyze the educational features used by plants whose accident records have been good over a period of years.

In the lead is the Iola, Kansas, plant of the Lehigh Portland Cement company, which now has a non-stop safety run of eight years.

Superintendent C. A. Swiggett, in discussing the safety educational features used at this plant, calls attention to the sympathetic cooperation of the company management. A general Safety committee which meets monthly supervises the safety activities through sub-committees composed of the Inspection, Fire, Accident, First Aid and Sanitary, Welfare and Publicity sub-committees.

All sub-committee reports are analyzed by the general committee with the plant superintendent as a member.

The Inspection committee inspects the entire plant regularly. The Fire committee inspects fire apparatus and housekeeping from the standpoint of fire hazards and conducts fire drills. The Accident committee investigates accidents to place the responsibility and make recommendations to prevent a recurrence. The First Aid and Sanitary committee inspects the first aid equipment and hospital and investigates all sanitary matters. The Welfare committee supervises all matters pertaining to the welfare of employees and their families. The Publicity committee supervises bulletin boards, June safety campaigns, contests, picnics, mass meetings and cooperates with safety activities in the community in connection with the schools, home and highway safety.

Twice a year meetings of all employees are held and talks on safe practices are made by the superintendent, foremen, plant physician and key men from the rank and file. First Aid and resuscitation demonstrations are made twice a year by employees trained by the United States Bureau of Mines. New bulletins are posted once or twice a week on the bulletin boards and pencilled safety notations are made on a black board. Each foreman instructs new employees as to their duties.

Another outstanding safety record has been made by the Toledo, Ohio, plant of the Medusa Portland Cement company, which has completed six consecutive years. Superintendent Worthy outlines the educational features:

We use all the regular features, such as bulletin boards in each department, safety posters, safety committee meetings and general mass meetings, all of which have their place. All of these features, however, can be of no effect unless interest is manifested from the management on down throughout the organization.

In April of 1928 we had a death due to a screw conveyor, which is the last lost time accident to date. At that time we formed our present safety committee composed of all foremen. This committee was advised, that if they expected to hold their jobs as foremen, that accidents had to stop.

This action, while rather severe, served its purpose. Safety, began as a matter of self-interest. The foremen began to try to educate their men to work safely and the men were glad to listen.

At the end of the first year we won our trophy. We held a big celebration and promised ourselves we would repeat next year. As our record has continued, each man is more determined than ever that he will not be the cause of spoiling it.

Another matter that has helped us very much is the way our Safety Committee is organized. Each foreman and the superintendent and assistant superintendent are permanent members. A new chairman is elected each six months. Meetings are held each second Thursday on company time and continues as long as is necessary. Each member has one vote and the vote of a majority is final insofar as the committee is concerned.

During these meetings I divest myself of authority as superintendent and am simply a member. The members are free to express themselves in direct opposition to my views without fear of a comeback later on. Minutes are kept, a copy of which is sent to our general management. I do reserve the right to veto, but exercise it very seldom.

We insist that minor accidents be treated within thirty minutes. Each foreman carries first aid cards, which are to be filled in in detail as to how the injury occurred to his man. The injured employee then goes to the first aid station for treatment, when the card is again filled out as to the treatment rendered. The foreman must have his man return for treatment as many times as the first aid department deems necessary. At safety meetings each foreman must explain how the minor injuries occurred. This method has eliminated infections.

The Trinity Portland Cement company's plant at Fort Worth, Texas has a non-stop safety run of five consecutive years and General Superintendent, C. E. Caron, attributes this record to educational work conducted through foremen's, departmental, and general organizations.

The Foreman's organization functions includes a permanent Safeguard committee which acts on all suggestions and consists of the master mechanic, chief electrician and plant superintendent. At the foremen's meetings rules and regulations are formulated. Injury reports are read and discussed.

The Departmental organization meets in the individual department at the discretion of the department head. The foreman who reports to the superintendent is a permanent chairman and the organization discusses safe practices and safeguards.

The General organization receives reports on all home injuries and sees to it that minor injuries are treated, that the first aid attendant makes out suitable reports, that safety suggestions are made out on forms furnished, that a safety rules book be given to each man when he enters our employment, that Bureau of Mines and Red Cross manuals are kept on hand, and methods of rendering first aid demonstrated at regular intervals, that each foreman is a first aid expert, that a careful analysis of all injuries is to be made periodically by the Plant Superintendent, to determine the frequency rating for individual men and the frequency of any particular type of injury.

The program of any Safety organization must be varied to keep up interest. One of our methods is to foster departmental and individual contests. Others are to have good men from one department serve as inspectors in other departments, to appoint different employees to fill out our weekly or monthly inspection reports, and to have different departments take charge of the bulletin board posters for a week or a month.

The Manitowoc Portland Cement company plant at Manitowoc, Wisconsin, has five consecutive perfect safety years and Superintendent F. E. Town says that a bi-weekly General Safety committee meeting is conducted. Inspectors reports are acted upon and minutes of departmental meetings are discussed.

Bi-weekly departmental safety meetings are conducted by the foreman of each department. The Portland Cement association's accident bulletins are posted. A bulletin board is maintained informing the men of the exact standing of the plant

relative to safety and the number of days remaining for the winning of another trophy. Enamelled signs are used to give departmental standings.

The Superior Portland Cement plant at Concrete, Washington has a four year non-stop "no accident" record. H. A. Ambler, general superintendent, reports on activities.

The various features of our program, he says, are so overlapping that it is difficult to segregate the purely educational ones. Our whole program is built around our General Safety committee, a permanent committee consisting of all foremen which meets once a month. The company serves a dinner before the meeting and the general superintendent presides. We invite five or six men from the employee roster as guests, so that, in the course of time, everyone on the payroll has a chance to attend.

At the meetings, we discuss the P. C. A. accident reports, any accidents in our own mill, and usually have either an outside speaker, or other feature. A safety inspector, not a member of the committee, is appointed each month and makes his report. Also, each foreman personally interviews each man in his department during the month, and reports any safety suggestions.

We have found bulletin boards and stunts to have very little value, but we do post the P. C. A. accident reports. We also try to have a safety rally or two annually, one on a quite elaborate scale. For the past few years the Trophy Dedication has taken the place of this rally. First aid work is encouraged and we try to have the Bureau of Mines' instruction given about once a year. First aid teams keep up the interest, particularly if they can be entered in contests.

As one feature we have sponsored essay contests in the local school, offering prizes. As another, we have sent a letter to each employee on the occasion of the first accident in the month, whether the accident be lost time or not. This letter pointed out how the accident might have been avoided, how, with a little bad luck, the accident might have been much more serious, etc.

We believe one of the best features of our program is the safety bonus. This is a bonus of $1 per month paid in a separate envelope to each person on the payroll, provided there has been no lost time accident during the month. This has had the effect of making each man his brother's keeper, and the increased watchfulness on the part of everyone has undoubtedly helped enormously.

Through all this work, we are constantly bringing out the causes of accidents and how to prevent them, but when all is said and done, most of the men need very little education on the safe way to do their job. A new man or a man transferred to another department may need such instruction, and we rely on our foremen to give this instruction.

Safety Rule Books are issued to each new man as he is hired, and to older employees at regular intervals. These rules are also posted at conspicuous places in the mill. Each man is required to study this book as part of his job. Some may think it "smart" to take chances, but they can soon be disciplined either by the management or by their fellow employees.

For the remainder, it is not so much education as it is making them remember what they know. It's a question of persistence, and we plan to space the letters, bonuses, inspections, meetings, foremen interviews, etc. so that the subject of safety is brought to each employee personally every three or four days.

The Dallas Plant of Lone-Star Cement company with a record of four no-accident years, three of them consecutive, according to General Superintendent Moeller, used the following educational safety features:

Probably the most influential part of our educational program, Mr. Moeller says, consists of the monthly mass meetings. Each meeting is in charge of some one department. The department heads, or foremen, are allowed considerable latitude in their choice of programs. Sometimes an outside speaker is secured. These meetings are held on the company's time, and every machine that possibly can be is shut down so that all employees attend.

On holidays, barbecues are given, and at these the speakers usually bring to the attention of the men's families that the plant wants to make our product without hurting anyone, and the families are appealed to in an effort to have their cooperation in the home in accident prevention work.

The Safety committee is composed of the heads of the departments, together with two special members. These two serve for two months and represent their departments in the safety inspections throughout the plant. It is through this Committee that suggestions are received from employees as to safeguards and dangerous practices. All suggestions are given consideration.

The regular educational features of the Portland Cement Association and the National Safety Council are also made use of,—such as posters, bulletins, and pamphlets. Posters must be changed frequently, and at this plant the posters are changed once each week.

Superintendent C. W. Edmonds of the Canada Cement Company Limited states at the Fort Whyte Plant their record of five no-accident years was accomplished by use of the following safety educational features:

Undoubtedly the principal feature in our campaign has been direct personal instruction by the foremen of the individual workman. Employees have been encouraged to offer suggestions with respect to safety. All injuries no matter how trivial are treated at the first aid room. Bulletins supplied by the National Safety Council are displayed on bulletin boards throughout the plant and are changed at frequent intervals. In selecting the bulletins to be ordered the safety inspectors, who are chosen from amongst the foremen, are asked to recommend a list from those published each month in the National Safety News, and these lists serve as a basis.

A meeting of all foremen is held fortnightly, at which matters connected with accident prevention are reviewed. Classes in first aid were at one time organized but owing to business conditions during the past few years these have been permitted to lapse. It is our intention to resume them as soon as possible.

Chemist E. H. Schantz of the Portland Point, New York, plant of the Pennsylvania Dixie Cement corporation makes the following statement in regard to the safety education program used to accomplish a four year no-accident record at this plant, three of which were consecutive:

It would be difficult to enumerate the steps which were taken at Portland Point to reach that particular ideal for which we were striving and which, for years, seemed practically impossible to reach. The plant had been properly guarded; regular, well-attended safety meetings were held monthly; weekly inspection of the plant and weekly foreman's meetings were never missed; bulletin boards were advantageously placed and frequently renewed with posters most suitable to our conditions. In fact, practically everything which any and all safety advisers had to advance, was tried and carried out—yet, we continued to have our accidents. Experience, we believe, has been our best and most influential teacher. The proper investigation of those accidents, however, made it possible for us to learn and appreciate just how and why they were caused.

The "other fellows keeper" ideal also has taken root. It is being preached and practiced everywhere throughout the plant and quarry.

We place special stress on minor injuries and employees are required to receive proper care for all scratches, cuts and bruises.

All of our foremen are sold on safety, one hundred per cent. They are required to speak to their men daily, if only for a few minutes and the foremen and their men appreciate the position of the new man in a department. This is vital even though the new man has been properly instructed after he has passed our physical examination.

The Pacific Portland Cement company with five no-accident years to its credit uses the procedure as outlined by Vice-President Colton.

In our preliminary work we centered our attention on safety guards and called upon our men for suggestions. We had a plant safety organization and a safety inspector. We had men from one department inspect other departments. We have maintained a well organized first aid crew. We had all of our men take the course offered by the Bureau of Mines in first aid work and more than ninety per cent of the men in our employ were given a certificate. We certainly believe that the individual training of the men in first aid work and the interest and enthusiasm which was created by our first aid crew have done much to gain the interest of the men and probably we can say that through it we created a general interest in accident prevention.

The Great Lakes Portland Cement corporation plant at Buffalo has a record

of five no-accident years and Chief Engr. Zook attributes this fine record to the following safety educational features:

Undoubtedly, our best feature is the use of the Monthly No-Accident Derby competition which has been in use since 1928. The plant personnel is divided into groups and at the end of each month, every group having completed the month with no accident requiring more than two visits to the first aid room or doctor shares in an award. Much interest is maintained and the morale of the organization has been raised to a high level by the introduction of the honor feature, i. e. it is a dishonor not to report any accident, and a heavy penalty is imposed for the dishonor, not the accident.

All new developments in safety engineering, up-to-date clippings and current events are posted on our bulletin boards which are changed regularly and kept clean and attractive.

The Safety and Welfare committee is composed of fifty per cent mill men and fifty per cent department heads. All of the mill men must have been with the company at last five years without a lost time accident.

Copies of minutes of the safety committee meetings are distributed and given publicity.

The main Safety and Welfare committee is divided up into sub-committees as follows: Inspection committee, to inspect the plant for accident hazards; Investigation committee, to investigate recommendations made; First Aid and Sanitary committee, to look into matters of sanitation; Welfare committee, to investigate all cases of relief or trouble among employees and to promote general good feeling; Publicity and Education committee; Fire committee, to inspect all fire apparatus and report all fire hazards about the plant.

Reports of these sub-committees are made at the general committee meetings held twice a month.

Much of the foregoing could not be classed with educational features but along with it we make use of the Portland Cement association and National Safety Council material for our bulletin boards. Probably one of the most interesting features is the posting of the monthly accident report of the Portland Cement Association.

The best safety educational features used by these ten plants can be summarized as follows:

Wholehearted cooperation of company officials, contacting employees regularly, thus teaching them that safety is essential to the proper functioning of a cement plant.

Well organized safety committees whose personnel is changed at least in part often enough for every employee to see and hear at first-hand the functioning of the committee.

Systematic, intelligent use of bulletin boards, posters, photographs of articles.

First aid on honor system basis for all injuries no matter how slight.

Bureau of Mines training in first aid and resuscitation for each employee.

Foremen instruction of each man under his supervision as to hazards of his job, especially the new or transferred employee. Creating interest in local community safety activities in the school, home and on the highway by having employees participate. Letters to employees families occasionally, telling of plant safety activities, thus educating and creating family interest in safety which environment aids employees.

ADJOURNMENT

Chemical Section

Officers 1934-35

General Chairman—A. L. Armstrong, Eastman Kodak Co., Rochester, N. Y.
Vice-Chairman in Charge of Program—H. L. Miner, E. I. duPont de Nemours & Co., Wilmington, Del.
Vice-Chairman in Charge of Engineering—C. L. Jones, Hercules Powder Company, Wilmington, Del.
Secretary—Ralph O. Keefer, Aluminum Company of America, Pittsburgh, Pa.
News Letter Editor—E. L. Root, Celluloid Corporation, Newark, N. J.
Occupational Disease Committee Chairman—Dr. Leonard Greenburg, New York Dept. of Labor, New York City.
Membership and Publicity Committee Chairman—S. D. Kirkpatrick, Chemical and Metallurgical Engineering, New York, N. Y.
Statistics Committee Chairman—R. C. Stratton, The Travelers Insurance Co., Hartford, Conn.
Members at Large—
F. E. Clancy, Jr., Mathieson Alkali Works, Inc., Niaraga Falls, N. Y.
F. W. Dennis, Hooker Electrochemical Co., Niagara Falls, N. Y.
Ira V. Kepner, Pennsylvania Salt Manufacturing Co., Menominee, Mich.
E. F. King, Lever Brothers Co., Cambridge, Mass.
H. P. Lewis, E. I. duPont de Nemours & Co., Wilmington, Del.
John Roach, Deputy Commissioner of Labor, Trenton, N. J.
C. E. Sevrens, Merrimac Chemical Co., Inc., Boston, Mass.
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.

Officers Elected for 1935-36

General Chairman—A. L. Armstrong, Eastman Kodak Co., Rochester, N. Y.
Vice-Chairman in Charge of Program—H. L. Miner, E. I. duPont de Nemours & Co., Wilmington, Del.
Vice-Chairman in Charge of Engineering—Ralph L. Rogers, Jr., Tennessee Eastman Corp., Kingsport, Tenn.
Secretary—Ralph O. Keefer, Aluminum Company of America, Pittsburgh, Pa.
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S. E. WHITING, Liberty Mutual Insurance Co., Boston, Mass.

TUESDAY MORNING SESSION

October 15, 1935

The first session was called to order by Vice-Chairman H. L. Miner, E. I. duPont de Nemours & Company, Wilmington, Del., who presided in the absence of General Chairman A. L. Armstrong. Chairman Miner presented a brief message from the General Chairman.

The Welding of Chromium Steels in Chemical Plant Equipment

By J. R. DAWSON

Research Metallurgist, Union Carbide and Carbon Research Laboratories, Niagara Falls, N. Y.

[NOTE: So terrible are the accidents which sometimes occur in chemical plants when welds in pressure vessels fail that the Council takes pride in publishing this paper on making welds on chromium steels that hold. Safe practices in welding as a process are discussed in standard Council publications.]

Chromium steels have been grouped[1] in various ways and probably the most useful arrangement from the standpoint of composition, fabrication, and use, is as follows:

Group	% Chromium	% Carbon	% Nickel
1	12.0 — 17.0	over 0.20	
2	11.0 — 14.0	less than 0.12	
3	15.0 — 18.0	less than 0.12	
4	20.0 — 30.0	less than 0.30	
5	17.0 — 25.0	less than 0.20	7.0 — 12.0
6	7.0 — 25.0	less than 0.20	17.0 — 22.0
7	Castings—considerable variation of composition		

Although the stainless steel of Group 1, which is relatively low in chromium and high in carbon, is seldom welded, the steels of the other groups may be fabricated or repaired by fusion welding either by the oxy-acetylene flame or the electric arc.

In oxy-acetylene welding, the welding rod chosen should be of the same composition as the material being welded. There are certain instances in which the low carbon chromium-nickel welding rods may be used for welding the alloys that contain only chromium, but this should be done only after assurance has been obtained that the weld metal from the nickel-containing rods will be suitable for the service that is to apply to the chromium steel. It is often customary to choose for welding rods, steels that have carbon on the low side of the specification and chromium, and nickel

[1] W. B. Miller, "Gas Welding of High-Chromium Corrosion-Resistant Alloys," Proceedings of the American Society for Testing Materials, Volume 28, Part II, 1928.

if present, on the high side so that if during welding there is a slight increase of carbon or loss of the corrosion-resisting elements, that final weld metal will have a composition well within the requirements of the specification.

A welding flux is required for maximum success with the oxy-acetylene process. Ordinarily this flux is painted along the edges to be joined, as well as on the top and especially the bottom surfaces for the length of the seam. The stainless steels conduct heat less readily than ordinary steels and it is important to avoid overheating the weld. Therefore the flame chosen for joining stainless steels should be smaller than that used to weld ordinary steel of the same thickness.

The properties of welds in stainless steels are greatly affected by the type of flame employed. The flame should be adjusted to give "neutral" conditions in which equal volume of oxygen and acetylene are consumed. Its regulation is understood and is made without difficulty by those experienced in oxy-acetylene welding. If more acetylene is used than is needed, a luminous envelope is formed around the main conical portion of the flame. This is called an "excess acetylene" or reducing flame and causes the absorption of carbon in the melted weld metal, which in most instances leads to decreased ductility in the weld and especially to less effective corrosion resistance. The increase of carbon, often referred to as carbon pickup, is practically negligible when the neutral flame is employed. If the flame is given too much oxygen, the molten surface of the weld metal becomes oxidized causing the production of an extremely infusible slag which leads to the formation of blowholes and the trapping of impurities in the weld.

In most instances sheet 1/16 inch or less in thickness are flanged at the edge to a height of about 1/16 inch. The flanged edges are painted with the flux at both the top and bottom and are held in place as the flame melts down the flanges to form a smooth moderately re-enforced weld. Slightly heavier sheets up to 1/8 inch in thickness may have the edges butted and welded with some addition of metal from a welding rod. A backing strip, generally of copper, is used beneath the joint to prevent the liquid metal from flowing out of the weld. Plates heavier than 1/8 inch are scarfed at the ends to provide a vee so that fusion entirely to the bottom of the weld will be easily obtained. The filling material for these welds is supplied by welding rods.

It has been found helpful to place the parts being joined so that the line of weld inclines slightly downward in the direction of the welding. This permits the flux, which fuses at lower temperature than the steel, to flow forward and constantly provide protection for the metal as it fuses. Welds in stainless steel are almost always made entirely from one side, and care is taken to completely fill the seam so that there will be no occasion to return to some point that should have been finished as the weld progressed. If this does become necessary, or if there is need for welding at the backside of the seam, severe stresses will be produced unless the entire seam is preheated before the flame is applied to a local area of the joint. Such pre-heating frequently is undesirable because of the likelihood of warping and because slow cooling is harmful to some of the steels. It appears justifiable to refer once more to the flux used for oxy-acetylene welding. A special flux which has the property of dissolving chromium oxide is essential to success. The fluxes ordinarily used for bronze welding or welding cast iron are not satisfactory.

In most respects the procedures necessary to obtain good results in the arc welding of plain carbon steel should also be employed for the stainless steels. When high chromium steels are melted they have great affinity for oxygen, and the various electrode coatings that are used serve to protect the melted weld metal from contact with the atmosphere and maintain a steady arc. There is a wide variety of coatings in use and most of them contain deoxidizing materials, such as ferromanganese which aids in removing oxides from the melted metal and in the production of sound welds. The stainless steel metal of the electrodes may contain various elements that are essential to give the weld the properties desired, and the coatings should be of a composition that will encourage the retention of these beneficial elements in the metal as it passes from the electrode to the weld.

Since the stainless steels are high in resistance to flow of heat and electricity, and low in melting point as compared with ordinary steel, generally a smaller electrode will be used than is chosen for welding a given thickness of ordinary steel and the current and voltage should be less than for a steel electrode. In practically all instances arc welding is carried out with reversed polarity, *i. e.*, with the electrode made

the positive pole. For quality in arc welding the edges to be joined must be cleaned thoroughly before the welding is started and if more than one layer or bead of weld metal is required, the slag on the surface of each layer applied must be completely removed. This slag may be broken by light blows with an air hammer and the cleaning should then be finished with a wire brush.

The following comments are offered in regard to the welding of the steels included in the various group classifications.

As previously stated, the steels of Group 1 that contain 12-17 per cent chromium and over 0.20 per cent carbon are often referred to as the cutlery type of steels. The stainless properties depend not only on the correct chemical composition but also upon heat treatment and a polished condition of the finished surface. The surface is affected and the properties altered by welding, which makes this material extremely brittle both in the weld and in the adjacent zone. As a result, steels of this group are generally not welded.

The weld metal and the adjoining base metal of group 2 steels, carbon less than 0.12 per cent, chromium 11 to 14 per cent, are subject to air hardening when heated to the high temperatures required for welding. These welds may be greatly improved by annealing at temperatures of 1200° F. to 1400° F. The treatment is applied most effectively in a furnace, but when furnace annealing is impractical good results can be secured by reheating with the welding flame. If the weld is heated and maintained for two or three minutes at a dull red temperature, the hardness and brittleness will be reduced substantially.

The steels of Group 3 contain 15-18 per cent chromium and less than 0.12 per cent carbon. These steels are more resistant to a variety of corroding media than the steels of Group 2, which are lower in chromium, but their main use is for resistance to oxidation and chemical corrosion at normal and temperatures up to 1500° F. Some of the steels within this range contain about 1 per cent silicon which is of particular benefit in oxy-acetylene welding because of the improvement in the flowing qualities. Welds in this material are subject to brittleness and to grain growth in the metal adjoining the weld, but by the low temperature annealing already described, the strength and ductility may be restored.

The steels of Group 4 contain chromium from 20 to 30 per cent and are used mostly to resist corrosion and oxidation at very high temperatures. These steels have greater general resistance to chemical corrosion than those of lower chromium content. Although weld metal and metal adjacent to the weld are not hardened by heating to the welding temperatures, welding causes grain growth with resultant weakness and brittleness at the joint. This enlarged grain condition can not be removed by heat-treatment, although appreciable ductility may be imparted to the welded structure by annealing. The steels containing over 20 per cent chromium may be depended upon to give long service at high temperatures even up to 2000° F. provided the atmosphere is not highly reducing.

Steels of Group 5 frequently referred to as austenitic stainless steels are those that contain both chromium and nickel. The widely known 18 chromium—8 nickel steel is a member of this group. This steel is the most suitable for welding and has the widest range of usefulness for resistance to corrosion by liquids and to gases up to about 1600-1700° F. The chromium gives the metal resistance to oxidation. There are instances in which the austenitic chromium-nickel steel may contain as high as 0.20 per cent carbon, but if the steels are to be welded 0.08 per cent maximum is frequently specified and even less than this amount of carbon is often desired in welding rods and electrodes. Neither the weld metal nor the metal adjacent to the weld is hardened or embrittled by the welding operation unless the welds are cooled very slowly. Usually the weld will have less strength than the base metal, but the yield point of the weld will be slightly higher and the weld metal will be satisfactory in ductility and toughness in the "as welded" condition. The deterioration in corrosion resistance, which may sometimes occur, has been eliminated by the use of columbium, which will be discussed later.

As compared with ordinary steel, this "18-8" metal has a much higher coefficient of expansion associated with lower thermal conductivity. Because of these properties the welding, especially when applied to thin material, will cause serious warping unless provision is made to prevent this action. Clamps, copper chill plates, and jigs are

used separately or in combination to hold the plates in line until the weld has cooled. Other advantages given by these appliances are greater ease and speed in welding, less absorption of heat in the parts welded and more rapid chilling. Quick cooling is desired because the corrosion-resisting properties of the 18 chromium—8 nickel steels are adversely affected by heating to temperatures in the range, 800 to 1400° F. These temperatures are reached in the base metal a short distance from the weld, and the shorter the time they are maintained the less the damage to the corrosion resistance of the material.

The 18 chromium—8 nickel steels that contain as much as 0.12 per cent carbon have good corrosion-resisting properties for many uses, but if severe corrosion conditions are involved, the metal, if possible, should be reheated after welding for a short time to a temperature of at least 1800° F. and cooled rapidly. The corrosion-resisting properties are much improved by reducing the carbon content to less than 0.12 per cent. The 18 chromium—8 nickel type of steel has been welded and used for a good many years. In most cases these steels have given excellent service.

The type of attack that has sometimes occurred in and adjacent to the welds has become generally known as intergranular corrosion. Considerable effort has been put forth to eliminate this difficulty in welded structures and it is pleasing to report that a practical means of preventing this type of corrosion has resulted. By the addition of sufficient titanium and maintenance of low carbon content the difficulty with intergranular corrosion in the base metal is substantially eliminated. However, a second problem is involved; in welding, practically all the titanium is eliminated in passing from the rod to the weld. If one weld crosses another, or if the end of a welded seam comes in contact with the beginning, as in circular welds, the metal of the weld made previously contains no titanium, and hence is again subject to the intergranular corrosion produced by reheating.

It appears that a happy solution has been found to this second problem by the use of columbium instead of titanium. Columbium is lost only to a moderate extent in passing through the arc, and the loss is still a good deal smaller in the oxy-acetylene melting of the metal from the welding rod. This element is favorable because it does not produce an infusible oxide to interfere with the welding. A great variety of tests that have been carried out under the most severe conditions of corrosion indicate that with columbium-treated 18 chromium—8 nickel base metal and welding rods of the same composition the welds obtained will be free from intergranular corrosion. There is no question of the great improvement imparted to welds in these steels by columbium and experience justifies the use of this element, if the conditions of corrosion to be encountered are severe and especially if higher than ordinary room temperatures are involved in the service. With base metal and weld metal not susceptible to damage by reheating in the range of 800 to 1400° F., vessels constructed by welding will safely withstand severe corrosive conditions without danger of failure due to local attack.

Group 6 stainless steels containing various combinations of nickel and chromium cover so wide a range and are employed for such varied uses that no general recommendations for their welding appears to be justified. It is recommended that for each specific application the manufacturer of the material be consulted for advice about its welding.

Group 7 covers the various castings that may contain as high as 28 to 30 per cent chromium with or without additions of nickel. Usually the carbon content is high, ranging from 0.50 to over 2 per cent. The welding rods preferably should be of the same composition as the casting that is welded. In the plain chromium steel castings it is frequently necessary to preheat prior to welding while the majority of the castings of the chromium-nickel steels can be welded without this precaution.

In the course of the development of the art of welding in general the application of the process was systematized and the system was given the name "procedure control." This "control" sets up a definite procedure that includes all the essential factors needed to insure successful welds. A parallel arrangement could be made of factors that are observed to aid good supervision in other types of construction. It has been found over a period of years that the intelligent following of this procedure control insures a satisfactory outcome to any welding project. The rules for welding, which have been set up by important regulatory bodies, and many specifications of materials and requirements in their welding are based on this procedure control and

it has been the greatest contribution to the wide acceptance of important structures fabricated by welding.

The procedure control has been outlined as follows:

(a) Check of welders' ability.
(b) Selection and inspection of material.
(c) Design and layout of welded joints.
(d) Preparation for welding.
(e) Organization and welding technique.
(f) Inspection and testing.

Strict adherence to this procedure control leads to high quality and safety in welded products. Each one of the items listed is important and should be observed in the welding of the chromium steels. The inspection applied to welds, especially pressure vessel welds, has been responsible for two new methods of testing that have been of great value, namely X-ray examination and the "free bend" method of testing for ductility.

Because of the great variety of stainless steels and their diverse uses, only a brief review has been possible here but it has been the purpose in this paper to present the information that will serve as a guide towards obtaining welds that will give dependable service when used in the corrosive conditions that are encountered in the manufacture, transportation and use of chemicals.

Stainless steels are used because they are the most practical and economical materials for resisting corrosion. However, this property is not the only reason for using the high chromium steels since their strength and toughness and other good qualities are also highly desirable. The use of these quality steels is justified because throughout their period of service the original strength will not deteriorate by the ravages of rust and chemical attack.

Merely to use a stainless steel is not sufficient. There is a correct stainless steel and welding procedure for a given condition of service, and care given to insuring a correct choice will be well repaid. The manufacturers of the steels and of welding supplies are in a position to give valuable assistance in this respect.

By welding these steels a perfectly smooth surface may be secured. This is in contrast with the irregularity that attends riveted or screwed joints, for example. The need for smoothness which enables thorough cleaning is obvious in much chemical equipment and it is essential if contamination is to be avoided in the manufacture and transportation of food products. It has been definitely established by experience that welding is by far the most satisfactory method of joining the chromium steels because it gives the best results in resistance to corrosion and in physical properties.

Welding and Cutting in Tanks and Other Small Unventilated Places

By H. F. REINHARD

Chemical Engineer, Carbide and Carbon Chemicals Corporation, New York City

For twenty-five years we in the gas welding and cutting industry have labored strenuously to safeguard the manufacture, distribution and use of oxy-acetylene materials and equipment. Nevertheless, there must remain certain hazards which can only be safeguarded by detailed consideration of each operation because operating safeguards cannot be built into the apparatus. They depend upon study of the operation coupled with proper education of the operators.

To guard against injury by explosion or fire, it is essential that any flammable vapors, liquids or solids be removed from a container before welding or cutting operations are commenced, or before commencing any type of hot work that might create a spark or flame.

A committee of the American Welding Society studied welding or cutting on small containers very thoroughly and published their recommendations under the title "American Welding Society Tentative Recommendations Describing Procedure to be Followed in Preparing for Welding or Cutting Certain Types of Containers Which Have Held Combustibles." All who have occasion to do any type of flame or high temperature work on used containers should secure a copy of the recommendations.

The cleansing of tanks, bunkers or compartments on board ship is covered in Appendix "A" of the "Regulations Covering Marine Fire Hazards" published by the National Fire Protection Association; also in "Suggested Good Practice for Safe Loading and Discharging of Oil Tankers" published by the American Petroleum Institute. The cleansing of outside above-ground, vertical petroleum storage tanks is covered in a "Manual on Cleaning Petroleum Storage Tanks" published by the American Petroleum Institute.

The recommendations of the American Welding Society cover the treatment of containers that have held both water soluble substances and those not soluble in water. Cleansing methods include the relatively simple flushing with water, steaming, the use of a hot chemical solution, and an approved inert gas treatment. The recommendations are not intended to cover large containers when entered by workmen for cleansing from the inside or certain other special types of containers and gas holders. The information is, however, largely applicable except that where inert gases are resorted to workmen cannot enter the container. Any welding or flame cutting must be performed on the outside of the container.

One general procedure should be used whenever conditions permit after cleansing a used container. This consists in simply filling the container with water as far as work permits, thus leaving as little space as possible in which explosive vapors might collect or be generated.

It is recommended that the inert gas method be used in all cases where the tank need not be entered and repairs can be made from the outside, even when the containers have been treated with steam or hot chemical solution previously. The presence of inert gas in sufficient quantity will prevent ignition or explosion of vapors driven out of seams and joints by the application of heat and not removed completely by steam or chemicals. Note carefully that the inert gas is to supplement rather than supplant other treatment. Permissible inert gases include carbon dioxide and nitrogen. When carbon dioxide is used a sufficient amount should be introduced to produce a concentration of not less than 50 per cent by volume. This will usually require the introduction of a volume of carbon dioxide at least as great as the volume of gas space in the container. When the carbon dioxide content is not less than 50 per cent any mixture, regardless of ratio of flammable vapor to air, will be non-flammable and non-explosive, unless the flammable vapor is principally hydrogen or carbon monoxide, in which case a minimum of 80 per cent carbon dioxide content is required. Carbon dioxide can be used either as a gas compressed into cylinders or as solidified carbon dioxide, commonly called "Dry Ice." One pound of carbon dioxide is the equivalent of about 8½ cubic feet of carbon dioxide gas.

The American Welding Society recommendations give the construction and operation of a simple type of gas sampler for testing the atmosphere within a container for presence of explosive or flammable gases. The apparatus consists of a rubber football bladder connected in series by rubber tubing to the following: a tubing clamp, check valve, rubber bulb, check valve, and a length of tubing sufficient to reach to the point in the container from which sample is to be taken. Squeezing and releasing the rubber bulb pump fills the deflated bladder with the gas sample. The clamp next to the bladder is then closed and bladder with clamp disconnected and reconnected to a fine mesh wire flash arrestor and nozzle. At a safe distance from the container a flame is applied to the nozzle as the gas sample is allowed to flow through it. If the flow of gas has a tendency to deflect or blow out the flame, it is considered to be non-flammable and non-explosive and the container sufficiently safe for welding or other hot work.

Several well known makes of combustible gas indicators and detectors will show safely and quickly whether dangerous concentrations of combustible gases or vapors are present. The most widely used, probably most accurate, detector is the Hot Wire type using a heated filament in a Wheatstone bridge or potentiometer circuit. These generally give readings directly in per cent of the amount necessary to reach the lower limit of the explosive range. At least one of this type of detector incorporates a safety lamp for the determination of oxygen deficiency, and has a method

for testing for dangerous concentrations or carbon monoxide and hydrogen sulphide. These commercial indicators are to be preferred when available, but the simple Gas Stampling device previously described should give reliable results if correctly used; it can be constructed of readily obtainable materials at little cost.

Often we read of the explosion of vapors inside gasoline tanks due to an operator attempting to weld, flame-cut or perform other hot work on the tank. Some operators apparently think that it is only necessary to drain the gasoline from a tank before performing hot work, whereas it should be well known that the vapors that remain in such a tank create more of a hazard than if the tank were full of gasoline.

A disastrous accident involving a substance not considered explosive occurred while attempting welding repairs to a large concentrated sulphuric acid storage tank. The tank had been drained and perhaps flushed out to some extent with water. What they failed to take into consideration was that the diluted acid had reacted with the metal of the container to produce hydrogen. Acid tanks should be repeatedly flushed out with water until free of acid and then filled with water to expel any gases that may have been generated. The usual precautions in adding water to concentrated acids, such as sulphuric acid, should of course be followed. When water is added to concentrated sulphuric acid, intense heat is generated, spattering is apt to occur, and goggles are essential.

In another instance, an outlet was to be flame-cut in a mastic lined steel vat. The operators knew that the volatile oils in the mastic would burn and took precautions to keep hot slag or sparks from coming into contact with the mastic. But they did not appreciate that in preheating the section to be cut, vapors from the mastic lining would accumulate and that such vapors should be removed by forced ventilation. Another procedure might have been to cover the vat so as to make it almost but not entirely gas-tight. Carbon dioxide or other inert gas could then have been introduced until the required 50 per cent concentration was reached and then allowed to continue to trickle into the vat while the cutting was performed from the outside.

Even though a tank or confined space does not contain or has not held flammable liquids or vapors, it is essential that certain precautions be taken. The following paragraphs will serve to point out the most essential precautions.

A disastrous accident occurred during the removal by flame-cutting of a steel casing at the bottom of a 42-foot well shaft. Two workmen had descended to the bottom of the shaft and an oxygen and an acetylene cylinder were suspended about 10 feet above their heads, the cylinders being connected through regulators and hose to a cutting blowpipe. The first trouble was a burst of flame around the workmen. Shortly afterward there was a mild explosion and twenty minutes later a second blast of greater intensity. Both operators were removed from the well before the explosions but they suffered fatal burns in the initial flash.

The accident emphasizes the necessity of proper precautionary measures. Cylinders should be kept above ground; workmen should be provided with fire resistant clothing; and should have ropes about their bodies with men stationed at the top of the shaft to observe them at all times and to haul them out and shut off the gas supply in case of emergency. Forced ventilation should be provided.

Recently an operator was overcome while welding inside the tender of a locomotive. The interior of the tender was accessable only through a small manhole and the depletion of the oxygen in the confined space and possibly the heat accounted for the operator's collapse. Fortunately, the man was roped and a watchman at the manhole quickly pulled him out and revived him. Proper provision for forced ventilation had not been made.

Two men entered a 4,000 gallon tank, 13 feet high and 10½ feet in diameter, to coat the interior with metal, using an oxy-acetylene metal spray gun. A 2-inch diameter opening at the tank bottom was stuffed with rags, leaving only a 17-inch diameter opening at the top of the tank. The workmen failed to wear the helmets that had been supplied and in addition failed to turn on the exhaust fan provided. Twenty minutes after entering the tank they collapsed. A cylinder of oxygen was released into the tank through the opening and the men were hoisted out. This accident can be attributed to failure to utilize the masks and ventilation equipment.

Releasing the contents of an oxygen cylinder into a tank, under such conditions, is of course debatable, since any flame or spark may result in the rapid combustion of material such as oily clothing. This point is illustrated in a report in the August *News Bulletin* of the Chemical Section, N.S.C. A workman was carrying on an electric welding operation inside of a steel shell 11 feet long and 2 feet in diameter. One end of the shell was closed by a hemispherical end where the welding was required; the other had an opening approximately 18 inches in diameter through which the operator entered the shell. Shortly after welding operations were commenced there was a dust flash inside the shell. The workman was supplied with a hose mask connected to an oxygen cylinder and the oxygen added to the atmosphere through the mask outlet may have made the ignition a little more violent, nevertheless it would seem that all combustible dust should have been removed before the workman entered the shell as any such dust cloud could have been ignited in air.

It is essential that, when hot work is to be carried out in confined spaces, thorough ventilation be secured or that workmen be supplied with proper masks. One good ventilation method is to lead an air hose into the confined space and direct the flow of air under low pressure on to the face and chest of operator. This not only insures a supply of fresh air but it circulates the air in the space and cools the operator. In shops, air under pressure is usually available; in field work, cylinder air, not oxygen, or a manually operated air pump can be used.

Where a confined space has at least two openings, a good method of keeping proper circulation and replacement of air is to place an exhaust fan in one of the openings. Where a fan cannot be used or is not available, an air jet arranged so as to blow out of one of the openings or through a length of pipe will exhaust the air on the injector principle and cause outside air to be sucked in through other openings.

Where the operator cannot be sufficiently safeguarded by ventilating the container, masks and half masks are available. Some of these devices are so simple that where fresh air can be reached in a relatively short distance pumps or blowers are not always necessary. The type of protection and method of application must be studied for each operation. Due care must be used to have the inlet air not contaminated.

Paragraph 35 of National Safety Council Safe Practices Pamphlet No. 23 on the subject of Gas and Electric Welding reads as follows—

> "When welding or cutting is being performed in a confined space, such as the interior of a boiler, always leave the cylinders on the outside with an attendant, and lead the gas in, through hose, to the point where the work is being done."

This is good commonsense and the attendant can close the cylinder valves in case of emergency. He can also observe the progress of the work and be ready to help haul out the operators if necessary, the operators wearing ropes for the purpose. Simply tying a rope around a workman is not sufficient if the opening in the container is small. The rope must be attached in such manner as to permit ready withdrawal through the opening head first. There have been cases where a man's body became lodged crosswise of the opening when a hasty attempt was made to rescue him.

There are various types of protective clothing, gloves and mittens, hip and safety leggings, spats and sleeves, and one and two piece suits, on the market. Some are made of asbestos as a protection against heat and of chrome leather and fire-proofed duck against splashes of molten metal or sparks. Good results also are obtained in fire-proofing clothing by the use of chemical solutions. In one treatment the garments are first dipped in a solution of three pounds of sodium stannate in one gallon of water, then wrung out and dipped in a solution of one-fourth of a pound of ammonium sulphate per gallon of water. The garments are then wrung out thoroughly, dried and put into service. It is stated that these garments will stand at least five dry cleanings without losing their fire-resisting qualities. Naturally, they should not be washed with water.

The question is sometimes raised whether acetylene is in itself poisonous and whether a leak of acetylene into a confined space might be detrimental to health. Before calcium carbide was commercially available acetylene was made by incomplete combustion of coal gas and the impurities attendant on such a process were to

be expected. This process is no longer in use. Acetylene generated by modern methods has a high degree of purity and has no harmful effect on human beings, as was conclusively proven by the late Dr. E. E. Smith.

Dr. Smith and three other men enclosed themselves in a tight room about 10 x 10 x 8 feet and while engaged in a game of cards the acetylene content was, during a period of two and one-half hours, increased to 2½ per cent. It was without effect. It should be noted that the acetylene was generated within the room by throwing calcium carbide into a bucket of water.

Acetylene in high percentages acts as an anaesthetic; it is used with oxygen by doctors and dentists for that purpose. In welding and cutting, however, we need not concern ourselves with atmospheres containing much over 2½ per cent acetylene, as such could not exist in the presence of a flame since about 2½ per cent acetylene in air constitutes the lower explosive limit.

When welding or cutting or using any flame, a certain amount of oxygen is taken from and a certain amount of carbon dioxide is added to the atmosphere. In a confined space one must therefore guard against too great a depletion of oxygen and too great an increase in carbon dioxide. The heat produced by combustion and its possible effect on the operator in such a space should also be considered. For the purpose of this discussion, we may regard atmospheric air as consisting of 21 per cent oxygen and 79 per cent nitrogen. Carbon dioxide is present only to the extent of about 5 parts in 10,000.

The percentage of oxygen in the air may be diminished to a certain extent without noticeable effect, especially if the difference is made up of nitrogen. A reduction to 14 per cent oxygen under these conditions produces little or no physiological effect. We also know that an increase in the carbon dioxide content of the air to about 3 or 4 per cent so increases the rapidity of breathing as to give unquestioned warning.

The chemical equation for the complete combustion of acetylene shows that two volumes of acetylene and five volumes of oxygen react to produce four volumes of carbon dioxide and two volumes of water vapor. In a neutral welding flame two volumes of this oxygen are supplied through the welding blowpipe and three volumes are taken from the atmosphere. If therefore we have a welding blowpipe consuming 20 cubic feet of acetylene per hour, 30 cubic feet of oxygen will be taken from and 40 cubic feet of carbon dioxide will be added to the atmosphere. The combustion of each cubic foot of acetylene produces 1475 British Thermal Units. Such an amount of heat alone requires the ventilation of tanks and other small confined space. In fact such an amount of heat would probably drive an operator from an insulated tank before any noticeable effects from other causes were produced. The circulation of at least 125 cubic feet of fresh air for each cubic foot of acetylene burned in such spaces is recommended. Workmen likewise consume oxygen and give out carbon dioxide but the amount compared to that attributable to the flame is small. According to a bulletin published by the Bureau of Mines (Miners Circular No. 18) a man at moderate work draws into his lungs about 80 cubic feet of air in an hour and takes from this air about 3.2 cubic feet of oxygen. He exhales about 2.56 cubic feet of carbon dioxide.

The experience gained in millions of welding and cutting operations each year shows that practically the only health hazard has been when working with materials involving lead or zinc, in which cases adequate ventilation and in specific cases special protection for the workman may be needed.

When welding on brass or bronze or when using a bronze filler rod, certain precautions are advisable if the work is being performed in a confined space or location such that any fumes are not carried away from the workman. Certain bronze welding rods are on the market which are free flowing at relatively low temperatures and consequently do not give off vapors to any appreciable extent. Such rods are therefore recommended.

When welding on brass, bronze, lead or zinc coated surfaces, the degree of protection necessary depends on the location in which the work is being performed. In fairly open locations, it is usually sufficient to drive the vapors away from the workman by means of a stream of air or to remove them by suction. In more confined spaces masks provided with air from an outside source should be used. Some prefer a simple mask with large hose leading only such distance as is necessary to assure a pure air supply, no pump or forced supply of air being used. In other cases, pressure air is used.

The great variation in size and shape of confined spaces as well as number, size and arrangement of openings prevent suggestion of a definite procedure to fit all cases, but it is recommended that when gas welding or flame cutting in a confined space, proper consideration be given to adequate ventilation, a rope to the workman and a watchman. These constitute the sensible safeguards against oxygen depletion, carbon dioxide increase and heat.

WEDNESDAY MORNING SESSION

October 16, 1935

How Can We Correct Accident Causes?

By HAROLD L. MINER

Manager, Safety and Fire Protection Division, E. I. du Pont de Nemours & Co.

If accidents to industrial employees are to be prevented, two fundamentals must be embodied in our safety activities:

1. Adequate safeguards must be provided, including both mechanical and personal equipment.
2. Employees must understand that they are required to work safely and they must be taught and encouraged to do so.

Prior to the last decade more emphasis was directed toward the safe-guarding of mechanical equipment. This has reduced injuries to a remarkable degree, but far too many accidents can still be traced to the second fundamental—lack of employee education and competent supervision.

A strict ruling might be established that employees must obey safety regulations to the same extent that they are required to follow operating instructions if they are to retain their jobs. But often the simple operating steps as pointed out by the foreman may be easier to understand and follow than the prescribed safety procedure involved in carrying out such steps. This important phase of accident prevention work is often overlooked.

A machine can be controlled because it is not endowed with intelligence. It does what it is mechanically designed to do; but human beings can be controlled and directed only through understanding. And understanding must be coupled with the desire to cooperate, and alertness to guard against careless or unconscious action which may not only endanger the workers, but sometimes the manufacturing process or the plant. Of course, management can be hard-boiled and punish willful disobedience or carelessness. Sometimes this is advisable but, generally speaking, far more can be accomplished by looking at the matter from a humanitarian standpoint, and resorting to measures to gain the employee's cooperation.

We sometimes hear the objection that "no-accident" contests have influenced supervision to encourage injured employees to continue to work when they should not do so, in order to maintain an unbroken no-accident record.

While the competitive spirit may be strong, one can hardly believe that plant management or supervision would be so lacking in human compassion, and surely no accredited physician would sanction such a procedure. On one occasion we felt the implied criticism so keenly that 45 plants were queried to find out how they handled what might be termed border-line cases. Thirty-seven plants replied that the decision as to the ability of an injured employee to continue to do gainful work at the plant without delaying recovery was left entirely to the physician, and eight plants advised that the decision was a joint one made by plant management and the physician. Therefore, while not underestimating the graveness of the objection, the

benefits resulting from safety contests are thought to far outweigh the possible disadvantages.

Early in the last decade, various duPont plants and departments began to have long "no-accident" records and Mr. Irenee du Pont, then president, agreed to recognize personally any record made by a plant of the company which equalled or bettered a rather remarkable one which a certain plant had accomplished. This recognition, known as the "President's No-Accident" award, consisted of small prizes for each employee, or a single group prize for the plant as a whole, depending upon the wishes of the employees. The goals for these prizes were based upon plants, laboratories or construction jobs operating certain definite periods without a tabulatable major injury. The classifications were determined by number of exposure hours per month, each class being required to operate a certain number of calendar days without a tabulatable major injury. The goals established were thought at that time to be so high that they would be difficult to attain. This award plan went into effect on April 1, 1923, and between that time and 1928, 19 plants equalled or bettered the so-called outstanding "no-accident" record.

During the latter part of 1927, it was necessary to revise this particular plan in order to provide additional goals, so that the employees' interest might be retained after they had won the single prize. The plan then became known as "Awards for No-Accident Records," and three prizes were offered—a "General Managers' Prize," a "President's Prize," and a "Board of Directors' Prize" which the plants could win in succession by extending their record. If the records were broken after winning either of the first two prizes, the next prize could be won if the plant operated the required length of time for that prize.

Under the new plan between January 1, 1928, and June 30, 1935, 29 plants have won the General Manager's Prize (making a total of 48 plants which, since 1923 have met the requirements of the original President's No-Accident plan) while 26 plants have won the President's Prize under the new plan, and seven plants have won the Board of Directors' Prize once. Furthermore, two of the seven plants have won the Board of Directors' Prize the second time, and many of the no-accident records are still unbroken. The accompanying table shows some very remarkable records established by this plan.

Early in 1927 a draftsman at the Wilmington machine shops submitted a poster captioned "Safety First as Seen Around the Plant," illustrating an unsafe condition which might cause injury. There was a switch and rheostat installed on a building column over a sink used by the employees for washing. A bar of soap was kept in the switch enclosure. Here was a possibility of serious electrical shocks and burns. The poster was so striking that the Safety and Fire Protection Division had it lithographed and sent copies to all plants.

(The poster described here, and numerous other illustrations referred to in this paper, could not be reproduced adequately in these transactions, but are on file in the Council Library, in Chicago, and are available for examination and reference.)

In the poster it was noticed that a number of unsafe practices and unsafe conditions were depicted. At that time cartoons entitled "What is Wrong in This Picture" were very popular. This poster suggested that the time was opportune for a contest to teach employees to recognize the importance of uncovering and correcting unsafe practices and unsafe conditions. In preparing the contest posters, the accident records of the company were analyzed to determine the predominating causes of accidents, and plant inspection reports were reviewed to determine common unsatisfactory conditions. This analysis produced 104 practices or conditions unsatisfactory from the standpoint of accident prevention, fire prevention or good housekeeping, and these were portrayed in posters showing six typical plant scenes.

The contest was limited to the payroll employees of all duPont plants and subsidiary companies, only the supervisory staff and employees on special duties being ineligible.

The method of replying to the contest posters was made very simple. A miniature poster was given each employee with the instructions, "Draw a circle around each of the things you think is wrong in this picture and explain why you think so on the back." Of the approximate 15,000 employees who were eligible, 11,000 actually did take part. The contest plan provided for the award of cash prizes on each plant, the amount ranging from $85 on the smallest plant (1st prize, $50; 2nd prize, $25; 3rd prize, $10), to $300 on the largest plants (1st prize, $50; 2nd prize, $40; 3rd prize, $30; 4th prize, $20; 5th prize, $10) and 30 prizes of $5 each.

Answers of those who won plant prizes were sent to the Safety and Fire Protection Division, Wilmington, Delaware, to compete in the Safety and Fire Protection Division Interplant Contest, for which the following prizes were given: 1st, $50; 2nd, $40; 3rd, $30; 4th, $20; 5th, $10; and 20 prizes of $5 each.

Committees were appointed at each plant to examine and grade the contest replies. Thus not only were the workmen educated to recognize unsafe practices and unsafe conditions and their remedy, but the plant supervisory staff also became thoroughly schooled. There was some criticism of the posters themselves, some employees finding several times the number of items which were actually intended. These additional items were of a questionable nature and a few were due to minor technical errors in the drawings. It must be recognized that the greatest supervision should be given the drawing of such posters, and if the duPont company were to undertake another contest of this character, no doubt even closer supervision would be given this matter. However, the criticisms did not react unfavorably to the contest, and probably in some cases reacted favorably because the men derived benefit from discussing even the technical errors in the posters.

Following the safety poster contest, several other plans for educating the employee in safety were discussed, and it was decided in 1929 to conduct a "No-Accident Month" Campaign during the month of August. The result of this campaign was so satisfactory that it was repeated yearly thereafter, until June, 1934, when the campaign was changed to a "Three Month Interplant Safety Contest," starting June 1 and continuing until September 30, 1934. Every year, except 1933, the number of injuries during the campaign month was substantially lower than the average for the previous months of that year and with one exception, the same year, remained at a lower level than the previous months' average.

In the campaign month, June, 1933—the number of employees increased approximately 4,000 over the average number for the first five months of the year. The increase in the average number of injuries for the last six months is due principally to an increase in injuries on two plants, and but for these injuries, the frequency rate would be much lower, or 1.70 instead of 2.83. In fact, following this particular contest, there was a general improvement throughout the plants as a whole.

Early in 1935 the question was again considered: May we expect an increase in accidents when new employees are hired or old employees are re-employed? To determine what was actually taking place a careful analysis was made of our accident experience for the year 1934, inasmuch as between December, 1933, and December, 1934, there was an increase of about 65 per cent in employment.

It was found that 24 per cent of the injuries occurred to employees with six months' or less service; 14 per cent to employees on our payrolls from six months to one year; 9 per cent to employees with from one to two years' service; and 53 per cent to employees with two years or over length of service. In other words, 38 per cent of the injuries during 1934 occurred to employees with one year or less service, while 62 per cent occurred to those having records of from one to 44 years.

This indicated that the problem of preventing accidents extends to all employees, whether new or old, and that the new employee is not any more likely to experience injuries than the old, possibly not as much so, considering the specific instructions and supervision which he receives.

The above experience may be an exception to what might be expected on the average plant, and is probably due to plant supervision and the older employees looking out for the new employee to prevent injuries which would terminate an unbroken no-accident record which they had labored so earnestly to establish and maintain. It is another proof that such accident plans are worth while.

When considering safety contests and campaigns it is well to include measures to interest the employees after the goal has been reached to guard against a let-down in safety effort. This need has been met in our contests by the "Awards for No-Accidents Records" plan, which is automatically continued regardless of other special "no-accident contests" or similar plant or inter-plant activities.

In 1934, the "Three Months' No-Accident" contest was established and an Interplant Contest idea was introduced, the contest extending from July 1 to September 30. The plants were divided into nine groups and awards were offered for the plant effecting the lowest frequency rate in each group.

Accident Record of "No-Accident" Contest Months

Year	Average Freq. Rate for Months Previous to Contest	Contest Month	Frequency Rate	No. Plants Having No Major Injuries	Average Freq. Rate for Remainder of Year
1929	6.05	August	1.93	65	4.41
1930	3.99	June	2.80	67	2.59
1931	2.06	June	.99	77	1.43
1932	2.25	June	.87	79	2.01
1933	2.80	June	3.69	62	2.83**

** The slight increase in the frequency rate is due principally to increase in injuries on two plants only.

"No-Accident" Records Established by Plants to June 30, 1935

Exposure Hours	Number of Records	Cumulative No. of Records Established above Minimum of Range
7,500,000 to 10,000,000	1	1
5,000,000 to 7,500,000	1	2
4,000,000 to 5,000,000	3	5
3,000,000 to 4,000,000	3	8
2,500,000 to 3,000,000	4	12
2,000,000 to 2,500,000	8	20
1,500,000 to 2,000,000	9	29
1,000,000 to 1,500,000	9	38
750,000 to 1,000,000	7	45
500,000 to 750,000	10	55
250,000 to 500,000	13	68
Below 250,000	5	73

49,000 Hazards Were Corrected

	Unsafe Practices Uncovered	Unsafe Practices Corrected	Unsafe Conditions Uncovered	Unsafe Conditions Corrected
Group 1	6,008	5,830	20,279	17,540
Group 2	1,467	1,462	6,342	5,780
Group 3	684	575	2,691	2,198
Group 4	850	794	4,319	3,586
Group 5	515	513	2,067	1,967
Group 6	30	30	156	149
Group 7	375	375	597	597
Group 8	71	68	449	441
Group 9	371	358	956	800
Group 10	1,129	1,081	5,648	4,167
Group 11	56	56	190	177
Group 12	107	104	399	318
Group 14	14	1	8	3
Group 15	8	8	50	36
Total	11,685	11,255	44,151	37,759

	Reported	Corrected
Total Unsafe Practices	11,685	11,255
Total Unsafe Conditions	44,151	37,759
Grand Total	55,836	49,014

During this contest 59 plants out of 84 operated the entire three months without experiencing major injuries, establishing perfect "no-accident" scores. These plants operated 9,029,596 man-hours without experiencing major injuries, while their accumulated accident-free man-hours since their last tabulatable major injury up to the end of the contest totalled 36,132,701 hours. On October 29, 1934, a month later, only three of the 59 records had been broken. Bronze plaques were awarded to group winners and to those plants with perfect scores.

At the request of several of the larger plants which failed to establish "no-accident" records during this three months' period, the "Interplant Contest" was continued from October 1 to December 31. In this latter contest, 45 plants out of the 84 continued their "accident-free" period until the end, operating six months without major injuries. The accident-free man-hours from July 1 to December 31, 1934, established by the 45 plants amounted to 8,079,832 hours, while the accident-free period from the date of the last inquiry experienced by these plants totalled 31,286,330 exposure hours. Thirteen of the plants having experienced major injuries during the first contest were successful in preventing injuries during the second period. These plants during the three months' contest from October 1, to December 31, 1934, operated a total of 4,737,606 man-hours without injuries and a total accident-free man-hours since their last major injury of 7,160,162 hours. As a result, 58 plants of the 84 established perfect records.

Additional bronze plaques were awarded to the new winners, and a Certificate of Merit was given to the twelve plants which, while making a splendid effort, were unfortunate and experienced injuries.

In the material prepared and sent out to the plants during these campaigns and contests, we attempted to impress upon the employees the importance of working safely, and at the same time obtain their cooperation in uncovering and eliminating unsafe practices and unsafe conditions.

The campaigns and contests which have thus far been described, had as a primary object reduction in personal injuries. During and following these contests, a number of the plants made some effort to have their employees report to supervision any unsafe practices or unsafe conditions which were noted. Employee inspection blanks were prepared by the Safety and Fire Protection Division and each employee was requested to fill them out weekly and give them to his foreman or supervisor. But with few possible exceptions, no coordinated plan was put into effect to systematically report and correct the unsafe practices and unsafe conditions. It was, therefore, decided to plan an interplant contest which would forcefully direct the attention of all employees to the uncovering and elimination of accident causes, leaving out of the contest any apparent attempt toward reducing the number of accidents. A contest plan with this object in view was drafted and sent to the plants with a contest announcement poster during December, 1934.

This contest for "the finding and eliminating of unsafe practices and the uncovering and remedying of unsafe conditions" extended from January 1 to June 30, 1935, and included all of the duPont company and subsidiary plants, operations, laboratories, warehouses, magazines, etc. The units were divided into 15 groups, taking into consideration as far as practicable both occupancy and size, in order that the competition might be as equitable as possible.

Three group awards were offered in the announcement poster.

1. For the plant in each group reporting the largest number of unsafe practices.
2. For the plant in each group reporting the largest number of unsafe conditions.
3. For the plant in each group showing the greatest improvement in correcting the unsafe practices and conditions which were found and reported.

In setting up this interplant contest and establishing requirements, careful consideration was given to the basis of the contest. Several fundamentals were kept in mind—

1. That the contest should reach every employee on all plants and operations of the company.
2. To prevent any particular plant concentrating either upon unsafe practices or unsafe conditions awards were offered for each classification. (Employee recognition.)
3. The uncovering and reporting of these two items, aside from the education feature, would not bring about the results desired unless they were corrected. (Managerial recognition.)

Therefore, a third prize was offered for the plant or operation which showed the greatest progress in eliminating both unsafe practices and unsafe conditions after they were uncovered and reported by the employees, this award being made in recognition of managerial interest.

In order to encourage contestants to look for major accident causes, as well as those of a minor character, a "Grand Award" was offered, to be given to the plant or operation which found and corrected the unsafe practice or unsafe condition considered to be the most hazardous to employees.

At the end of the second month of the contest the 15 groups had sent in 1,892 unsafe practices and 6,910 unsafe conditions, or a total of 8,800 unsafe practices and unsafe conditions. A review of these items indicated that they could be grouped according to the "classification of injuries," i. e.—falls of persons, stepping on or striking objects, falling objects, flying objects, burns and scalds, etc.

It is interesting to note that with one or two exceptions the unsafe practices and unsafe conditions reported as possible causes of accidents very closely parallel the causes of accidents for the previous five years. This was strikingly indicative of the probable success of the contest.

During the contest 55,836 unsafe practices and unsafe conditions were reported. Of these 11,685 were unsafe practices and 44,151 unsafe conditions. At the end of the contest all of the unsafe practices were reported as eliminated and all but 6,500 of the unsafe conditions were corrected. In other words, 88 per cent of the unsafe practices and unsafe conditions were either eliminated, corrected or safeguarded, and it is presumed that the majority of those remaining have been corrected.

Individual employee awards Nos. 1 and 2 were won by 19 plants—embracing nearly 10,000 employees—while award No. 3 was won by 13 plants, involving over 7,000 employees, so that the efforts of over 17,000 employees or nearly 50 per cent of those participating in the contest were definitely rewarded. The individual employee prizes for either group awards Nos. 1 and 2 averaged about $1.50 per employee, while employees on plants winning both awards were permitted to select a prize valued at $3. Prizes consisted of toilet sets, cutlery, pen and pencil sets, wallets, brief cases, bridge sets, jewel cases, cigaret boxes, tobacco pouches and pipes, aluminum kitchen utensils, ladies compacts, handbags, belts, brushes, key cases, picture frames, miniature tool sets, manicure sets, magnifiers, reading glasses, telescopes, drawing instruments, cameras, pocket secretary notebooks, etc. Over 60 per cent of the articles selected were aluminum kitchen utensils, and the second largest selection was carving sets and kitchen cutlery sets. This demonstrated that the employees were discussing the contest and its success with their families and that the families were helping them to select the prize.

While the interplant contest did not specifically embrace the question of reduction in the number of accidents, the major injuries were reduced nearly 50 per cent as compared with the same period of the previous year. The two interplant safety contests during the latter part of 1934 resulted in a fewer number of major injuries as compared to the first six months of that year. However, as of September 30 of this year, the number of major injuries has been reduced 43 per cent as compared with the first nine months of 1934.

It is sometimes more difficult to prevent the recurrence of an unsafe practice and in some instances unsafe conditions than it is to remedy them when first uncovered. Recognizing this, the poster announcing the winners of the contest which was sent to all of the contestants states:

Preventing the recurrence of the unsafe practices which this contest eliminated and the unsafe conditions which were corrected is the problem which now confronts all of us.

At the end of the contest 45 of the larger plants were surveyed to ascertain: (1) If they considered a contest of this character basically sound; (2) If the idea of the contest should not be included as a part of the regular operating procedure.

Forty-three plants replied affirmatively and at the present time many of the larger plants are continuing the contest on an inter-departmental plant basis. As of November 1, 1935, the records show that since the contest ended over 40 plants and operations have continued to follow the contest plan, and since June 30 have reported 2,331 unsafe practices and 17,332 unsafe conditions, in addition to those sent in during the contest, which have been uncovered and received attention.

ADJOURNMENT

Construction Section

Officers 1934-35

General Chairman—E. N. Goldstine, San Francisco, Calif.
Vice-Chairman for Publicity—C. H. Black, Stone & Webster Engineering Corp., Boston, Mass.
Secretary—Robert McKinley, General Accident Fire & Life Assurance Corp., Detroit, Mich.
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Vice-Chairman for Road Construction—Fred I. Rowe, W. L. Johnson Construction Co., Hicksville, Ohio.
Vice-Chairman for U. S. Engineer Department—Major Elliott Vandevanter, C. of E., Office of the Chief of Engineers, Washington, D. C.
Vice-Chairman for Building Construction—Chester W. Wright, Wright & Kremers, Inc., Niagara Falls, N. Y.
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Program Committee Chairman—W. A. Dearborn, James S. Kemper Co., Inc., New York, N. Y.
Statistics Committee Chairman—W. A. Snow, Associated General Contractors of America, Inc., Washington, D. C.
Member at Large—R. G. Buchanan, Dravo Corporation, Neville Island, Pittsburgh, Pa.
Past General Chairmen—
W. F. Austin, Detroit, Mich.
John Russell, Jr., Public Service Electric & Gas Co., Newark, N. J.
George Widua, Builders and Manufacturers Mutual Casualty Co., Chicago, Ill.

Officers Elected for 1935-36

General Chairman—W. A. Snow, Associated General Contractors of America, Inc., 1329 "E" Street, N. W., Washington, D. C.
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Vice-Chairman for Highway Construction—F. I. Rowe, W. L. Johnson Construction Co., Hicksville, Ohio.
Vice-Chairman for U. S. Engineer Department—Major Elliott Vandevanter, C. of E., Office of the Chief of Engineers, Washington, D. C.
Vice-Chairman for Building Construction—Chester W. Wright, Wright & Kremers, Inc., Niagara Falls, N. Y.
Secretary—Robert McKinley, General Accident Fire & Life Assurance Corp., Detroit, Mich.

News Letter Editor—G. O. Griffin, Dravo Corp., Neville Island, Pittsburgh, Pa.
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Past General Chairmen—
W. F. Austin, Detroit, Mich.
E. N. Goldstine, San Francisco, Calif.
John Russell, Jr., Public Service Electric & Gas Co., Newark, N. J.

MONDAY AFTERNOON SESSION

October 14, 1935

The opening session was called to order by General Chairman E. N. Goldstine, San Francisco, Calif. Chairman Goldstine called attention to the section's accomplishments during the past year, praising the work of the various committees.

The Story of Rope

By FRED A. JENKS

Plymouth Cordage Co., North Plymouth, Mass.

For a better understanding of rope let us briefly review the material, its characteristics, and the process of manufacture. Raw material of the ropemaker is often incorrectly referred to as "hemp." All hemp is fiber, but all fiber is not hemp. Let us first consider the true hemps—bast fiber (Cannabis sativa) is obtained from the inner layer of the bark of an annual plant. American, Russian and Italian hemp are the varieties generally used in our country. They are classed as soft fibers. They will absorb and retain tar, and before the hemp rigging of ships was displaced by wire, were in constant demand. Their use for cordage is now very limited but they still have a place.

The fiber in general use today in the manufacture of rope, whether used by shipping, the fishing industry, in construction work, the oil fields, or on the farm, is Manila, and its use so far overshadows any other fiber for these purposes that whatever information is given from this point on refers entirely to rope made of Manila fiber.

Manila fiber is Abaca and this name refers both to the plant and the fiber produced from its stalks. Botanists call this plant Musa Textilis. It grows extensively in the Philippines.

The fact that a rope is made of Manila fiber is, however, not enough to insure quality or service. There are many grades of Manila fiber—different grades of fiber are obtained from the same plant—varying from the bold, strong fiber obtained from the outside leaves, the long, white, strong fiber from other layers of the stalk, to the very fine, white fiber which is used in ropes made for such purposes as yacht rope, lariat rope, etc.

All fiber is graded under the Philippine grading law. There are 15 varieties of the Musa Textilis, presenting a like range in the quality of fiber produced, but at least half of these have no place in a first-grade Manila Rope.

The prime factors in determining grades are color, length, strength, texture, whether fine or bold. Furthermore, fiber that might well be classed as a high grade may be injured by careless cleaning and drying. These factors compel the careful manufacturer to re-grade the fiber purchased, and when doing so, not only using the same factors as are recognized by the Government graders, but in addition, bringing judgment to bear, based on experience, as to the spinning qualities of that fiber, and determining where it can be used to give the greatest strength and utility.

So it is not enough to say Manila—we must consider who says it—the reputation and character of the manufacturer must be considered, the grades of fiber he is known to buy, the quantity carried in stock in order to maintain a standard of quality. He cannot depend upon the day to day offerings, but his warehouse must contain such amounts and such parcels of fiber as will assure his ability to make and deliver a standard product.

Process of manufacture: The bale of fiber is first opened—the matting is removed and the bands from the individual heads of hemp.

Fiber is run into a sliver: There are six runs generally, leaving a long, continuous ribbon of parallel fibers, but without twist. Due to the length of fiber, it is not necessary to put twist into the sliver or roping as into the shorter staples such as cotton and wool.

Spinning the yarn: The first twist is put into the fiber on the spinning machines—direction of twist being from right to left. Yarn is sized in feet per pound, and the sizes indicated by the number of yarns necessary to make a strand one-half inch in diameter.

The number of yarns necessary to make strand for the size of rope required are hauled through a tube of the proper diameter and twist is put into the strand in the opposite direction to the twist in the yarn.

These strands are now laid into a rope. The angle of lay in rope for general use and for shipping and construction work is approximately thirty-eight degrees, and the twist in the rope is opposite to the turn in the strands, viz: from left to right. It is a lack of knowledge of this principle of the opposite twist that causes many a rope to fail, and become useless long before it should.

As the twist in the strands and in the rope are opposite, when twist is thrown into the lay the three strands into a completed rope, twist is thrown out of the strands. This is, of course, regulated by the machine on which the rope is made—result—when the rope is completed the turn in the rope and strands are, or should be, in balance. But with a rope in service, if you continually throw twist into the rope you are shortening the angle of lay, which if continued will cause kinks in the rope and when one of these kinks jam in the swallow of the block results are disastrous to the rope. When twist is thrown out of the rope the angle of twist in the strands is shortened—they become hard and the rope becomes long-jawed. If released suddenly from strain the strands will kink back and you will have the beginning of a spoiled rope.

Now this condition in a rope can be brought about in various ways—taking out of the coil in the wrong way, by use on a capstan—there the rope comes off the capstan throwing turn in or out, or from coiling the rope down improperly, so that when overhauled you again throw the twist out of balance. The way a rope is generally handled on a car puller is a good illustration. If you see the angle of lay in a rope shortened, throw out twist—if the rope becomes long-jawed, throw in twist—handle the rope so that the opposite twists are kept in balance—this is the answer to much of your rope troubles—a principle that any mechanic, if it is brought to his attention, will understand.

Types of lay: Hard, medium and soft will cover the needs when rope is to be used for running riggings or in general construction work.

The properties of hard laid rope are great elongation, more elasticity, greater resistance to abrasive wear, but still having the strength necessary for duty required.

Common laid rope has all these properties of elongation, elasticity, and resistance to abrasive wear in a slightly less degree, but it possesses greater tensile strength.

Soft laid rope is very popular when quick handling is necessary or for dock lines where the crew is few in number. It will have greater tensile strength but much less elasticity under strain. It often goes down to stay and it presents much less resistance to abrasive wear.

For ropes used to transmit power and for falls used on hoisting engines and on pile drivers, a hard lay is best and rope will be so made if use is stated. Indeed, it is always advisable when any quantity of rope is required on special work to state the use to which it is to be put.

Every rope has two ends and in general use one end must be secured. Often two pieces of rope must be joined. How can this be done with safety? No knot is as strong as the rope itself. The average efficiency of knots in general use will vary from 50 to 60 per cent. These figures can be found in most books of engineering and in many catalogs. However, these books are not *in* the hands *of the handy man* who does the moving of machinery or the general rigging around your plant, and furthermore all of these published tests are the result of tests made on new rope. Why not, therefore, establish a definite figure of 50 per cent efficiency?

Eye splice: A properly made Eye Splice, especially if made over a thimble, will give 90 per cent efficiency; generally more. Indeed, an Eye Splice without thimble is used in the testing of ropes, a splice at each end to connect with beam and pulling head. Although many breaks occur in the splice, many of our highest breaks also come at the splice. The size of pin, hook or eye bolt to which the splice is hung, makes little difference. In an eye splice you are pulling two parts against one. My experience in testing rope from ¾ inch circumference to 7 inch circumference, and all over a 2-inch diameter pin, shows no appreciable loss in the larger sizes. Still, if testing larger ropes I would if possible use a larger pin, and with a larger pin, use a longer splice—long enough so that the two parts of the splice will pull at an angle of not more than 30 degrees.

In selecting a thimble if possible use the wire rope thimble rather than the round thimble found in the becket of the average wooden block.

When rope is used as a strap it is often called a sling. Strap is undoubtedly the much better term. For the best definition of a strap let us refer to an old book, "The Art of Rigging," published in London in 1794. "Straps—wreaths of rope—spliced around blocks, or encircling a yard, or any large rope by which tackles may be connected to them, such as setting up the rigging where the hook on tackle is fixed in a strap."

A strap or sling is in general use by stevedores, construction gangs, etc. It is a rope made endless by means of a short splice. Now here is a series of tests made on slings. While difficult to explain on paper, it is easy when you have a sling in your hand.

In these tests we will first consider the material used.

Size of Rope—¾ inch diameter.
Material—Manila fiber.
Strength of single part—average of three breaks—4,840 pounds.
Theoretical strength of two parts—9,680 pounds.
Splice—short splice.
Diameter of pin in pulling head—2 inches.

Test on sling used in its perfectly natural condition as an endless rope over the two pins in testing machine—rope at no disadvantage such as might be caused by unequal strain or shearing stress.

Average of three breaks—all breaks on pin—8,000 pounds. Loss from theoretical strength, 1,680 pounds. Strength of sling 165 per cent of single part of rope.

Strap in double form—four parts under strain. Theoretical strength of single part, 4,840 pounds × 4 equals 19,360 pounds. Average strength of three breaks 15,773 pounds. Loss from theoretical strength 3,587 pounds. Strength of sling double 325 per cent of single part.

Rope used as strap is most often put around a spar or box or an I beam with end passed through sling, bringing a severe shearing strain on sling, the same as can be best illustrated as shearing stress in a bowline knot. Average strength of three breaks 6,530 pounds. Theoretical strength of two parts 9,630 pounds. Loss from theoretical strength 3,150 pounds. Strength of sling—134 per cent strength of single part of the rope.

The size of pin, hook or eye bolt to which sling is attached has direct relation to the strength of a sling in use. Two slings made of the same size rope were tested on pins of different diameters. Over a 2½ inch diameter pin the sling developed 170 per cent of the strength of the single part. Over the 3½ inch diameter pin the sling broke at 185 per cent.

Rope, however fine the quality of the fiber and care in construction, is not indestructible! This seems like an unnecessary statement, but too many people, judging by the way they handle rope, appear to think that it is. We sometimes receive complaints of rope failure when specimens of the rope that failed show an absolute lack of care and understanding on the part of the user as to what should be reasonably expected of a rope.

Abrasive wear: A good rope dragged over the ground, picking up sand and grit, and then put onto a gypsy or capstan is an illustration of this. The grit becomes embedded in the rope resulting in both external and internal wear by abrasion. The rope has short life and the user complains of short fiber. Now short fiber is the one complaint that I refuse to listen to. Four feet is considered a short fiber in Manila.

In slinging heavy weights to be lifted, the angle of the stress on slings or lashings is something to be considered and is more often neglected. Have not some of you on construction jobs seen a fiber rope sling used around structural iron with no protection for the rope, and pulling at a sharp angle? Have you not seen workmen sling a stage from I beams and trust their lives to a rope against their own lack of care?

Acid damage is a very real danger. Hydrochloric acid is the most dangerous of all, for it leaves little trace on the rope as it evaporates quickly. Sometimes it can only be detected by the presence of free chlorine in the rope, but this always after the accident has occurred!

Sulphuric acid will leave its mark from dark brown to black. Hydrochloric gives little color other than a smooth place on the rope—sometimes a light pinkish-brown color.

A rope will last for many years if properly cared for. In the days of the old sailing ships the master riggers would have a heavy fall used in masting ships. These lasted for many years, but they were taken care of. Cleaned and dried they were stored in a dry loft, coiled on a grating raised from the floor to insure a free circulation of air—the rope was always ready when needed. Such care meant safety and economy.

Again, I have seen perfectly new rope put into the water until it had absorbed 50 per cent of its own weight, then thrown into a storage place where there was an average temperature of 70 degrees and no circulation of air. Deterioration developed within a few weeks.

Sometimes a leaky valve or a small leak in a steam pipe, or in a roof, will allow water to drop into the coil. I have seen coils of new rope in store ruined in this manner. The individual worker, such as the steeplejack, the diver and the rigger, cares for his rope, but many men who trust their lives to a rope have little opportunity to know its quality or condition.

When rope is stored, be careful there is nothing in the storage room which would cause chemical injury. A window washer on the tenth story of a building noticed that the rope in his safety belt was badly worn. He got inside quickly and going to another worker on the opposite side, found his belt to be in the same condition. The belts, leather webbing, rope and metal, all showed an acid reaction. They had been stored in a closet where acid was also kept.

Now let us imagine a condition. A gang is on a distant job. Perhaps you have call for a fall and new rope cannot be quickly obtained and you are obliged to use what you have. How are you to safeguard the operation?

Run over the whole length of your rope to see if there are any cuts or severe abrasions. Look for spots that will indicate acid damage; dark brown, even black, for sulphuric acid, and just smooth places in your rope, sometimes of a faint pinkish color, hard to describe, indicating hydrochloric acid. If found, throw twist in and out of rope—take a short kink in the rope and put on strain. If rope has been injured by acid, weakness of the yarn will be apparent.

Throw twist out of the rope and look at the inside of the strands. See if the color is bright and if there is evidence of internal wear indicating long use. Cut off a foot or two of rope, untwist the strands, see if the yarns are of good color, and if the fibers show life. Break a few of the individual fibers and note their strength. Then you will know something about the rope; at least you will have exercised due

care. Then take every precaution in handling and it is very probable you will succeed. This is, however, in a case of actual need, but why not do this with every rope before you put it away. It will make for safety of both life and material.

Prevention of Construction Accidents

By THOMAS BENTLEY

President, The A. Bentley & Sons Company, Toledo, Ohio

All classes of industry have done a much better job in accident reduction than the construction industry. In the first place, this industry does not readily lend itself to a pre-medical examination of employees for the reason that the work even though conducted by what is known as "the same gang," is still itinerant. Nor does construction have the continuity of employment of the railroads, factories or hotels for two reasons:

1. The weather plays such a big part in the working schedule.
2. Few contractors have that continuity of work which permits their employing the same gang of men year in and year out, and further, they have to divide up due to many classifications so that from the beginning of the work to the completion (excepting in highway work and railroad work) they do not have the same gang three weeks in succession.

The contracting fraternity as a whole is a polyglot lot of people who are in the business today and in something else tomorrow. Less than 40 per cent of the people doing the construction work of the world stay in the business over five years, and there is quite a large percentage who do not stay in over one year. Consequently, they do not have the incentive to furnish the care and methods which it takes to put on a successful safety campaign.

I was brought up in the business and have been in it continuously for 48 years; and do all that I will by coaxing, damning, pleading and firing, I have yet to find a job on which there have not been some unnecessary accidents.

There was a period from 1918 to 1920, and again from 1923 to 1931, when the company with whom I am connected, did a business of such a magnitude that they could employ safety engineers, superintendents, managers, or directors—whichever you wish to call them—for safety work, and in this period we did lessen our accidents, and during this period we did one job of $2,500,000 where there was not one major accident, but a multiplicity of small, unnecessary nail cases, skinned shin cases, bruisings by falls, etc. On this particular job barricades, signs, posters, mid-week lectures, etc., were used, but we still had minor cases.

Taking the regular run of construction work that is done by general building contractors, you can find some appalling figures in the number of accidents, most of which do not have a severity other than the loss of an average of four days' time for the workman, but the cost of having these accidents is something almost beyond human conception. It is a ridiculous comparison to say that more than 40 per cent of the accidents, and 35 per cent of the costs of accidents are built up on individual work, the cost of which is under $25,000 per unit. The bigger jobs are much more favorable in accident cost in relation to dollars expended than are the small ones, and I have come to the conclusion that this is because the man who is operating the small work has an utter contempt for the hazards thereon.

After an extensive study I have come to the conclusion that more than 50 per cent of the accidents on the jobs are directly attributable to the frame of mind in which he who suffers from accidents leaves his home in the morning. I have found that men come on the work utterly disgusted with life and being in this frame of mind, they are very careless in making scaffolds safe, giving protection to themselves and their fellow workmen by seeing that ropes are properly lashed or tied, that cable clips are properly drawn up, that lumber is put on wooden joists or steel beams in such a manner that if stepped on near the end it will let them down or turn over on account of not having a bearing near each end. They will throw, it seems to me almost deliberately, lumber which is full of nails, out into a passageway where they know other workmen are continually going to and fro; they will almost deliberately fix a trap in some way or other, feeling that by doing this they are in some way or other getting even with society. This often comes about because of petty annoyances that all humans have to go through.

There is another very serious and easily corrected source of accidents to which the average employer pays little attention, and that is the furnishing of safe and palatable drinking water, especially during hot weather. Men become so fatigued, and in many cases so dizzy under the beating down of the hot sun that they overdrink, taking any kind of water they can get. In 99 cases out of 100 all waters which have not been pre-cooled or medicated when the temperature is over 80 degrees, are harmful to human beings when taken in large quantities. Water with ice in it is peculiarly troublesome. Heat cramps may be avoided by furnishing saline tablets to be taken with the water. The water may be cooled by running it through a system of pipes sunk in the ground.

Many people who rave and rant twice a year when they have to pay the premium on a public liability insurance policy, or have to send to a state fund premiums on their payrolls for the protection of their workmen, go out the very next day and absolutely disregard all safety measures. Until they take it upon themselves to correct the number of accidents, they might just as well stop hollering about the cost of insurance. They are the ones who have it within their power to correct accidents, and if they do not see fit to do this, they can keep on paying present high premiums. Perhaps they will be twice as high five years from now, as we are in a period when lawmakers are in the habit of carrying to the extreme, laws for what they think is Social Reform.

I can say without fear of contradiction, that unless the boss himself takes a deep rooted, conscientious, critical position about accidents on his job, he is going to find that no one else, even though he be the highest paid man in the world, will not do it for him.

Some Major Factors in Construction Safety

By PAUL F. STRICKER

Safety Engineer, Division of Labor Standards, U. S. Department of Labor, Washington

The National Safety Council's figures for 1934 show a most satisfactory, in fact, remarkable improvement in accident rates for the Construction Industry. Frequency dropped from 55.66 to 31.89, and severity from 5.76 to 4.32. Unfortunately, these figures do not represent great improvement in the entire industry, but show the effect of the 69,000,000 man-hours worked on U. S. Engineer projects with a frequency of 26.25 and a severity of 3.92.

More important, is the fact that only 37,000,000 man-hours were worked by the concerns reporting, excluding the U. S. Engineers. I believe you will agree that the extent of reporting is one fairly reliable index for guaging the interest in accident prevention of any industry. Calculations based on data obtained from the Bureau of Labor Statistics, Department of Labor, and F. W. Dodge Corporation, indicate that about 650,000,000 man-hours were worked by the Construction Industry in 1934. On this basis, the 37,000,000 man-hours represent less than 6 per cent of the construction work done in 1934. The amount of work on which reporting was obtained from the entire Construction Industry, exclusive of U. S. Engineers, was just a bit greater than that performed to date in the construction of Boulder Dam.

Let's contrast this evidence of interest—or more correctly, this evidence of lack of interest—with the performance, at reporting, of the utilities. The same sources of information indicate that the man-hours worked by this group, exclusive of municipal plants, is only slightly higher than the man-hours reported to the National Safety Council. In other words, excluding municipal plants, almost complete reporting was obtained from the utilities. Actually 7,000,000 of the 37,0000,000 man-hours in construction was public utility construction. You all know the fine accident experience of the utilities and I believe this supports the contention that where a good job is being done statistics seem to be available. The converse is equally true; where statistics

are unavailable, there is evident lack of interest in accident prevention. This comparison presents a somewhat discouraging picture regarding the Construction Industry.

I have picked at random from the Compensation Manual various classifications of risks in the Construction Industry. The choices were made without prejudice and those most hazardous risks which require special appraisal were omitted. The average rate for 21 classifications was $10.54 per hundred dollars payroll. Now, this is a sort of "catch as catch can" estimation and this figure doesn't give any sort of exact estimate of the cost of compensation, but I think it is worth mentioning to express, though inadequately, some measure of the high cost of accidents in the Construction Industry. I compared, again very roughly, these rates with a few other industries, such as Steel and Utilities. The relatively high rate for construction was impressive.

We have all heard repeatedly that this high cost of accidents constitutes not only a waste of human resources, but also an unnecessary economic burden on the contractor. If any doubt exists on this point, the following should help to remove it. I obtained recently from our friend, Tom Kearns, some figures on compensation rates charged to contractors in the State of Ohio. These, as you know, are based on the accident experience of these companies. I should like to quote a few maximum and minimum rates per hundred dollars payroll in some classifications of your industry.

	Maximum	Minimum
Sewer Construction	43.56	7.20
General Building Construction	12.55	2.73
Structural Iron and Steel Fabrication	6.12	1.96
Lime Quarries	10.34	3.96
Demolition	76.84	14.28

Although the inherent hazards of jobs in the same general classification do vary, greater hazards call for increased efforts in accident prevention. This variation in premium rates was due undoubtedly to the difference in accident prevention performance on these jobs.

If new evidence is necessary to prove that construction accidents can be reduced, the work of the U. S. Engineers during the past year supplies it. That organization, working 69,000,000 man-hours, reduced its frequency rate 38 per cent and its severity rate 24 per cent. They have been working intensively on accident prevention for only two years. I have had an opportunity to learn, not from them but from other sources, something about how they operate and how they cooperate. I have had first-hand information in three states as to their attitude toward state inspectors. Whenever anyone has an idea which might improve the accident experience of one of their projects the U. S. Engineers are eager to have it. They are doing everything they can to prevent accidents.

The Navy has done an excellent job over many years and has produced splendid reductions year after year. Other departments of government are giving attention to construction accidents and among these the Works Progress Administration, Civilian Conservation Corps, the Bureau of Reclamation and the Tennessee Valley Authority should be mentioned. Accident prevention is distinctly on the "up-grade" in many government departments. The Secretary of Labor called for October 9th of this year, with the sanction of the President, a conference of all Departments of Government, having a major accident problem, to discuss methods for organized preventive effort. This conference was postponed a few hours before the time set, because of the inability of the Secretary to attend. It will be held within a few weeks. The previously justifiable criticism, that Government is lagging behind private industry, in accident prevention among its employees, will no longer maintain. This work of the U. S. Engineers certainly supplies additional proof that accidents can be prevented in the Construction Industry.

Great quantities of data could be obtained to substantiate further these facts: That accident costs are high in your industry; that these high costs are due to the frequency and severity of accidents; that accidents can be reduced greatly; and, that a tremendous opportunity exists in the Construction Industry for decreased cost of operations through the conduct of effective accident prevention work.

You have discussed this problem over many years in the light of your own experience and the essential elements of construction safety are quite well defined. Therefore, I can hope only to stress a few factors which seem to me to be most pertinent at the present time.

I should like to touch briefly upon the relative merits of definite state safety regulations and enforcement in contradistinction with voluntary methods based primarily upon safety organization. We probably all agree that effective approach lies in the promotion of a program based essentially on safety organization. I believe also, however, that reasonable regulation and enforcement by the state is necessary. The absence of a broad program of prevention throughout your industry constitutes the best indication that definite regulations, reasonable and intelligent control by the state are absolutely essential. Some state enforcement has not been confined entirely to regulating the efforts of the employer. Wisconsin has inaugurated a system of registering and licensing blasters which offers a splendid means for controlling this dangerous element of construction work through the employee. Wisconsin not only registers, inspects and licenses its blasters, but provides, in addition, the important element of education through schools conducted for them throughout the State.

It is my opinion that no matter what type of accident prevention work is under *consideration, enforcement* is a necessary element in the program. Propaganda, instruction and educational means generally are not sufficient to develop safe people. The adult mind must be challenged through enforcement in order to obtain serious consideration of this problem. To command attention to this problem regulation is necessary for both employer and employee.

I should like to relate one experience in connection with the job of selling safety to management which occurred less than a year ago: One project employing about 3,000 men had been turning in frequencies over a hundred for months. My discussions with the management were met courteously, but with the honestly and repeatedly expressed conviction that the work was unusually dangerous and therefore accidents were bound to occur. I met with one objection that discussion of the probability of accidents would decrease production efficiency. There's nothing new in that reaction of course.

Conscious as I was of the lack of interest, I was not prepared for the downright opposition which was evidenced when the superintendent and six others suddenly walked out of the room and left me talking to myself!

Following this, I got the "run around" for weeks. During this time nothing along accident prevention lines was done until, after three months, the management was confronted with a frequency of 180. Then the Superintendent got the "Go" signal and he certainly dug into the job. A Safety Engineer was appointed and earnest efforts were begun. Frequency the next month dropped to 120; to 60 the next; then to about 55, and finally to 38.

A few months ago we made a safety survey at Grand Coulee Dam. As many of you know, the foundation work is being done for both the low and high dams. When the high dam is built it will constitute the largest man-made structure on earth with three times as much concrete as Boulder Dam.

An analysis of compensable accidents on this project showed only 4 per cent were due to mechanical or equipment failure. Ninety-six per cent involved essentially the human element. I do not mean to infer by this that in 96 per cent of the cases accidents were due to the fault of the worker. In some cases it was faulty engineering judgment; in others, failure of supervision; still others were caused by the absence of sufficient and proper instruction. Failure or carelessness of the worker was, of course, responsible for some.

It is not fair for an employer to ask an employee to obey safety rules until the employer has first provided safe equipment and safe working conditions.

It is logical that a thorough knowledge of accident rates and causes precede the organization of a safety program. Anyone would expect the approach to prevention to lie in, first, a thorough analysis of the problem, and second, the designing of the remedy; but I am sure all of you will agree that thorough analysis and comparison of rates are accomplished only after the concern has organized its safety program and decided to stop accidents.

No employer can justly discipline an employee for infraction of safety rules unless the employee has been informed as to what the rules are. Although considerable information and material are available in such forms as the A.G.G. Manual of Accident Prevention in Construction, and the Safe Practices Pamphlets of the

National Safety Council: and although this material can be used as a basis for the drafting of job safety rules, nevertheless, construction operations are so varied and the types of jobs so dissimilar, that specific rules should be developed for every major contract.

The instruction of the new employee in the hazards of his job is particularly necessary at the present time when conditions of employment are so different. Men will lie about their experience, and I believe I would too if I saw for the first time the possibility of a job after two or three years of unemployment. Conditions imposed upon the National Reemployment Service by the act itself enhance on Government contracts the difficulty of obtaining skilled workers in these hazardous pursuits. Where employment is confined to relief workers the problems are increasingly serious. It is true, nevertheless, that the contractor has accepted the job on the basis of these specific requirements and the only sensible conclusion therefrom is that more and better accident prevention work must be done and that the program must stress education of the new employee.

I believe, as I hope you do, that the Construction Industry can look forward to increased activity and improved business during the coming months and years. I need not remind you that increased accident rates practically always follow emergence from a depression. I should like to point out again the conditions of employment existing today: where workers skilled in this hazardous employment are difficult to obtain; when a job means a change in the accustomed routine of the worker; when insecurity has impaired the worker physically and mentally and when eagerness to make good on a new job encourages instability. These conditions require, as never before, greater efforts on the part of the Construction Industry to avoid heavy human and financial losses as a result of increased accident rates.

WEDNESDAY MORNING SESSION

October 16, 1935

Safety in Construction Work

By WELTON A. SNOW

Safety Director, Associated General Contractors of America, Washington, D. C.

Gentlemen, for the next twenty minutes imagine yourselves a group of construction superintendents and foremen. As the president of this company, which undertakes a wide variety of construction projects, both large and small, I have always been luke warm with respect to accident prevention work. My company has had quite a few accidents in the past, some serious and others minor. To be frank, I have never paid much attention to our accident experience or the cost of my compensation insurance. I *might* be classed as an "average contractor."

Something happened the other day, though, that made me realize that I had been overlooking a good bet in the conduct of my business.

And so—here we are!

The Time: 10:00 A. M. on any working day.

The Place: My office.

"All right fellows, make yourselves comfortable. I've got a lot on my chest this morning and I want to get it off in about thirty minutes, as we've all got plenty of work to do.

"You've all heard that we lost out on that half million dollar dock job the other day. We were next low. Fred Smith got it by $2,000. Mighty close bidding. I had hoped to land this job to keep you all at work when our present jobs finish up next month. Anyway, we didn't get it, and I want to tell you why we didn't.

"Being licked on this job, when I had figured mighty close aroused my curiosity as well as my temper. I sat down and thoroughly analyzed our bid. I noticed one item that looked out of line and I figured someone had made a terrible mistake.

"So, in came Jim, our estimator, and I started to jump all over him. Boy, did he hit the ceiling and bounce back on my head! What he didn't tell me about our costs was aplenty and that item of $25,000 for cost of compensation insurance on the job was correct and not an error as I had thought!

"Think of it, $25,000 for compensation insurance on one job, 5 per cent of the total cost! Jim told me that, due to our poor accident experience, we were charged a penalty of 25 per cent. And then he told me that Fred Smith, who landed the contract we lost by $2,000, had a credit of 5 per cent on account of his good accident experience. So, it just shows that if we had as good a rating on compensation insurance as Smith has, we would have landed the job.

"After Jim had knocked the wind out of me with those figures, he ended up with a shot that made me blink and started me thinking about another cost item that I had entirely overlooked. He said: 'By the way, Chief, did you ever figure up what that busted ladder cost you last week?'

"After he had gone I sent for Tom, foreman on the Library building where we had that crash caused by a weakly built ladder breaking at the splice. Tom and I sat down and figured out the cost of the damage and lost time on the job, and here it is:

3 carpenters, 2 masons assisting 3 injured men (includes time taken to talk accident over) 5 man hours	$ 6.75
Time of Andy, the foreman, in (a) assisting the injured men, (b) investigating the cause of the accident, (c) readjusting the job and checking damage, (d) phoning office to report accident, 4 hours	12.00
Damage to pre-cast cement ornaments struck by falling section of ladder	150.00
Repairing section of staging smashed by falling section of ladder	15.00
Cost of new ladder	18.00
	$201.75

"In other words, because two of our short ladders were spliced together to make one long one, it cost me just a little over $200. A pretty expensive ladder, but I can assure you that hereafter we'll build our ladders strong and there'll be no splicing.

"Now, what is past is water over the dam! From now on, though, you fellows are going to work with me on this accident prevention stuff. I'm not going to lose another job if cutting out accidents will prevent it.

"And, by the way, I found some mighty interesting figures this morning, gotten out by the National Safety Council, which show that for 1934 the construction business ranks 27th on the list for frequency and 28th for severity.

"This means that we contractors had better wake up to the situation. Other businesses have done a good job. The cement mills stand fourth in frequency, the rubber factories fifth. If these two industries, doing the hazardous work they do, can cut down their accidents, we ought to be able to also.

"Why, the National Safety Council says that accidents are worse than gangsters in results. For every single homicide there are eight accidental deaths. In construction, 2,300 workers were killed during 1934. We contributed to that figure last summer when Bill Hayward and Art Stringer were knocked off that staging into the water when that old cable broke and whipped around them. I'll never forget the terrible job I had of breaking the news to their families. It was mighty tough on them, and as I look back now I can't help but believe that proper inspection of that cable might have prevented the deaths of those men.

"I know I'm rambling around a lot in what I'm saying, but I want all of you fellows to become as impressed as I am with this stuff. I find, on looking over our files, that we have been regularly receiving all sorts of literature and letters on accident prevention work in construction. None of it ever came to my desk, but it sure will from now on.

"You know this company is a member of The Associated General Contractors of America, and they have been dinging at their members for years to practice accident prevention work. I just discovered that we had one of the A. G. C. Safety manuals. It looks as if it had never been opened or read. I'm placing an order for a dozen of them so that you fellows can study up and see if we can better our accident experience.

"I have also filed application for membership in the Construction Section of the National Safety Council, and hereafter, if I can't attend their meetings myself, one of you men will go. I'm going to order some of the Council safety posters, and we'll use them on our job office bulletin boards. In short, I'm most serious about this whole matter.

"There are several other things that we must work out and realize if we expect to get anywhere with this business. First, we've all got to appreciate two things:

(1) There is a cause for every accident.

(2) It's our job to eliminate these causes.

In fact, we've got to become safety minded. We've got to realize that no matter how large the job or how small, working conditions must be kept safe.

"I'm going to hold Safety conferences with you fellows twice a month from now on even though we may not have much work going on. When the manuals come in, I want each one of you to read them from cover to cover. At the start of any new work the job superintendent or foreman will talk to his men regarding the need of guarding against accidents. Men will be cautioned against the dangers of upturned nails in boards, stumbling over tools and materials, falling objects and dangers from infection in cuts and bruises. It will be right up to the boss of the job to see that his job is a safe job to work on. Otherwise, his own personal job will be 'unsafe.' Get me? Each job will have a first aid kit that I want kept clean and filled at all times. And above all things, I want them *used*.

"I repeat, I'm going to get you some of the most glaring accident prevention posters that I can order from the National Safety Council and they'll be tacked up on the job where every man can see them as he goes to work. We'll change them every now and then so they won't get stale. And another thing, I want every accident on our jobs reported in writing to me. I mean by this not only accidents where someone is injured, cut or bruised, but also I want a report of every other accident. You know, if we study causes of non-injury accidents, we may be able to prevent a recurrence that would cause injuries.

"Never again if I can possibly prevent it, will I, or any of you, have to tell the widow of one of my men that, due to carelessness, indifference and lack of organized safety work on the part of this company, a life was lost."

Manual Lifting and Conveying

By C. E. RALSTON

Safety Director, Pittsburgh Plate Glass Company, Pittsburgh, Pa.

The speaker said in part: When we realize that over 25 per cent of all compensable injuries are chargeable to Hand Handling and Manipulation of Materials, we may well wonder whether we have not been overlooking a fundamental question. A study of a recent report developed a few rather startling facts as to costs, namely, 38 per cent of all compensable injuries are hand injuries and 38 per cent of compensation paid is for *hand injuries. 27,596* compensable injuries from a variety of industries show that there were 10,477 hand injuries which *cost $1,231,000 compensation* and *$355,000 medical*. That is an average of $151 for each hand injury and that does not begin to account for the multitude of trivial injuries that require one bandage or the additional large number that lost time, but did not lose enough time to be compensable.

Poor Physical Condition

Too much emphasis cannot be given to this problem. Strains, hernias, falls, vision, colds, constipation and many other items enter this picture.

The Physical Examination program must take first place in a proper selection and placement plan. The examining physician should be a man having personal knowledge of the labor situation and able to visualize the man at work.

Important items to be given consideration by him are: arthritis or rheumatism, tumors, tuberculosis, syphilis and bone abscesses. Infections from abscessed teeth, diseased tonsils, infected sinuses may cause much trouble by flooding the system with poisons which may affect any joint. A thorough examination will detect the presence of these troublesome items.

When two men are handling and carrying a load and one slips, it is not always this man who suffers an injury. Quite frequently the sudden shifting of the load to the other causes him to be injured. If two men can barely handle the load, three should be used. This is not waste of labor—just good planning. The waste comes from having a man on the disabled list.

The laborer must be fitted for his work in regard to his body type. The short, thickset type of man must be given the heavy lifting and handling jobs, while the lighter work goes to the slight built tall men.

Slight men should never be placed on heavy lifting or handling jobs. Light loads for slight men should be the rule and fatigue producing loads should be avoided if the labor is efficiently handled. I believe that loads of not to exceed 100 pounds should be considered the efficient load limit for the average man. Fatigue or weakness will often be found as the cause of dropped loads. It is certainly inefficient for workers to lift to their capacity. No adequate studies are available as to the capacity of man to lift efficiently or safely.

One fatal case in our company during recent years would emphasize the fatigue element. A man had been off duty for about five weeks as the result of an automobile injury. When he returned to work, although he had been passed by not only *his own* physician, but also the company physician, he was kept under very close observation by his foreman, his co-workers in the gang and also the departmental Safety Committee. He was naturally inclined to make a real attempt to hold his own with the other men as he had always been a very efficient worker. Several times he was ordered to slow down and once he was forced to sit down and rest. But, in his weakened condition, fatigue soon overcame him. While carrying two small pieces of glass, he collapsed and, in falling, the glass caught under his left arm severing the main arteries so that he bled to death.

Improper Labor Method of Lifting and Conveying

In considering this problem, I can recall many personal experiences and observations. The outstanding fact has been the lack of definite instructions by the supervisors and their apparent inability, or incompetence, to give such instructions. This includes their failure to properly recognize the mental capacity of the laborer, whether he be a foreigner, a son of foreign-born parents, or an American with little education. All three groups may have different understandings of instructions given if the supervisor is not explicit.

An inadequate force is not only inefficient but dangerous. The distribution of the force to the load is of prime importance, whether handling boxes, crates, barrels, timbers, rails, pipes or other bulky, as well as lengthy materials.

Team work is essential and only obtained through careful and systematic training—one slow thinking, or acting, man can and will wreck the gang. They are a menace, not only to themselves, but others, unless their supervisor constantly recognizes their weakness and places them accordingly.

Failure to obey orders may often denote either mental or physical inability on the part of the man and should be a warning flag to the supervisor.

Inadequate Hand and Foot Protection

This is mainly the problem of the employer, worked out through the supervisor. The construction field has given very little attention to this phase of the problem in the past. Protection against bodily injury, as well as protection of the worker's clothing, should receive careful consideration. All exposures should be carefully analyzed, in justice to the laborer, and adequate protective equipment should be provided. In some cases this may only involve the hands, arms, feet and legs, while in others the body will be included, such as in handling pig-iron or other rough as well as heavy materials. Hot substances and acids call for special consideration and treatment as in such cases we find the face, head and eyes also involved.

Proper protective equipment for the hands will include gloves of various types and materials, as well as wrist protectors and hand laps. Leggings and special foot protectors, whether the latter be safety shoes, metal, or leather guards, will be clearly indicated from an analysis of the exposure. Improper or inadequate protection will often act as a boomerang to the employer through its failure to properly protect the worker. I fear that too often protective equipment is purchased entirely on a price basis and as a result many preventable injuries occur that never would

have occurred had proper consideration been given the importance of the problem. Where inadequate equipment is furnished, there is bound to result a false sense of security and the responsibility of the employer is increased. Also, in many instances the employer is penalized by the compensation commission for failure to provide necessary equipment.

In addition to protective equipment consideration should also be given to providing special hand tongs, or grips, for special materials.

In our operations we are confronted with many problems as the handling of glass is so different from other materials, particularly those of an unbreakable nature. We can protect the hands and arms, but must leave fingers exposed in most cases as it is necessary for the men to feel the glass. Special soft rubber hand laps are used wherever the work will permit—these have been found very satisfactory as they will not slip. Some few operations permit the use of gloves.

Safety shoes are good in many operations, but they do not furnish complete protection as they do not protect the most vulnerable parts of the feet. I am more in favor of special foot guards which will afford complete protection.

When the working conditions indicate the need for protective equipment, its use should be a requirement of employment—no protection, no job.

Unsafe Practices

Here we can consider too heavy, or bulky loads, or inadequate force. I recall many old time stone masons and their handling of stones too heavy for one man to properly handle. Hernias were very common among the men. They had never been taught how to lift. Forty years ago the principle of lifting with the heavy leg muscles instead of the weaker back muscles had not been called to the attention of any one, as far as I can recall. Shipping of loads when muscles are under tension has and will cause serious strains.

Walking backward with loads is a dangerous practice and this is particularly so in restricted areas. Vision is very important, as there is not only the stumbling hazard to be considered, but also that of bruised hands and arms against projecting piles of materials or parts of permanent structures.

Care should be exercised in piling and blocking material so that it will not roll, or slide, and also that it will furnish proper hand hold when rehandled.

Bulky materials should be carefully tipped to a balance and secure hand-holds obtained before any attempt is made to lift or move.

Piled materials should always be raised from the pile before any side movement in order to prevent dragging which might cause the balance of the pile to fall.

Inadequate Regard for Inspection Hazards

This condition can be accounted for in several ways—namely, ignorance, inability to think, inability to draw a personal lesson from the experience of others, overconfidence and a desire to make good on the job. These can only be overcome by careful and systematic handling on the part of the supervisor. His is the responsibility of putting over to the worker the value and advantages resulting from a close observance of rigid safety inspections.

Necessity for Systematic Organized Safety Effort

With the high rate of losses chargeable to accidents, there should be little need to make a plea for more concerted action along this line. As safety men, we know how easily the small employer could be put out of business as the result of even a few cases. The larger employer, as well, cannot afford to overlook the situation—his losses, through the waste of time, money and materials, will seriously affect his profits and hold his company up to the public as an inefficient organization. The ever-increasing cost of compensation insurance will undoubtedly be a factor in forcing more consideration for well organized Safety Work. Personally, I emphasize the side of Humanity above the Dollar and am satisfied from long experience that where Humanity rules, the profits will be satisfactory. Where a real safety program is followed, efficiency and economy of the highest order will also prevail.

Final Program Feature

Past General Chairman E. N. Goldstine gave an illustrated talk on "Safety On the San Francisco-Oakland Bay Bridge Project", as a last feature of the Congress program. His talk was extemporaneous and no record is available.

ADJOURNMENT

Food Section

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General Chairman—T. A. SCHENDEL, Premier-Pabst Corp., Milwaukee, Wis.

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WILBUR THOMAS, Hage's, Limited, San Diego, Calif.
LIONEL W. UDELL, United Fruit Co., Boston, Mass.
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P. SILAS WALTER, International Salt Co., Inc., Scranton, Pa.

Officers Elected for 1935-36

General Chairman—C. W. Dempsey, Liquid Carbonic Corp., Chicago, Ill.

Vice-Chairman in Charge of Program—S. B. Horrell, The Carey Salt Co., Hutchinson, Kan.

Secretary and Publicity Committee Chairman—D. M. Clark, Society of Grain Elevator Superintendents of North America, Chicago, Ill.

News Letter Editor—C. W. Turning, Goddard and Heinselman, Minneapolis, Minn.

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E. C. Grether, The American Sugar Refining Co., New York, N. Y.
Theodore Krueger, Pennsylvania Hotel, New York, N. Y.
Henry J. Mineur, The Borden Co., New York, N. Y.
T. A. Schendel, West Disinfecting Co., Chicago, Ill.
A. C. Schroeder, Church & Dwight Co., Syracuse, N. Y.
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Vern D. Sutton, Postum Company, Inc., Battle Creek, Mich.
Wilbur Thomas, Hage's, Limited, San Diego, Calif.

TUESDAY MORNING SESSION

October 15, 1935

The first session of the Food Section was called to order by General Chairman T. A. Schendel, Premier-Pabst Corporation, Milwaukee, Wis., who presided. Chairman Schendel presented a resumé of the year's activities mentioning particularly the work of committee chairmen of the section.

Progress Made in Dust Explosion Prevention in Food Industries

By DAVID J. PRICE

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

The Food section always has manifested keen interest in the work of the U. S. Department of Agriculture on dust explosion and fire prevention. At the Congress in 1931, we referred to the reduction of dust explosion losses by industrial cooperation. At that time we stated that the splendid cooperation given by the food industries, through their safety organizations, in the application of control measures had been instrumental in bringing about a marked reduction in the losses of life and property resulting from dust explosions. A careful analysis at that time showed that in the five-year period from 1926 to 1930, three food industries—flour, starch and sugar—had experienced a marked reduction in dust explosion losses.

In connection with the Congress in 1932, the Food section cooperated with the Department of Agriculture in arranging for dust explosion tests at the Arlington, Virginia, testing station. These tests were designed primarily to show the possibility of releasing dust explosion pressures, through properly proportioned vents, without structural damage. In these tests grain elevator dust, soap powder, starch dust, milk powder, baking powder, wood charcoal dust, wood dust, and cork dust were used. The program included 12 different explosion tests, each planned for a scientific purpose. A detailed description of these tests was published in the National Safety News, November, 1932.

The research investigations on dust explosion prevention now being conducted by the federal Department of Agriculture were brought about as the direct result of the interest manifested by the grain millers of the country, particularly Western New York, following the disastrous explosion at the Husted Milling company plant in Buffalo in 1913. The Millers' committee, consisting of Mr. L. E. Harmon, then president of the Buffalo Cereal Co.; Mr. F. F. Henry, manager of the Washburn-Crosby Co.; and Mr. George P. Urban, of the Urban Milling Company, made it possible for the government to cooperate with the grain-milling industries in a thorough study of the causes of dust explosions in industrial plants, with a view to the development of methods of prevention. The active interest manifested by this Millers' committee and the early provisions made by them for conducting both the necessary engineering and chemical research investigations have been of inestimable value to all American industries.

The Chemical Engineering division of the Bureau of Chemistry and Soils has record of 615 dust explosions in industrial plants in the United States from 1860 to September 1, 1935. In 210 of these explosions, 475 people were killed and 961 were injured, or a total of 1,436 people directly affected. The property loss in 502 cases was more than $49,000,000.

The extent of these dust explosion losses in some of the principal grain-handling and food industries can be summarized as follows:

Industry	Total Explosions Reported	Explosions with Injury or Fatality	Number Killed	Number Injured	Number of Explosions with Reported Losses	Amount of Property Losses
Flour Mills	83	24	27	44	57	$ 4,398,000
Grain Elevators	115	38	90	189	105	17,661,730
Feed and Cereals	80	33	53	190	71	5,922,450
Starch and Corn Products	33	17	128	124	28	5,095,850
Sugar Refineries	24	4	12	31	14	1,622,300
Coffee and Spices	10	2	5	13	9	201,700

Dust explosion losses in some other industries can be summarized as follows:

Woodworking Plants	73	31	27	100	55	$1,952,160
Metal Dusts	15	10	32	60	14	1,538,500
Fertilizer Plants	19	4	12	12	9	647,250
Cork Plants	31	4	4	19	28	163,670
Malt Houses	20	2	2	18	15	666,700

There has been a marked reduction in losses from dust explosions in the food industries during the last five-year period, 1930-1934, inclusive.

In *flour mills* we find a record of only five explosions for that period. One man was killed and ten were injured, and the total property loss reported as the result of the explosions and the fire which followed amounted to $131,600.

In starch and corn products plants we find that only two explosions were reported. In one case there were no fatalities or injuries and practically no property damage. In the other case, six lives were lost and ten employees injured, with a property loss of $7,500. This explosion occurred on September 20, 1930, and there has not been an explosion involving any loss of life in a starch factory since that time. This remarkable record for the starch and corn products industry is a significant indication of the value of the work of the safety organizations in this industry.

The sugar industry also has a remarkable record during this five-year period. The last recorded ignition of sugar dust occurred in a pulverizer on January 31, 1930. Not a life has been lost in an explosion of sugar dust since June 13, 1917.

There was only one explosion in a cocoa and chocolate plant during this period. This explosion resulted in the loss of three lives, injuries to three others, and property damage of about $15,000.

There has not been an explosion reported in connection with the grinding of coffee or spices during the last five-year period.

We can more fully appreciate the reduction of dust explosion losses in this group of industries when we realize that in the five-year period under consideration (1930-1934), a total of 105 dust explosions in industrial plants have been reported, resulting in a loss of 61 lives, injuries to 190 others, and a total property damage of $5,038,160.

During the five-year period (1930-1934, inclusive) 39 grain elevator explosions were reported. In these explosions 26 people were killed, 87 were injured, and the property losses amounted to $3,481,930. These 39 explosions in grain elevators were more than 34 per cent of the total number of 114 explosions reported. This is a very positive indication that more definite attention must be given to the application of methods for the control and prevention of dust explosions in grain elevators.

In feed and cereal mills 23 explosions have been reported during the last five years. As the result of these explosions six people were killed and 31 were injured, and the property loss amounted to $751,600.

This record of progress in dust explosion prevention and control in the food industries is a challenge to safety engineers to continue this achievement.

Rodent Extermination and Control

By C. K. STEWART, D.R.C.

Representing West Disinfecting Co., Long Island City, New York

I recently read of three children whose deaths were caused by eating poison set for rats. Such deaths are preventable.

As far back as civilization can be traced, the human being has always been molested with the rodent pest. People would be astounded if they had concrete knowledge of the millions of dollars of foodstuffs consumed and destroyed by rats and mice. The U. S. Chamber of Commerce and the Bureau of Biological Survey estimate that there are two rats for every human being in this country. In order to live, each rat must consume at least $2 worth of food material a year, and this estimate of loss does not take into consideration the important fact that the rat will damage merchandise worth many times this amount.

Some of our worst plagues and diseases have either originated with, are being carried by, or transmitted through the rat. We have millions upon millions of brown rats, (Rattus Norvegicus) in this country and it must be clear that if plague infested rats were introduced among them, disease would spread with great rapidity. The recent outbreak, in Queensland, Australia, of Infectious Jaundice (known as Weil's disease) calls attention to another disease, transferred from the rats to mankind.

Rats, being transmitters of diseases, contaminate food and water supplies, and are known to have been the cause of many plagues. Some of the diseases transmitted through the rat are: typhus fever; bubonic plague, sometimes called Black Death; infectious jaundice, also known as Weil's disease; rabies, or hydrophobia; tuberculosis; anthrax; ratbite fever; cholera; amoebic dysentery; paratyphoid; trichinosis; hog cholera; swine erysipelas; fowl tuberculosis; hoof and mouth disease; and many others.

Plague is primarily a disease of rodents, and secondarily a disease of man. Man's safety from this disease lies in the extermination of the rat and his parasitic host of fleas. This is the basis of all prevention and eradication work. If man can live in rat-free surroundings, he need have no fear of plague.

Rats breed throughout the year. Females, when not paired, come in season about every ten days, but the season only remains a few hours and in the absence of pairing returns in another ten days. The period of gestation is about twenty-one days, and impregnation may be renewed within a few hours of the bearing of a litter. Generally, they begin to breed when only three or four months old, and breed five or six times a year.

Rats are interesting. For example, they will pyramid to reach a piece of meat in a butcher shop until two or three can gnaw the meat off the hook to bring down a feast for all. In stealing eggs one will wrap its tail around the egg and drag while another braces it in his paws. They become "trap-wise" through seeing another one trapped, or by smelling the odor of a rat on the trap. If a rat wants the bait, he will jump over the trap until his tail releases the spring and then get his bait. Should his tail be caught, he will gnaw it off and go on his way more "trap-wise" than ever.

Rats travel a considerable distance by night to obtain food and migrate to banks of rivers and streams in spring; in the autumn they return to the shacks and buildings.

During nesting periods they destroy blankets and woolen materials to feather their nests. In food depots, such as grocery stores, meat markets, warehouses, they destroy a great deal more food than they consume. In eating food, a rat sits on its hind legs, holds the foodstuff between its forepaws and bites through the middle. If he likes the flavor, he eats the greater part of it, but always leaves a piece at each end. A full grown rat, or ten full grown mice, will eat and waste a pint of wheat in twenty-four hours, or the equivalent in other foodstuffs.

To destroy a large colony of rats, traps should not be used unless a very large number are set simultaneously, and even then only a small number are trapped because of the cleverness of the rodent. Only one cat out of fifty is a natural mouser. When a cat is used to repel rats, the rats entrench themselves more deeply in underground burrows until they are large in numbers. From then on they master the situation, coming out in the open freely. Cats are lucky if they are not themselves destroyed. In numbers, rats have been known to attack pigs, dogs, cats and even human beings!

The majority of rat poisons depend either upon strychnine, arsenic, or phosphorous for the poison element. These poisons suffer little deterioration on exposure, and remain dangerous to children and domestic animals indefinitely. For this reason they are not recommended for rat extermination.

Under a multitude of names, six basic media have been employed in the war against rats, (when I say rats, I mean rats, mice and other closely allied rodents). These consist of strychnine, phosphorus, arsenic, bacterial culture, thallium and barium carbonate. Statistics now show that through the use of strychnine alone 3,000,000 poultry, 150,000 pigs and 60,000 dogs have succumbed in one year. Through phosphoric compositions, many fires resulted and 1,800,000 poultry were lost. From the use of arsenic, 700,000 poultry died. Yet it has been definitely proven, in conducting laboratory tests using 100 rats in each test, that strychnine killed only 63 rats out of the 100; phosphorus, 49; arsenic, 43; bacterial culture, 16.

There are three distinct types of rats. Norvegicus is a large, clumsy rat, living in the sewers, under the ground, on the floors and beneath them. Alexandrinus is

smaller, weaker and more agile. They live in the walls and on shelves. Rattus type rats are the smallest and will be found on roofs, rafters, and in attics. Ordinarily, none of these species will encroach upon the territories of the others because of their cannibalism—the big ones eating the little ones. All rats will scare mice away. Mice will be found on and under floors, in walls and over ceilings, when they are present at all. It is necessary, therefore, to bait all parts of the building in order to reach all types of rats and mice.

During the time I was associated with the Los Angeles Health Department, we used the fast-base poisons in our rodent extermination work. Many a sleepless night we spent not knowing which morning we would receive the report that some man, woman or child had met death through accidental contact with these poisons. The dogs, cats, chickens and other animals killed ran into the thousands, and knowledge of the use of Red Squill as a non-poisonous raticide was welcomed with enthusiasm.

Farmers Bulletin 1533, entitled "Rat Control," issued by the United States Department of Agriculture, discusses the merits of Red Squill as a raticide, however, only the subject of Red Squill powder is considered, admitting the difficulty of maintaining evenness of toxicity and eliminating the bitter unpalatable taste. This development, however, was the beginning of a new era in rodent control work, and although our results with the use of the powder were not too successful, it gave us the assurance that we were on the right track, and from that time on we experimented with Red Squill preparations.

Now we have a liquid concentrate of Red Squill, a product which conforms to the exacting requirements of the ideal raticide. The West Disinfecting company has developed a process whereby only the toxic Red Squill is utilized; this liquid concentrate assures a minimum lethal dose and if rats or mice nibble only a small part of the bait, they cannot live. In our extermination of rodents, particularly where foodstuffs, humans, domestic animals and poultry are concerned, the results attained through the use of this concentrate were very effective.

To maintain health and prosperity, rats must be exterminated, and it is important to humanity that a non-poisonous raticide is used in this work.

THURSDAY MORNING SESSION

October 17, 1935

EXPERIENCE EXCHANGE

Experience Exchange: Accident Causes and Remedies in Canning and Preserving Food Products

By E. E. DREWS

Div. Supt., Libby, McNeill & Libby, Chicago, Ill.

All of our plants have a safety inspector or committee who have the full cooperation of the management. Foremen are the "key men." Their job is to send out quality products at the lowest cost. Since part of this cost is compensation and accident prevention, we hold each foreman responsible for the complete management of his department.

Weekly meetings (limited to one hour) are held and we talk over the foreman's position in the organization. The foreman can either make or break any employee and the employee knows it, so we do not try to take the foreman's place in his relations with his men.

A statement of department standings in safety is presented monthly listing the various kinds of accidents. These figures are shown in comparison to previous months and years.

All employees hired are questioned as to their previous safety experience and are instructed by the employment manager concerning our rules. A medical examination is given all new employees before they are turned over to their respective departments at which time they are instructed further on requirements pertaining to the reporting of all accidents at the time they occur regardless of how slight they may be.

Our Chicago plant is divided into a number of departments, the largest of which is where cans and pails are manufactured. Seventy per cent of our minor injuries are tin cuts and scratches.

A few of the safety devices perfected this year in this department include the following:

On the slitter machines, the scrap from the trimmed edge always went out the back of the machine and became mixed with the sheets of tin causing cuts to men handling them.

A guide and guard were arranged on the rollers to reverse the scrap into a chute under the front of the machine and let it drop into a box.

The installation of a hinged guard over the end of the feed bar on our automatic presses eliminated a big hazard.

We equipped our can end compound applying machines with a block of wood with two lugs fastened with a chain to the machine. The block is used by the operator to place on top of the stacks of ends in the magazine to lessen the chance of a girl using her fingers to hold down the last end which sometimes tips up when there is no weight on it.

On some of our presses the left side was never guarded on account of gauging the sheet while cutting lithographed pail bodies. However, one accident brought about several ideas and our presses were immediately equipped with an inexpensive guard.

The canning department is next in size. We have knife cuts and bone scratches in the preparation of some of our products. Although they are slight, they must have immediate medical attention to prevent possible chance of infection.

One of the most hazardous machines is the hasher. Experience has taught that regardless of the size of the feed table around the hopper, which was designed to keep the operator's hand from coming in contact with the feed spiral, the operator will stand on a platform, if he be permitted to do so, where his hands may come in contact with the spiral.

We installed a number of direct motor-driven high-speed grinders equipped with a table on top of the hopper extending out to one side about 2½ feet. Directly above the hopper the table has a cover raised 6 inches which is hinged and provided with an automatic stop operated by slight pressure.

Sausage stuffing machines should be equipped with steel safety rings securely and rigidly bolted to the cylinder to prevent the plunger from over-traveling and leaving the cylinder.

In our dried beef slicing department the slicing machines are direct motor-driven with a padlock on the switch. The cutting knives are enclosed with a hood guard, the bottom of which is equipped with a visible shield extending far enough below the cutting edge so that the operator will not come in contact with the knives. The hood itself has an automatic switch. When removing or raising it the switch will automatically shut off the power.

Chip guards on grinding machines are fastened securely so that they cannot be pushed to one side.

To overcome the hazard of climbing ladders, oilers in some plants have a standing order to provide extensions for all grease cups to bearings. The use of extension cords is discouraged and they are in the keeping of the electrician. After use they are returned for inspection.

Replacing light bulbs and fuses is done by the electrical department.

Motion studies are made in our plant through the use of a moving picture camera and stop watches. Effort and benefit to employee is taken into consideration. The safe movement or manner to perform the operation is watched and allowance made when setting standards so that the operator will not become over-tired and careless.

Safety in the Manufacture of Beverages

By G. L. GORE

Bruce Dodson & Co., Kansas City, Mo.

In discussing safety in the manufacture of beverages, I will first refer to the revival of the manufacture of beer and the problems which accompanied repeal. Since repeal came suddenly, there weren't very many brewers who were ready.

Picture an eager market with remodeling, new construction, practically an inexperienced force and top production at the same time and you can realize what we were up against from an accident standpoint. Experienced men were at a premium and those who had worked in the old days were reaching advanced age. Accidents due to strain were common. We encouraged physical examinations among our brewery risks and our findings were astonishing.

We encouraged the use of a safety committee composed of the brewmaster, bottle house superintendent, someone in the office to act as secretary, one plant employee and two plant inspectors. Inspections should be made weekly and the inspectors changed at least quarterly. A new inspector will always find a few important things that his predecessors overlooked, but after a few inspections, everything looks all right to him.

The committee should meet at least once a month. Unless there is something special we have seen no need for the inspectors being present, their recommendations being acted upon as soon as they are made. As a matter of fact, I consider the inspection end the least important of safety work. The function of the committee should be directed toward safety education. One of the most effective means is to have the injured employees present at the monthly meetings. At these meetings the committeemen should feel free to ask any questions which would have any bearing on the accident with a view toward prevention of a future similar accident. The purpose of this is two-fold. First, no employee likes to be called on the carpet before his superiors. Second, information as to the real cause always comes to light.

A code for classifying the accidents should be formed. For example, "A" might mean employees' negligence entirely, "B," someone else's fault, "C," defective equipment, "D," hazard of the industry. It will be the tendency of the committee to use this latter classification freely because it is an easy way to absolve everyone from blame, but it doesn't get us very far in preventing accidents.

A board should be erected near the timeclock and the accident classifications bulletined after each meeting. It will be surprising to note the interest that will be shown by the men. Safety suggestion boxes placed about the plant, with some award for an appropriate suggestion, are helpful. Contests between various groups always get results but they shouldn't be worked to death.

The above plan, while not new, will work. An example is the M. K. Goetz Brewing Company of St. Joseph, Missouri. I don't believe there is a brewery in the country of similar size enjoying a larger experience credit in its workmen's compensation insurance rate.

Injuries due to falling objects, such as barrels and cases, are most prevalent. Sometimes this means a fractured hand or foot. The barrels are particularly hard to handle for with the return of beer, every brewery was short of barrels and they had to get them from any manufacturer who had them. Some were made of staves, others steel; some one size at the top and bottom, others different. To stack them safely or get them down was quite a task. We have encouraged the use of safety shoes without a great deal of success. We can get the men interested, but we have had difficulty in finding a good shoe bearing a union label.

Insofar as bottle explosions are concerned, those occurring on the crowner are inconsequential. However, when the bottles are being taken from the table to be placed in cases, inasmuch as they are picked up two in each hand, quite frequently the employee will strike the bottles together, and if the bottle is the least bit weak, being under pressure, there is an explosion which frequently means a cut hand. We have endeavored to promote the use of gloves and goggles, but it appears gloves would increase the hazard. Naturally the glue on the bottles would come off on the gloves and together with water, would make the gloves stiff, rendering an employee more likely to drop a bottle. Insofar as goggles for this operation are concerned, I am afraid it is just due to poor salesmanship on our part, because they are practical and it is a great wonder that there are not more eyes injured. I have seen a bottle explode and throw jagged pieces of glass ten feet. There seems to be a greater explosion hazard in new bottles than old, because there are a percentage of weak ones which break on first use.

In my opinion, the big thing in a brewery is to get those who run it thoroughly sold on safety and functioning in a definite well planned consistent program.

Bottlers of carbonated beverages find their greatest trouble in the fleet. It must be remembered that these men are driver-salesmen and are selected for their sales ability rather than their driving skill. If they are able to produce as salesmen, their accident record is overlooked to a certain extent. During the summer months when more goods are sold than during the other nine months together, they put in long hours and have to drive at a good rate of speed to get around. Long hours induce fatigue and fatigue means accidents. I would recommend that a column be added to the cost sheet, showing exactly what the salesman costs by way of accidents, and that this be considered along with his other costs in determining his worth.

In the plant, bottle explosions are the greatest hazard. Most of these occur during inspection. The inspector picks up a bottle in each hand and upends them. This natually places the bottle close to his eyes. Our assureds have lost several eyes due to this cause. By all means goggles should be worn at this work.

It is difficult to promote a successful safety campaign in the average bottling plant, due to its size. Naturally it is difficult to organize a safety program in the smaller plants because the manager usually feels that he can accomplish more with his men by personal talks. He can, but does he do it? Personally, I believe 120 men in ten organizations are just as susceptible to accident as if they were in one, but it is a difficult task to make ten managers believe it. It is the same old story of difficulties we have to meet in organizing for safety in the small plant. However, in one large company operating 50 small bottling plants, an executive of the company keeps after the managers, holding them responsible for accident records. He corresponds with them freely. Each plant is kept informed of the standing of the others.

It is my opinion that it is necessary to concentrate on driver-salesmen. They are salesmen, with a lot of distracting incidents on their minds, and not professional drivers. They must be taught to drive safely.

In my ten years of experience, I can truthfully say that there is much more interest in safety at the present time than ever before. It is much earier to sell our ideas. Companies now seem to be interested in saving the money that they previously lost due to accidents. If there was just some way to educate the public, we safety engineers would stay young much longer.

Tobacco Products Manufacturing

By EMIL PIEPER

Insurance Department, General Cigar Co., Inc., New York City

During the past ten years the cigar industry has been transformed from a purely hand manufacturing industry to one using machinery almost exclusively. In the days of hand work, accidents were few and of very slight nature.

With the introduction of machinery, however, we soon found out that we had to make strenuous efforts for accident prevention, as crushed and lost fingers were frequent. We found that the manufacturers of the machines had not guarded the danger points, claiming that the machines were safe if proper use was made of stop or safety handles provided on three sides of them. The trouble, however, is that employees get the idea that they are quicker than the machine and reach into moving parts without considering the stop handles.

We not only had the element of machinery to contend with, but we also had to introduce a new type of employee, one that was entirely unfamiliar with machinery.

Of course, we immediately started a strenuous accident prevention campaign, adopting all the approved safety measures and these had the desired results. Year after year our safety experience has been better, until at the present time our accidents on these cigar machines are the smallest factor in our accident experience. However, we have not relaxed our efforts. Standing still in accident prevention work is the same as going backward. We are constantly devising new means of encouraging the safety idea among the supervising force and employees in our plants.

At the present time, the accidents which cause us the most trouble are those occurring through unusual work or handling and moving of material. This work includes the moving of heavy machinery, the breaking down of a partition or wall, painting tanks or other parts of buildings, etc. When such work is to be done, superintendents often feel that they can save expense by letting their own shop help do the work, and sometimes they assign men to these jobs who have had no previous experience. As they are also given very little advice on how to go about it in a safe way, the result is often an accident, the cost of which exceeds the saving made.

During the past year, we have had two unusual accidents which spoil an otherwise perfect record at two of our plants. Our Perth Amboy factory operated during the year 1934 without a single disability accident and was doing splendidly in 1935 when a serious accident occurred. Employees enter this factory through a wide driveway which circles the corner of the boiler room into the factory yard. All trucks enter and leave the yard through this driveway, which is 20 feet wide except at the corner where the clearance is only 12 to 14 feet. One day a large truck was emerging from the yard while employees were coming to work. The driver and helper were calling to girls to wait until they had cleared the turn. However, one girl did not heed and as the truck was just swinging around, she was caught at her hips between the truck body and the wall. Luckily she was a very slim girl, but her injuries were quite serious; the pubic bone was broken in two places, also a slight fracture of the spine and bruised kidneys. Recovery in this case is very slow and it will be expensive.

Trucks belonging to this factory always have a helper on the ground at this corner of the yard to hold back employees until the truck is past, but this was a truck from another factory with a new driver. It was the first time an accident had occurred here. The superintendent of the plant had always given instructions to drivers and all the help to be careful and we can only attribute this accident to the impulsiveness of the injured girl. Needless to say, a full investigation was made and measures adopted which will prevent any future accidents of this kind.

The other unusual accident involved a night watchman who during his rounds noticed that the elevator gate on the top floor landing was not closed, although the elevator car was not at this landing. Realizing the danger, he attempted to pull the gate, which is of the automatically closing type, down. To make this gate reach the floor when down, someone had placed an eight inch board across the bottom and had fastened it with hinges opening toward the shaft. When the watchman could not pull the gate down, he tried to loosen it by jarring and hit the bottom board with his fist. The board opened toward the shaft and, losing his balance, he fell three stories to the top of the elevator car grating where he was lying helpless until his relief man came at 6 in the morning. His lumbar region was shattered into more than twenty pieces, but with careful treatment by an exceptionally good doctor, the man is, after a year and a half, able to walk straight; there is a loss of about 15 per cent in flexion and on account of his age (60 years) he will probably never work again.

Another unusual accident is the case of a tobacco handler who was delegated by the manager to unload a car of railroad ties. Instead of waiting for a second man to help him, this man started to unload alone. Holding a tie to throw it over side of the car, he lost his balance and fell to the ground against the wall of the warehouse. Result, a fractured vertebrae in neck and a broken collarbone.

We have bad conditions to contend with in our tobacco leaf department. This is the hiring of seasonal help which takes care of the raw tobacco. The work involves the handling and piling of thousands of loosely packed bundles. Then the tobacco is sorted as to sizes and packed in cases. The cases are distributed to the warehouses for curing and piled up, in some cases, as much as 11 cases high. These cases weigh about 450 pounds. Case hooks are used in handling and piling, and this alone causes quite a number of accidents.

The men who do this work are mostly farm help or any other unskilled labor we can find. Most of them are entirely unschooled in safe practices and before we have an opportunity to impress upon them the manner in which this work should be accomplished, the packing season is over and we do not need them again for many months. Of course, we have a skeleton force of regular warehouse employees who endeavor to keep an eye on the new employees and instruct them properly. This, however, is quite a task when a force of 20 to 25 regular employees is suddenly increased to 500 or 1,000. Our accident frequency among these seasonal employees is very high.

Our organization has a regular safety program and each factory has its own safety committee which holds regular meetings. All sorts of literature, posters and all the usual safety propaganda are used.

In analyzing the whole matter of accident prevention, we have come to the conclusion that results can only be obtained when responsibility for accidents is placed squarely upon the shoulders of the foremen and immediate supervisory force. You have to get their full cooperation and full understanding of the importance of the safety program. Only in this way will your accident prevention work reach the highest point of effectiveness.

Bakery Operations

By R. C. HAVEN

Safety Engineer, Continental Baking Company, New York City

In bakeries which operate one or more vehicles the greatest problem is the prevention of accidents resulting from their operation. Using our 1934 figures we find that the major causes of accidents for which our own employees were responsible rate, according to percentage, as follows:

Automobile accidents—Inattentive driving, i.e., backing up, etc., 43; following or passing too closely, 18; reckless driving and excessive speed for conditions, 14; failure to grant right of way, 7; leaving curb without signalling, 6; violation of traffic signals or improper turn, 3; improper parking, 2; horse hazards—runaways, etc., 1.6; drowsiness from any cause, 1.2; alcoholic influence, .8; miscellaneous, 4.4.

Compensation accidents—Handling objects other than tools, 23.5; falls of persons, 19; stepping on or striking objects, 13; vehicles, 9; machinery, 8; hand tools, 5; falling objects, 4; animals, 3; miscellaneous, 15.5.

In our prevention program we employ the scientific principles of engineering, education and enforcement.

During the last eight years we have kept a record and made a thorough investigation of all accidents. With this knowledge we carry on a year-round program of inspection, maintenance, supervision and education.

Daily inspection is made of machinery and plant conditions. Special attention is given to lighting, ventilation, floors, aisles, and condition of racks and pans. Automobile equipment undergoes nightly inspection.

Every employee is carefully selected for each job. All applicants undergo a physical examination. They are specially supervised until they are at home in their new surroundings and familiar with their duties, and then they come under routine supervision.

In the case of salesmen a road test is made over a prearranged route; an oral examination with reference to company safety rules and regulations as well as local traffic laws, is given. A sales supervisor accompanies new salesmen on their trucks for two weeks or more before they are permitted to cover their routes alone.

At each bakery a Safety Committee composed of key men and salesmen meets monthly. This committee handles all safety matters in the bakery and decides the responsibility for all accidents. Safety bulletin boards are also maintained. We get four dollars back for every dollar spent on safety, and I doubt if any other department in any bakery can show a 300 per cent profit.

Confectionery Manufacturing

By H. E. WHEELER, JR.

Personnel Manager of Henry Heide, Incorporated, New York City

We could sum up our experience in accident prevention work in a few words, by saying that approximately 95 per cent of the accidents which have occurred in our plant were of the "mental hazard" rather than of the "machine hazard" type.

Many persons not conversant with the confectionery industry seem to feel that the manufacture of candy is largely a manual process, an operation similar to making fudge in one's own kitchen. Today, however, most candy is manufactured with the aid of machinery. Practically all candy wrapping is done by machine. So that the machine hazard has become an important factor in this industry.

In addition, we are constantly faced with another hazard which is present in most food establishments—namely heat. Many of our employees constantly handle batches which are at the boiling point. One drop of hot candy may cause a burn or blister which is, of course, an invitation to infection. For instance, the hard candy maker handles batches whose temperature is not less than 250 degrees and at the same time is speeding this hot mass into forming rolls which are an additional hazard.

Despite the number of machines and the type of hazard involved, we feel that we have made progress in the elimination of accidents. We have eliminated every exposed set-screw, installed slip-sleeves on exposed shafting, completely inclosed all gears and sprockets, thoroughly guarded all belts, and have thereby provided safeguards for every transmission hazard. We have many "point of operation" hazards and have provided mechanical safeguards where possible and warning signs were safeguards are impossible.

Like the baking industry, we use many batch mixers and dough mixers which are *inherently* hazardous; anyone unfortunate enough to be involved in this type of machine is usually seriously injured. To remove this hazard as much as possible, we have raised all of our dough mixer type machines from the floor so that the worker cannot stick his arm into the mixer unless he does so deliberately. Liquid batches from these machines are drained off at the bottom. Thick batches which cannot be drained off are usually in tilt type kettles and are thrown out of the mixer by the action of the arms. For these machines, we have provided loading tables which are so constructed that the worker cannot get near the mixer arms. *In addition*, the doughmixers are equipped with interlocks or two-handed shifting devices.

During the last few years, we have had few accidents in which the machine hazard has been a factor, and each of these was caused by disregard of operating rules on the part of the worker. In most instances the guards had been removed without permission or had not been replaced before resuming operations. We personally investigate each accident, and not only talk to the worker, but insist that the foreman be present, together with any witnesses. All involved are brought into the investigation, and when all the facts have been ascertained, we attempt to place the responsibility, with an explanation of how that accident could have been avoided, and the care to be taken to avoid a recurrence. In all of these impromptu talks on safety, we never fail to stress the motto—"If you think SAFELY, you will act SAFELY."

Most safety engineers have for years preached that the key man in safety is the foreman. There is no question but that the foreman can prevent accidents in his department if he trains his workers properly and makes sure that they adhere to his instructions. However, we cannot leave the problem with the foreman today; production requirements call for more time and effort from the foreman than ever before. Probably the great majority of our workers are working under an incentive system and it is quite natural that if the importance of safety has not been stressed to them they have a tendency to sacrifice caution for speed. We, as management, must maintain a constant check-up. It is not enough that we have installed machine guards, instructed the foreman, posted bulletins and issued lists of "Thou shall's" and "Thou shall not's." Eternal vigilence will ever be the price of safety.

The principal accidents in our plant are non-mechanical and the more common causes are as follows:

Strains and sprains from lifting, pushing and pulling. Whenever such an accident occurs, we try to show the worker how he should have lifted or pushed in such a manner as to avoid a sprain, and at the same time demonstrate the best method to other workers doing the same kind of work—in other words, we try to make each accident an object lesson.

Infections. Regardless of the number of bulletins, posters and safety talks, many workers are prone to disregard slight cuts and bruises as inconsequential and will not report for medical treatment until an infection has developed. The answer to these accidents invariably is the same, "I didn't think it would amount to anything."

Despite the fact that we have won several "No Accident" contests, and are considered a safe plant, in 1932 our frequency and severity rates were high—painfully so. We are happy to state, however, that in 1933 and in 1934 both of those rates were materially lower.

Why Safety?

By H. A. BARKER

Personnel Director, Hotel New Yorker, New York City, N. Y.

Little thought has been given to organized individual safety in the hotel and restaurant industries. My reason for making this statement is that the basic rate for compensation insurance in New York for hotels in 1929 was $1.18 for $100 payroll, in 1933 the rate was $1.71, and that it has been advancing steadily since. Compare, if you will, these rates with rates of other industries even more hazardous.

Two years ago, with the aid of the National Safety Council and the New York Hotel association, a committee of representatives of several hotels and insurance companies was formed. As chairman I will report what has developed by describing our program in the New Yorker. Our President, Mr. Hitz, advised me that one of my first duties was to assume the responsibility of safety in our hotel. Our management to-day is as much concerned about safety as about any other phase of operations.

At least once a month, Mr. Andrews, our manager, calls a meeting of our safety committee. Our accident experience for the previous month is reviewed and recommendations are made and carried out to improve our experience. Hotel New Yorker has always kept a monthly analysis of accidents both by cause and by department. We thought our records were complete until the Hotel Safety committee was formed and competitive accident contests begun.

Since January, 1935, a safety campaign has been in progress and the results for the first six months of this year compared with the same period last year speaks for itself: 1935, 281 accidents; 1934, 469 accidents.

To accomplish this we first established the whole-hearted co-operation of the management. Our next step was to pass along to department heads their responsibility. They in turn held their assistants and foremen responsible for safety in their individual departments. It is absolutely necessary to obtain the full support and co-operation of department heads, foremen and employees to obtain the desired results.

Next we found that extreme care is necessary in selecting and training the new employee. He should be selected for experience and adaptability and trained in the particular job he is engaged to do.

Weekly educational meetings are held by the safety director in individual departments to point out safe practices. Accidents reported are reviewed. Employees are warned of dangers inherent in their jobs. Penalties are meted out to employees having repeated accidents. The habitually careless worker is replaced.

We have placed frames in each department with a background in red and a cross bones and skull in white. To all departments having no accidents for the period, a gold certificate is placed in the frame. To departments where accidents have not been eliminated entirely but show a decrease, a green award of honorable mention is given. In either case the skull and cross bones is obscured. In other departments no award is made and the skull and cross bones are shown with the inscription below "Where is your Safety Certificate?"

A monthly inspection is made of the premises by the Safety Director in company with a representative of the insurance carriers. Also the department head joins. A report of findings and suggestions is directed to the management.

We have been making a study of how to prevent breaking dishes, the cost of which runs into astounding figures. Spoiling food by accidents is another large item. Foreign bodies found in foods by guests, resulting in public liability claims is another tremendous item. This can be minimized by the proper storage of ingredients and the protection of physical properties.

ADJOURNMENT

Marine Section

Officers 1934-35

General Chairman—E. W. Fiske, Jr., Socony-Vacuum Oil Co., New York, N. Y.

Vice-Chairman (In Charge of Posters and Slides)—Robert F. Hand, Standard Shipping Co., New York, N. Y.

Vice-Chairman (In Charge of Publicity)—Arthur M. Tode, Consulting Marine Engineer, New York, N. Y.

Vice-Chairman (For the Pacific Coast)—A. O. Woll, General Petroleum Corp., of California, Terminal Island, Calif.

Secretary—John S. Hunter, The Atlantic Refining Co., Philadelphia, Pa.

News Letter Editor—Henry Blackstone, United States P. & I. Agency, Inc., San Francisco, Calif.

Engineering Committee Chairman—B. C. Edwards, Consulting Engineer, New York, N. Y.

Membership Committee Chairman—F. C. Holden, Jr., United States P. & I. Agency, Inc., New York, N. Y.

Program Committee Chairman—Frank E. Ames, Lykes Bros.-Ripley Steamship Co., New Orleans, La.

Statistics Committee Chairman—Benjamin H. Self, Travelers Insurance Company, New York, N. Y.

Stevedoring Committee Chairman—F. C. Gregory, Waterfront Employers Union, San Francisco, Calif.

Members at Large—

W. P. Biggs, Navy Department Safety Engineer, Washington, D. C.
C. F. Blackton, Erie Railroad Co., Jersey City, N. J.
Frank H. Cogan, The Delaware, Lackawanna and Western Railroad Co., Hoboken, N. J.
F. P. Foisie, Shipping Federation of the State of Washington, Seattle, Wash.
J. M. Griser, Alabama Dry Dock & Shipbuilding Co., Mobile, Ala.
Wm. Groundwater, Union Oil Co. of Calif., Los Angeles, Calif.
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Willard F. Jones, Gulf Refining Co., New York, N. Y.
W. P. Kain, Marine Surveyor, New York, N. Y.
T. F. Kavanagh, Grace Line, Inc., New York, N. Y.
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Stewart Lee, Jr., New York Shipbuilding Corp., Camden, N. J.
J. L. Luckenbach, American Bureau of Shipping, New York, N. Y.
Daniel J. Murphy, Murphy, Cook & Co., Philadelphia, Pa.
Carl E. Petersen, Newport News Shipbuilding and Dry Dock Co., New York, N. Y.
Byron O. Pickard, Pacific American Steamship Assn., San Francisco, Calif.
H. W. Proom, Black Diamond Lines, New York, N. Y.
J. K. Robison, Sinclair Navigation Co., New York, N. Y.
J. C. Rohlfs, Standard Oil Company of California, San Francisco, Calif.
Arthur R. Savage, Peninsular & Occidental Steamship Co., Port Tampa, Fla.
H. L. Seward, Yale University, New Haven, Conn.
A. J. Smith, Marine Office of America, New York, N. Y.
Wm. E. Stewardson, Columbia Steamship Co., New York City.

J. H. Tomb, Capt. USN Rtd., New York State Merchant Marine Academy, New York, N. Y.
E. Storm Trosdal, Jr., South Atlantic S.S. Line, Savannah, Ga.
Carl F. Vander Clute, Admiralty Attorney, New York, N. Y.
Elliott Vandevanter, Capt., Officer of the Chief of Engineers, Munitions Bldg., Washington, D. C.
John Wright, American Export Line, New York, N. Y.
G. D. Zeh, Associated Oil Co., San Francisco, Calif.

Officers Elected for 1935-36

General Chairman—E. W. Fiske, Jr., Socony-Vacuum Oil Co., Inc., New York, N. Y.
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J. M. Griser, Alabama Dry Dock and Shipbuilding Co., Mobile, Ala.
Wm. Groundwater, Union Oil Co. of Calif., Los Angeles, Calif.
Henry J. Heidorn, Standard Shipping Co., New York, N. Y.
John S. Hunter, The Atlantic Refining Co., Philadelphia, Pa.
Willard F. Jones, Gulf Refining Co., New York, N. Y.
T. F. Kavanagh, Grace Line, Inc., New York, N. Y.
R. K. Kelly, Tide Water Oil Co., New York, N. Y.
Stewart Lee, Jr., New York Shipbuilding Corp., Camden, N. J.
J. L. Luckenbach, American Bureau of Shipping, New York, N. Y.
J. H. McEachern, Standard Oil Co. of Calif., San Francisco, Calif.
Daniel J. Murphy, Murphy, Cook & Co., Philadelphia, Pa.
Carl E. Petersen, Newport News Shipbuilding & Dry Dock Co., New York, N. Y.
Byron O. Pickard, Pacific Coast Marine Associations, San Francisco, Calif.
H. W. Proom, Black Diamond Steamship Corp., Pier K., Weehawken, N. J.
J. K. Robison, Sinclair Navigation Co., New York, N. Y.
A. J. Smith, Marine Office of America, New York, N. Y.
W. E. Stewardson, Colombian Steamship Co., New York, N. Y.
J. H. Tomb, Capt. USN Rtd., New York State Merchant Marine Academy, New York, N. Y.
E. Storm Trosdal, Jr., South Atlantic S.S. Line, Savannah, Ga.

Elliott Vandevanter, Major, Office of the Chief of Engineers, Munitions Bldg., Washington, D. C.
L. H. Westdahl, Dollar Steamship Lines, San Francisco, Calif.
G. D. Zeh, Associated Oil Co., San Francisco, Calif.

TUESDAY MORNING SESSION

October 15, 1935

The first session was called to order by General Chairman E. W. Fiske, Jr., Socony-Vacuum Oil Co., Inc., New York City, who presented a brief review of the year's activities, praising the work of the section committees.

The Safety Man's Part

By G. O. GRIFFIN

Safety Director, Dravo Corporation, Pittsburgh, Pa.

I am a "Safety Man" and proud of it. I am proud to be a member of the American Society of Safety Engineers and a delegate to this Congress. A "Safety Man" is any safety director, safety supervisor, safety engineer, safety inspector, or safety committeeman. The term should also include superintendents, foremen or pushers, in fact anyone who should or can influence the safety of others.

The attitude of many "Safety Men" disgusts me. We are too apologetic about the humanitarian aspects of our job. We don't like to stand up and say we are working for the good of our fellow men. We speak of the dumb employee that caused the accident and bemoan the fact that our costs are rising. In fact, all we can think of is cost. Our lives, our work, our pleasures, in fact everything bows down to the great god COST. We can't even have a National Safety Congress which, if anything, should be dedicated to the higher humanitarian values, without taking costs into consideration. It reduces the attendance and takes away some of our best speakers.

Cost, to a "Safety Man," is a very important thing. We must bear in mind the cost of accidents, both direct and indirect, particularly the latter which statisticians have shown us are four times the direct. We must know the maintenance cost of hospitals, dispensaries, and our own safety recommendations, together with safety equipment. We must endeavor to cut down the total overall cost—direct and indirect from year to year.

But is this all there is to our safety job? If it is, in my opinion, it is an ordinary career. But a "Safety Man" has a great deal more at stake, a great deal more to fight for. Let me quote P. B. Juhnke's well known thought: "And the end is that the workman shall live to enjoy the fruits of his labor, that his mother shall have the comfort of his arm in her age; that his wife shall not be untimely a widow; that his children shall have a father and that cripples and helpless wrecks who were once strong men shall no longer be a by-product of industry." This is the true goal of accident prevention.

Safety work is both a responsibility and a great privilege. It certainly is a privilege to be identified with this great movement which is fighting to protect Americans from their own thoughtlessness. "May God hold you in the hollow of his hand" is an old Irish farewell saying which is particularly apt. Figuratively speaking, we hold in the hollow of our hands the well-being of the employees under our direction, as well as that of their families. It is our privilege to keep them earning and off relief. An effective program adds to the prosperity of any com-

munity. We can, by eliminating accidents, keep children in school and families together. These are our privileges.

As we can hold all this in the hollow of our hands, so can we, by relaxing our muscles or turning the palm over, destroy it. Our job, then offers not alone a privilege but also a responsibility to our employees.

We also have a responsibility to our employer. Serious accidents affect adversely the morale and good name of any company. The yard or construction job that drips with blood gains a sour name. Men refuse to work there. Our goal should be to give our companies an accident-free reputation.

As you all know, the Centurion in the New Testament said to our Lord: "For I also am a man subject to authority, having soldiers under me. I say to one, go, and he goeth, and to another, come, and he cometh, and to my servant, do this, and he doeth it." We also are men of authority and like the Centurion, our greatest responsibility is the safety of the men under us.

The fifth commandment given to Moses on Mount Sinai was, "Thou shalt not kill." Although this commandment contains only four words, its ramifications are large. It also means, "Thou shalt not maim, Thou shalt not attempt to kill, Thou shalt not allow to be killed or be maimed." If I, as "Safety Man," allow an employee to be killed by a condition I know to exist and for which I know there is a remedy, I am just as guilty as if I stabbed him in the back while he slept. If I know the condition exists, yet do not know the remedy, I am falling down on my job for not finding out. If I don't know the hazard exists, I am guilty of what is, in America, one of the greatest sins—"I don't know my job."

Let us mark our desk calendar so that at a specific time each week we will review our efforts for the preceding week to determine whether we have met our responsibilities and availed ourselves of these privileges which are ours. To do a real job, we must interpret our place in its broadest sense and shoulder our greater responsibilities.

Ours is the privilege, the duty, and the responsibility of seeing that the world as represented by the employees of the members of the Marine Section of the National Safety Council go home safely every night. That is what I mean by the "Safety Man's" part.

The Underwriter's View of a Marine Safety Program

By J. J. SANTRY

Manager, Personal Injury Department, United States P. & I. Agency, Inc., New York City

The safety movement with its service to humanity is growing in success and needless to say, progress has been made in the Marine industry. The loss records, however, still show there is considerable work to be done before this industry can boast of a record comparable with the reported progress made in some of the other industries.

The record shows there is a real need for concerted action in the Marine industry as a whole to support the general safety movement. Any serious catastrophe suffered by one shipowner brings forth a lack of public confidence which is reflected throughout the industry. Public condemnation of accidents causing injuries and loss of life instigates the enactment of new laws, or amendments, increasing shipowners' liability. Many of you will recall that other industries affected with a similar public interest have had this experience, and ultimately their realization of the value of the national safety movement caused such a decided change in the situation that their safety records now are used for advertising material. Merely a glance at the records made in accident prevention by these other industries should be sufficient to gain the support of the shipowners.

In the Marine industry practically the same problems have been confronted which were encountered in other industries, the major one being to convince shipowners, operators, ship masters and officers that accidents really can be prevented.

Our own problem was not with the person who definitely turned down our offer of assistance when first approached on the subject, but on the contrary, with the person who promised to cooperate and never fulfilled the promise. Under such circumstances underwriters must come to the decision that adequate rates cannot be obtained by promises. The other fellow is the one whom underwriters know might eventually be won over because he had the courage of his convictions to say "No" in the beginning, indicating that he was merely unaware of the value of safety work.

Satisfactory results in a safety campaign cannot be accomplished if cooperation of the executive leaders, on whom rests responsibility for the creation of a proper attitude toward the work, is lacking. The safety program must be given its initial impetus by an official pronouncement. The executives must enter into the movement whole-heartedly and keep in constant contact with its progress. They should make certain that their policies are being developed systematically and conscientiously, and if this interest is taken there is no reason why, like all other major shipping policies, the safety movement will not be successful.

Moreover, the policies adopted to reduce accidents must be so clearly defined to all in the organization that safe practice will become a part of the daily routine. The accident prevention program must be administered by an experienced safety engineer with a practical marine training in order to procure the full respect and confidence of the seafaring personnel. The sea-going fraternity, particularly the "old salts," are very set in their ways and in many instances would resent suggestions from a person inexperienced in the ways of the sea. Safety education must be intelligently administered, otherwise the entire safety program may become ineffective.

The next important step is the establishment of an organization to initiate, supervise and carry out safety policies and practices. The establishment of ship safety committees has been found to be effective in promoting safe working conditions. The committee members assist in locating hazards, and investigate and report on all accidents. They are the best agency for procuring employee cooperation. The master of each vessel should be held responsible by the management for the successful conduct of the safety committee.

No accident prevention program can be well organized without workable, adequate and readily accessible statistical information. This is derived from accident reports. Every injury, regardless of its apparent consequences, must be reported on a regular form setting forth in all detail the facts relating to the accident. Remedial measures may be applied only when the character of the injuries and their causes are known and analyzed. Statistics enable the steamship management to discover past errors and to obtain the information essential to prevent future accidents.

Many shipping companies have organized a medical division in their operating department to examine each seafarer applicant as well as keep tabs on the physical condition of old employees. Special attention should also be given to prevent seamen from being employed who are affected with loathsome or contagious diseases. Efficient medical examinations will tend to prevent claims on the part of unscrupulous seamen, who may misrepresent their physical fitness when employed.

In no other business is discipline more needed than in the operation of sea-going vessels. Discipline should start with the inception of employment and all rules should be strictly enforced, including the rules to enforce safe practices.

In order to assist the master and the officers of a vessel to maintain proper discipline members of the crew should be selected by a competent employment manager. The employment of young men in their teens lured by glamorous tales of the sea should be discouraged. The record shows that some of these, lacking the experience and intelligence to evaluate the responsibilities and dangers of working around movable machinery, are employed in berths which should be filled by experienced men. The employment of these youngsters not only increases the danger of accident to themselves and others, but also affects the morale of the other members of the crew, who realize that the place should have been filled by an experienced fellow-seaman.

When a safety program is vigorously pursued, shipowners will find that underwriters credit their effort in making a rate schedule.

What Safety Means in the Shipyard

By A. ALBERT GIESE

Staff Supervisor, Personnel Division, Newport News Shipbuilding & Drydock Co., Newport News, Va.

The shipbuilding industry is really making progress in its safety work. Records kept by six major shipyards, eight large repair yards, and ten Navy Yards prove this. Their combined accident frequency rate was reduced from 22.6 lost time accidents per million man-hours worked in 1931 to 10.6 in 1934. The severity rate came down from 2.40 in 1931 to 1.30 in 1934. These Yards, which probably will show well over one hundred million man-hours worked for the twelve months of the present year, had a combined frequency rate of 9.4 for the first four months of 1935. In the case of our own Yard at Newport News, the accident frequency rate has been gradually reduced from 24.0 in 1927 to 9.1 in 1934. The 10.6 frequency rate in 1934 for the group of shipyards just mentioned compares very favorably with 10.8 for the steel industry for the same year, with 31.9 for all construction work in the country during the same year, and 15.3 for all United States industries.

The building of ships, particularly large ocean going merchant vessels and warships, presents practically every accident hazard imaginable in modern industry. Safe working conditions are frequently complicated by the necessity for several trades to work at the same time in small congested spaces where each is subject to the occupational hazards created by the others. The extensive use of stages and scaffolds offers numerous opportunities for accidents.

The industry comprises, in the ultimate analysis, about twenty distinct trades, which, if broken into their component parts, would represent about one hundred separate, distinct kinds of jobs done by men with their hands.

Repair work on ships in dry dock and afloat is especially hazardous. Here the work is inherently hazardous yet it must be expedited, whether below deck, on deck, or overboard, and in all kinds of weather.

Extensive use of electric welding in ship construction offers certain hazards which must be met. Injuries to eyes from electric flashes and inhalation of noxious gases are the principal dangers here.

There is comparatively little opportunity for standardization in shipbuilding, nor can safety work in a shipyard be standardized except in few instances. Where working conditions change from day to day, the accident hazards vary with the work.

Mechanical devices are used to protect workmen wherever they can be applied effectively; however, their application and usefulness in a large shipyard is limited. Guards can be used on certain types of machine equipment and are, if used faithfully, very satisfactory. Guard rails find a wide variety of uses both in the shops and on the ships. Because they are usually of a very temporary nature, guard rails installed on ships under construction must not have too much dependence placed on them.

The safety device of greatest single value in a shipyard is probably the goggle. Our experience as regards eye injuries has been steadily improving during the past five years. In 1930 there was an improvement of 15 per cent over 1929; 1931 improved 20 per cent over 1930, 1932 improved 5 per cent over 1931; the 1933 record was 14 per cent better than that of 1932; and in 1934 we showed an improvement of 9 per cent over 1933.

It would be difficult to enumerate all the safety devices which have some use in a shipyard. The use of standard and special safety equipment has its place in our safety program; so does the wide display of safety posters and bulletins. But if we were to stop here it is doubtful that our accident frequency would ever be much under the 24.0 index we experienced in 1927.

The formation of safe habits by workmen is, to our certain knowledge, the surest way to reduce accidents in a shipyard. We find that job training, whether in the skilled, semi-skilled or unskilled classes, is a prerequisite to real safety. In our own case the training of skilled workers is a function of the Training Department. The training of semi-skilled workers is the dual responsibility of the Training department and the supervisory staffs of the several Yard departments. The responsibility for carefully selecting replacements belongs to the Employment department.

Regardless of how an individual finds his way to a given job, the final responsibility for his safety while on that job is placed on his immediate supervisor. Full time safety inspectors and plant watchmen are helpful in detecting unsafe conditions and practices, but their presence and duties do not in any way lessen the responsibility of the supervisors where the safety of workmen is concerned. Of first and equal importance in a shipyard safety program, we do not hesitate to place, selection and training of personnel, and fixing of responsibility for preventing accidents upon supervisors immediately in charge of the work.

No one familiar with shipbuilding would admit the possibility of completely eliminating accidental injuries in a shipyard. It just isn't that kind of work. In our Yard the term "accident" covers everything from pin scratches to fatalities. We have a rigid rule, that employees injured in any way while at work must report at once to our Medical Department for treatment.

Medical attention is provided for all employees injured while at work. A fully equipped clinic and competent medical staff is maintained on the Shipyard premises. Our Medical Department has been certified by the American College of Surgeons as complying with the standards of that body for medical service in industry. This department can be described as a small emergency hospital and a first-aid station. The main clinic contains a large dressing room, an X-ray room and dark room, an operating room, a small three bed ward, a physiotherapy treatment room, a dressing room for screened cases, doctors' offices, an examination room, a waiting room, and a supply room. Removed from the main clinic and near the building ways we have a fully equipped first-aid station, provided primarily to save the time of employees working at a distance from the main clinic, and to encourage the reporting of the most minor injuries.

All applicants for employment are sent to the main clinic for a thorough medical examination before they are allowed to go to work. Temporary defects are often found which must be corrected before they can be employed. Complete records are kept of all accident cases and all pre-employment examinations. These histories permit an efficient follow-up system in cases where patients must return for retreatments and are very valuable for statistical purposes.

The staff of our Medical Department consists of two part-time surgeons, five registered white female nurses, a stenographer, and two colored orderlies. The fact that less than 2 per cent of all injuries occurring in our Yard result in the injured employee losing time from work must be credited largely to this group and the fine services they render.

The Essentials of Safety Co-operation in the Marine Industry

By CAPTAIN HENRY BLACKSTONE

Safety Engineer, United States P. & I. Agency, Inc., San Francisco

The improvement in the mechanical details of ships has far surpassed the improvement in the ability of the officers and crew to handle them. We cannot turn over the full responsibility for accident prevention to a safety engineer. Every officer in the fleet and every stevedore foreman must be the "safety engineer" for his own particular group of men. The best accident prevention plan that an enlightened management can conceive can be "messed up" by a supervisor, be he licensed officer or gang boss on the dock.

The management may set up definite accident prevention policies, put them in writing, post them on bulletin boards or distribute them in circular form. But if the officers do not live up to the letter and the *spirit* of these policies more harm than good can result. The men are quick to follow example and if they know a policy of the management is being disregarded by their superior, they will have no respect for either the superior or the management and co-operation goes by the board.

The Marine industry needs a common plan for accident prevention. This plan

to be 100 per cent effective must be adopted and administered co-operatively by every concern in the industry. Within the industry there is a similarity of men, practices, hazards and equipment which makes co-operation and the exchange of experience particularly valuable. A plan of safe operation which proves helpful to one company cannot fail to be beneficial to all. Because of the peculiar personnel problem involved, the plan cannot be thoroughly efficient in any company unless it be accepted by all. In no other industry, perhaps is there such constant labor turnover in plants as there is in ships. For this reason the need for complete co-operation should be apparent. The old theory of "Different ships; different square knots" must be discarded and the problem fully realized and faced.

Just what is co-operation? Is it not joint action for mutual benefit? Is not accident prevention the one phase of operation in which all units can agree? Should there be competition in the saving of lives?

The enactment of workmen's compensation laws forced many industries to a realization of the necessity for industry-wide co-operation in accident prevention. The rising cost of insurance and the toll taken by negligence lawyers should bring home to the executives of the marine industry this same realization. It is far cheaper and much more humane to prevent accidents than to pay damages to the injured victim or his dependents. If we are too hard boiled to care about the human side of the problem the financial angle should offer sufficient appeal.

Sporadic spurts are useless. For lasting results it is necessary to settle down to sustained effort, to formulate a workable plan and incorporate it into the everyday operation of the industry. Some companies have made remarkable strides in the elimination of accidents. Some ships have operated for years without a lost time accident. Would it not be of inestimable value to the industry as a whole if the secret of the success of these ships and companies were to be made available to all? And, more important, if the successful method were to be followed by all?

What possible objection can there be to the inauguration of an industry-wide plan of co-operation in accident prevention? There are at least three basic organizations ready to help: the Marine section of the National Safety Council, the Accident Prevention bureau of the Pacific American Steamship Owners Association and the Accident Prevention department of the United States P. & I. Agency, with similar service available from other insurance companies. These organizations all are in a position to disseminate information which will make close co-operation possible. What is required is an honest desire on the part of the companies to reduce the human wastage and financial cost of accidents. Primarily accident prevention is a matter of education. The ships are similar in their physical characteristics and have few defects which cannot be remedied at slight expense. Our principal problem is that of training the officers and men. First and most imperative, however, the executives of the industry must realize the importance of the problem and be in accord regarding the solution. Fortunately we do not have to start from scratch. We have several examples to study and can profit by the experience of others who were pioneers. The Lake Carriers association did not build up their present organization overnight.

Of the many obstacles in the path, perhaps the most difficult is tradition. Good old custom! "When I was a boy"—we did thus and so, say the "old timers", and pseudo old timers who are living in the glorious traditions of what they have read in books written to perpetuate the good old days of, "wooden ships and iron men."

But just let the forecastle of a modern ship spring a leak that wouldn't fill a teacup in a week! Then our bully boys, our hard boiled old timers, run to the nearest negligence lawyer and come down with a case of acute tuberculosis and the ship is declared unseaworthy, the owner negligent, etc., etc. *ad infinitum*. The state of mind of the old timer is a weird and wonderful thing. Not long ago I was investigating a so-called accident in which four ratlines carried away, dropping a man to the deck, much to his embarrassment and physical discomfort and, I am afraid, much to the financial embarrassment of the company. The captain of the ship was a real old timer, in that his first contact with the sea was in a sailing ship where ratlines were one of the principal traffic arteries. When I asked him when the ratlines in his present ship had last been overhauled, he replied in all seriousness "Why, they were all new about five years ago!"

And, another time, I had a chief engineer, who already was shy one eye, tell me that he would rather lose his other eye than wear goggles, and he added that he would not have any goggles in *his* engine room. So far as I know that man is still the chief of that ship! Do you suppose the executives of that company have any realization of the importance of co-operation? Certainly not! They furnish goggles and then let their officers get away with things like that.

The demand for a co-operative industrial plan must start with the individual companies. The educational plan and program, when formulated, can be altered to meet the peculiar problems of each concern, it being realized that, while operations may be similar and personnel exchanged and often rotated, managements are competitive and human and have various peculiarities making administration of hard and fast rules impractical.

Our object is a co-operative industry-wide plan, the essential details of which will fit all cases, but elastic enough to be applicable to every situation that may arise. We must never lose sight of the governing factor—i. *e.*—the fact that our personnel is floating—(no pun intended) from one ship to another and one company to another.

Now, if our educational campaign for accident prevention is to be effective it stands to reason that our methods must be standardized. If an officer or a man signs on a ship, in which a well organized safety campaign is in operation, he will, more or less automatically, become a safe leader or workman. Then he pays off, goes on a bust, and signs on another ship in which "old time" methods prevail. Our safe worker immediately loses his desire to work safely and promptly becomes an accident hazard. He gets back into his old, slack habits once more and, when he again signs on "safe" ship, we have to educate him all over again but with an added bit of resistance because of the bad habits formed in the slack ship. It is human nature to take the line of least resistance even if it kills us!

There is no excuse for it but the Marine industry will always be in last place until, (1) educational methods are standardized, (2) officers are selected for ability to supervise and (3) owners and employers co-operate in the adoption and administration of a real safety plan.

WEDNESDAY MORNING SESSION

October 16, 1935

Some Aspects of the Law Contributing to Increase in Injuries and Compensation Costs

By J. NEWTON RAYZOR

Admiralty Attorney, Houston, Texas

I believe that there are certain aspects of compensation laws which tend to increase injuries and the cost of carrying compensation insurance.

Under the Compensation Act of Texas, for example, we have an Industrial Accident Board consisting of three members before which controversies are placed. But the board, insofar as its judicial functions are concerned, is of little consequence because both parties have the right of appeal to our Courts. It is a rare controversy where both parties agree to accept the Board's award.

Fundamentally, I am not opposed to jury trial. However, in compensation cases a retrial before a jury is not only cumbersome and expensive but inequitable. Especially is this true in jurisdictions which have compensation laws similar to Texas, where an insurance carrier is the defendant. Subconsciously or otherwise a jury in a controversy between an injured employee and a supposedly wealthy insurance company will not only give the benefit of the doubt to the employee but will often bend to see that he gets the better of the deal. Many are the cases in which minor injuries have gone before juries in my state with the evidence overwhelmingly

in favor of the insurance carrier and with nothing but a bare thread upon which to hang the employee's case, which resulted in verdicts for total disability.

I am therefore in favor of eliminating the right of trial by jury in this class of cases. Many obstacles will be thrown in the way of the necessary constitutional and statutory changes but such changes have been made in other states. If this cannot be attained I recommend that the law in such states as Texas be changed to make the employer and not the insurance carrier the defendant.

Since under the present system the employee receives in many cases more compensation than he is entitled to the cost upon the industry is unjustifiedly and unreasonably increased. The compensation rate on longshore work in my state today is $15.54 having risen from $5.25. I am firm in the conviction that one of the greatest factors in this upward trend is the jury with the insurance carrier before it as the defendant.

Contrasted with the right of trial by jury is the method employed under the Federal Longshoremen & Harbor Workers' Compensation Act and statutes of various states. There no jury is available to either party. The commissioners are free from bias and are better able to weigh the evidence and determine the facts than the average citizen. I am satisfied that the compensation cost in Texas would be reduced between twenty and thirty percent were our Texas Act administered in a similar fashion, and I am further satisfied that this reduction would be accomplished without working any injustice to employees or their employers.

Far more important in connection with reducing injuries, deaths and costs of compensation than the point I have discussed, however, is the method of assessing and collecting the cost of compensation insurance.

The theory is sound that the cost of compensation should be borne by the industry which benefits therefrom. This theory has been accepted but in my judgment has been only partly applied. It has been said and emphasized by the New Deal that labor is a partner in industry. If this be true, then I submit that the cost of compensation insurance should be borne by the industry as a whole and not by only half of it. Now the premium on compensation insurance is paid by the employer. It should be partly paid by the employer and partly paid by the employee. My basis for this proposition is this: The employee benefits as much, if not more, from compensation insurance as the employer. It is primarily for the protection of the employee and his family. It is his insurance as well as his employer's insurance. That being true there is no more reason to require the employer to furnish insurance for the employee than there is to require the employer to furnish meat and bread for his employees. If the arrangement is a partnership, then why not let each partner bear his part of the cost?

But aside from this reason there are other considerations which lead an open mind to subscribe to the suggestion that the cost should be divided.

If it were established that the compensation fund (the money with which claims are paid) belonged both to the employer and the employee, two salutary results would follow:

First, there would not be so much eagerness on the part of employees to go to unreasonable length to support a claim of a fellow-employee. If compensation funds were partnership funds co-employees would be eager to protect them against those presenting unfair claims and to preserve such funds for those who have just and valid claims.

The second good result from this method would be the exercise of greater precaution by employees in their daily work. They would not want the insurance fund to be imposed upon so that the burden on the employees would be increased by unnecessary injuries.

I believe that the right to compensation in any industry should be predicated upon physical fitness for duty. A life insurance company does not issue policies at random. Trace the records in your own industry and see what a heavy price has been paid because of the injury and death of individuals who were physically unfit to attempt the work assigned them. I have personal knowledge of deaths and severe injury cases within the ports of Texas in the past two years which were attributable directly to physical incapacity. At present a great hue and cry goes up at the suggestion of a physical examination for employees. I see no injustice. If a man is not physically fit to labor it is inhumane to permit it.

You must take into account other problems besides the dangers that inhere in work, in your efforts to reduce injuries and death and to lower the costs of compensation. I am confident in my own mind that the aspects of the law which I have discussed are of vital importance to your purposes.

Safety of Life at Sea

By HON. J. B. WEAVER

Director, U. S. Bureau of Navigation and Steamboat Inspection, Department of Commerce, Washington, D. C.

The whole subject of safety of life at sea has become one of major significance. In fact, since the disasters to the "Morro Castle," the "Mohawk" and the "Havana," it has constantly been in the press and the consciousness of the American people. There is stark tragedy in any sea disaster, it is as though suddenly a whole village or town were engulfed. Ships may now be likened to villages with every modern convenience that one may find in the great cities of the world. It is for this reason that our objective is to make the vessel the safest place one could possibly be.

There is a mistaken idea that our passenger ships are unsafe and that they differ in vital characteristics from foreign vessels. But that is not a fact. Naturally, our interest is aroused to the keenest pitch when our fellow citizens are in danger, and a great amount of publicity results; but a far more significant disaster to a ship of a foreign nation may entirely escape our notice. We have sailing today on the oceans several vessels which are far ahead of all foreign ships in regard to safe construction, with the exception of the French "Normandie." These vessels are: four ships of the American Export Line; four vessels of the Scantic Line; the "Washington" and the "Manhattan."

With the exception of these American vessels and the "Normandie," all passenger vessels now in service are constructed along similar lines to that of the "Morro Castle," and there are no other vessels afloat that approach the safety features of the vessels I have just mentioned.

In regard to the inland waterway vessels, there are practically none that are fireproof. Many of the more recent vessels with steel hulls can be made much safer; but it would be impossible to reconstruct or make a satisfactory job out of any vessel with a wooden hull. Out of 944 vessels plying the inland waters of the United States, 413 are of wooden hull construction.

The entire question of safety as applied to ships—their passengers—their crews—and their cargoes—both ocean and inland—is at present occupying a place of paramount importance in the work of the Bureau of Navigation and Steamboat Inspection of the Department of Commerce. The recent disasters to steamships have been intensively studied by the Bureau to determine the fundamentals lying behind these tragic events.

It has been determined that the prevention of similar disasters will depend largely upon the extent to which the Bureau has jurisdiction and control over (1) ship personnel; (2) ship operation; and (3) the design and construction of tonnage. These are the great fundamentals of our problem.

To accomplish this end, it is necessary that the scope of the authority of the Bureau be extended and that the Bureau receive sufficient funds to properly administer its functions.

The Bureau has done everything within its power under existing legislative authority, and modifications to the existing rules and regulations have been made during the past fiscal year. These modifications are embodied in Supplements 51 and 52 of our Rules and Regulations; they go as far as is possible toward increased safety within the limits of the present law.

Supplement No. 51 is generally called the Boiler Code; it is regarded throughout the world as an outstanding accomplishment and is recognized as a new standard in safety in this particular field.

Supplement No. 52 is modeled upon the 1929 Convention for the Safety of Life at Sea and embodies certain improvements upon that convention gained by our recent years of experience.

The Bureau has prepared for the Congress certain recommendations in regard to new legislation and has rendered every assistance within its power to the Congressional Committee in their study of the subject. Unfortunately, the entire legislative program was not completed before the adjournment of Congress, but four acts greatly strengthening the position of the Bureau were adopted. One act extends the provisions of the load line regulations to coastwise, intercoastal and Great Lakes vessels; another requires that direct steering orders be given, rather than the old system that has always been confusing; another extends the inspection laws to cover the regulation of the transportation of dangerous and flammable cargoes; and the fourth raises the limitation of liability of ship owners.

Lack Legislative Authority

Lack of legislative authority is emphasized when it is realized that motor vessels operating by sea are not subject to inspection nor are they required to carry a single lifeboat. Many of these vessels are of greater than 7,500 gross tons. While the operators have submitted to inspection, the federal government has no effective means to enforce safety. A motor vessel may be operating in direct competition with an inspected steam vessel and yet the motor vessel is not required to be inspected.

The remainder of the program failed to pass on account of lack of time; however, there is every indication that at the next session of Congress, the entire project will be completed. When this is done, the Bureau will be in a position to control efficiently the three great fundamentals already mentioned. Provisions are being made for (1) the complete reorganization of the Bureau; (2) increasing its personnel; (3) establishing a technical division; (4) setting up proper trial boards to investigate accidents and disasters, and improving working conditions of the personnel, thus giving greater efficiency of inspection and more just treatment of the employees of the Bureau.

During the year the routine inspections of the Bureau have been improved and a system of thorough periodical surveys has been instituted, which adds to the assurance of proper maintenance of vessels. Studies have been completed in regard to fire retarding and fire resisting construction, compartmentation and stability in damaged condition.

Plan Statistical System

We are at present engaged in devising a system of statistics that will enable us to catalog efficiently every accident. It is from the nature of the accident that the cure must be determined.

An effort has been made to adapt the activities of the Bureau to the requirements of the industry. Certain information in connection with the stranding of the steamship "Dixie" was furnished her owners, which proved of great assistance in the salvage operations when she was successfully refloated. These studies are the most advanced of any nation today and this is the only Government capable of rendering such valuable assistance to its citizens.

The ships of the Middle Ages were so frail that the slightest leak might prove fatal. Today, many vessels may be pierced and even two large sections completely flooded, yet by virtue of adequate bulkheading and meeting of stability requirements, the vessel can float without serious danger to those on board. Our calculations and studies on this subject are of outstanding value in safety of life at sea.

The work of the Bureau's patrol fleet is being extended, inspections greatly increased and at the same time a friendly cooperation with the small motor boat owner is being built up—all to the end that the operators of this class of boat may be educated in safety matters. Also a close contact has been established with the motor boat industry and marine underwriters. A committee has been formed with these two groups to study and recommend additional protective measures. This will tend to reduce the large number of accidents and explosions which occur annually on such craft.

Results of the Marine Accident Prevention Program on the Pacific Coast

By BYRON O. PICKARD

Manager, Pacific Coast Marine Associations' Accident Prevention Bureau

The Pacific Coast marine accident prevention program is administered by an accident prevention bureau with its main offices in San Francisco. The Bureau was inaugurated February 1, 1927. It comprises the joint efforts of three major ports' waterfront employers' associations and two American shipowners' associations. It is supported by the employers of more than ten thousand longshoremen, who normally work more than twelve million man-hours each year, and of fifteen thousand seamen, who worked approximately forty million man-hours last year. In addition to the manager's office at San Francisco, the Bureau maintains three district offices, one at Portland, Oregon; one at San Pedro, California, and one at San Francisco, with a district safety engineer in charge of each. The aggregate stevedoring accident cost in the years previous to 1927 must have approached nearly half of the total cost charged to operating and overhead.

In the marine industry both the longshoremen and seamen interchange between ships and companies. All shipowners, as well as stevedoring concerns, have almost identical industrial relations and legislative problems. There is, so far as the operation problems are concerned, a similarity of ships and cargo handling operations. Consequently, the marine industry lends itself readily to the administration of a common accident prevention program, the scale of which can be as large as the industry itself; especially as practically all of the shipowners and stevedoring concerns are members of associations organized for the purpose of dealing with their common legislative and industrial relations problems.

Any bureau delegated with power to administer an accident prevention program for a shipowner, a waterfront employer or an association of shipowners and waterfront employers must be more than a mechanical guarding bureau. It must dedicate itself to the task of organizing, investigating, selling, educating and inspiring.

The results of our accident prevention program can now be classified under two main headings; direct results and by-products. Under direct results I shall include first reduction in injury frequencies for longshoremen and for seamen.

There was a rapid decline in frequencies through the years 1928 and 1929; by the end of 1929 the frequency was about half of what it was in 1927. Through the years 1930, 31 and 32 the frequency curve, while continuing to descend, flattened out somewhat until in the last quarterly period of 1932 it reached all time lows in all three districts. The low frequencies averaged 20 per cent of the 1927 frequencies. About June, 1933, the curve began to show the effects of disturbed industrial relations, although the average for the year remained about the same as it was for 1932. In May, 1934, these disturbed labor relations culminated in a 90-day coastwide longshore strike. The frequency curve rose rapidly to the average of 1930. After the strike the frequencies did not descend as rapidly as was expected. In fact, during the first six months of 1935, due to another serious decline in managerial control, there was an upward trend.

Reducing longshore injury frequencies 80 per cent in all of the three major ports over a five-year period and holding the low point practically steady during a sixth year, when labor relations were beginning to be strained, is the outstanding direct result of our program.

There have been differences in the results which various companies have attained, some deriving exceptional benefits. Several contracting stevedores and shipowners have found it profitable to become self-insured; others have changed to policies with high deductibles. It is noticed that the companies that had consistently low accident frequency rates before the strike are also the lowest since the strike, and I predict they will be the first to completely regain their low frequencies of 1932.

The results in reduced severity of longshore injuries is best illustrated by quoting from our fatality record since 1927. There was an average of six longshore fatalities

in San Francisco Bay in the years 1927 to 1929 inclusive; Los Angeles Harbor had 5 fatalities in 1929; and Columbia River during the same year reported four. During the four years 1930 to 1933 inclusive, San Francisco Bay and Columbia River each averaged two fatalities per year, while Los Angeles Harbor had a total of only three. San Francisco Bay longshoremen worked 617 consecutive days without a fatality from the spring of 1932 through 1933; in Los Angeles Harbor from 1931 to 1933 the longshoremen worked 1,103 consecutive days without a fatal injury; in 1932 and 1933 in all the Columbia River ports, where heavy logs and timbers are handled daily, the longshoremen worked 354 consecutive days without a fatality.

The reports of both the Federal and the three Pacific Coast State Compensation commissions, as well as the California Insurance Rating bureau, also indicate that the severity of injuries has been materially lessened. This is in spite of the increasing compensation-mindedness created by the leniency of these Commissions and the Courts.

Using the 1929 disabling injury rate as a base, it is estimated that during the five-year period (1930 to 1934, inclusive), 23,945 injuries to longshoremen were prevented in the three major Pacific Coast districts; considerably more than two-thirds of these would have been disabling.

1932 was the first year that seamen man-hours were reported to the Bureau. In the year 1933 there was a 10 per cent reduction in the frequency ratings for tankers and passenger carriers. Freighters increased their frequency rating by 12 per cent; this increase was due to better reporting of disabling injuries; also, more companies and more reporting ships were added to the list. In 1934, due to strike conditions, the seamen injury frequencies in all groups were increased to approximately the 1932 rates. More than half of the reporting companies in 1934 experienced lower seamen injury frequency ratings than in 1933. During 1934 several of the larger steamship companies established safety committees on their vessels and are following the program recommended by the Bureau.

However, until we can eliminate the fear of a negligence suit for every reported injury, organized accident prevention for seamen will lag. In many instances, it is difficult to learn the actual cause of an accident resulting in an injury to a seaman because of the possibility of the information being subpoened and used as evidence in a negligence suit. A safety engineer naturally hesitates to insist upon responsibility being assigned for the non-prevention of an accident resulting in an injury to a seaman when by so doing he may liable the ship to a negligence suit. Personally, I hope that some day soon we will have a federal act providing definite compensation for injuries to seamen.

Among other direct results I shall list the following:

1. We have studied, analyzed and classified 50,000 reports of injuries; 29,000 of which were to longshoremen, 17,000 to seamen, 2,000 to miscellaneous employees and 2,000 to passengers.
2. A classification and Hollerith code system for longshoremen, seamen, miscellaneous employees and passengers has been developed which makes it possible to supply information on (a) accident type (hazards); (b) reasons for non-prevention (responsibility); (c) nature of work; and (d) injury types and parts of body, for any company, any ship, any port, over any period.
3. Standardized forms for company and group monthly reports.
4. Three printed monthly publications: one for licensed officers, one for stevedoring foremen and one for executives.
5. Safe practice pamphlets for both stevedores and seamen at bi-weekly intervals.
6. Special weekly poster service for seamen and for longshoremen, supplemented by National Safety Council releases.
7. Special safety reminder cards, which are handed to all working longshoremen on the job at bi-weekly intervals.
8. Eight annual reports, which, if combined and analyzed, would give a valuable diagnosis of the ills of the marine industry.
9. Safety rules that have been developed and are enforced covering:
   - Practices for handling cargo on ships, docks and terminals;
   - Minimum safety standards for stevedoring and ship cargo handling gear;
   - Minimum safety standards for illumination on ships and docks;
   - Minimum safety standards for goggles, respirators, gas masks, and oxygen-breathing apparatus;
   - Standardized course for first aid instruction in the marine industry;
   - Minimum standards for portable first aid kits and pier first aid dressing stations;
   - Minimum standards for safe working places and conditions in new ship construction.
10. Hazards are known, not assumed; responsibility can be definitely assigned for the non-prevention of accidents. The district safety engineers know the men; the supervisors; the company's methods; and the ships.

"By-Products" of the accident prevention program include human relations, economic benefits and public relations.

What are the benefits to seamen and longshoremen? They have been provided with safer working conditions; safe gear; sanitary toilets; and sanitary drinking devices. On several docks, waiting rooms and club rooms with lockers have been provided. Prompt medical attention and the best available hospital service, as well as first aid treatment and prompt ambulance service is made available to them at every dock or working place. They have been provided with goggles and respirators for use when handling noxious or dusty cargoes. Their bosses are charged with the responsibility of looking after their safety. More than 3,000 of the longshoremen and foremen, as well as several hundred seamen, have been given the standardized first aid course. They are friendly with the safety engineer and are no longer suspicious of his motives.

Included in the economic benefits accruing to our employer members from the accident prevention program are:

- Lowered stevedoring operating costs. Companies have reported reductions in operating costs of as much as 30 per cent through adopting the accident prevention program. This reduction does not include reduced cost of injuries or other reductions in items formerly charged to overhead. I do not know of a single company among the 53 waterfront employers and 45 ship operating members that has not experienced a reduction in both operating and overhead costs.
- Lowered compensation insurance premium rates.
- Better stowage of cargo.
- Less damage, breakage and pilferage of cargo; less damage to equipment, vessels and docks.
- A coordinated effort between longshoremen and members of the crew.
- Better type of longshoremen and seamen through selection, organization, training and fair discipline, and trained bosses.

In other words, waste and time lost have been eliminated to a great extent and efficiency of operations correspondingly increased.

It has been proved definitely that an elaborate or expensive organization is not required to administer an accident prevention program; that the outlay for prevention of accidents is only a fraction of one percent of the payroll.

Through advertising the coastwide program for accident prevention, the industry's public relations have been improved to an immeasurable extent. Both shippers and the travelling public have increased confidence in the industry. The State Industrial Accident commissions have cooperated to the fullest extent in developing safe working conditions and practices.

The most friendly and cordial relations have been established between the Bureau and the United States Compensation commission; statistical data have been exchanged and close cooperation maintained in the consideration of decisions and amendments affecting the Federal Act.

Compensation insurance companies are now accepting longshore risks at competitive rates, whereas, formerly, it was difficult for many stevedoring concerns and vessels to secure protection from more than one carrier and then at an exorbitant rate. Through the lessening of the labor turnover, employment conditions were stabilized and other industries have profited thereby. The safety rules adopted for the industry have been copied and used in other industries.

Some ten years ago the handling of cargo and operating of ships was rated with the most hazardous of occupations. Laws eventually were passed giving definite compensation to longshoremen for time lost due to occupational injuries. Seamen

soon learned that it was profitable to sue shipowners for negligence. The direct cost to the waterfront employers and shipowners for injury compensation increased to such an extent that it was necessary to establish a definite program to control the situation.

Excellent Results

The program adopted produced results more satisfactory than even the most sanguine supporter had expected. Not only were the costs of injuries reduced but the operating costs as well. Losses due to damage, breakage and pilferage were reduced. What was formerly wasted time became operating time. Other forms of waste, which were formerly taken for granted, were eliminated. Longshoremen and seamen became valuable in the eyes of their employers. Physical conditions of operations were improved. One of the noticeable and unanticipated results was the increased confidence of the public and public agencies in the industry. Favorable legislation, safety codes and cooperation with labor departments, state and federal government bureaus, play important roles in the achievements.

What has been accomplished through the Pacific Coast accident prevention program for the marine industry is the direct result of unified action to control conditions that were the outgrowth of the mechanization of an industry without change of customs or habits of thought.

Marine Section Safety Contest

The data on the Marine Section Safety Contest were presented by General Chairman E. W. Fiske, Jr., as follows:

In this, the fourth annual contest of the Marine section 85 units, entered by twenty-nine members of the National Safety Council, competed. In all, 63,528 persons who worked 66,965,397 man-hours were active participants. The average frequency rate for this year's contest was 12.977, which was a 14 per cent increase from the 1934 rate of 11.338. In the 1935 contest 43 units ended with a frequency rate below the average. Ten units had a perfect record.

Awards Presented

Eleven plaques and eight certificates were awarded, the plaques being presented by D. D. Feunell, consulting engineer, Chicago, and Vice-President for Public Relations of the National Safety Council, to the following:

Liners Division—Lykes Dixie Mediterranean Line, New Orleans, La., 182,312 hours, no injuries.

Tankers Division—Lago Shipping Co., Aruba, N. W. I., 731,240 hours, 2 injuries.

Harbor Equipment Division—Three tied for first place—Atlantic Coast Line Railroad Co., Terminals, Norfolk, Va., 168,929 hours, no injuries; Associated Oil Co., San Francisco, Cal., 103,616 hours, no injuries; Atlantic Coast Line Railroad Co., Terminals Port, Tampa, Fla., 38,096 hours, no injuries.

Stevedoring Division—Lykes Bros.—Ripley Steamship Co., Tampa, Fla., 8,706 hours, no injuries.

Shipbuilding and Repair Division, Group A—U. S. Navy Dept., Philadelphia Navy Yard, Philadelphia, Pa., 3,823,767 hours, 2 injuries.

Shipbuilding and Repairing Division, Group B—Four tied for first place—The New York Central Railroad Co., New York, N. Y., 108,770 hours, no injuries; U. S. Engineer Dept., Great Lakes Div., Cleveland, Ohio, 105,757 hours, no injuries; The New York, New Haven & Hartford R.R. Co., New Haven, Conn., 73,248 hours, no injuries; U. S. Engineer Dept., South Atlantic Div., Norfolk, Va., 56,360 hours, no injuries.

THURSDAY MORNING SESSION

October 17, 1935

The Promotion of Safety in the Design and Construction of Ocean Going Vessels

By DAVID ARNOTT

Chief Surveyor, American Bureau of Shipping, New York City

Recent passenger ship disasters, involving loss of life have again brought the subject of safety of life at sea prominently before the public, with the inevitable demand for still higher safety standards for ship construction and operation, despite the fact that of all the means of transportation sea travel is the safest. Under the circumstances it might be of interest to review briefly the problems of the naval architect in providing for safety and to give some account of governmental and classification society rules with reference to structural strength, freeboard, stability, subdivision arrangements and fire protection.

The problem of the naval architect is to design a floating structure to carry, with the highest practicable degree of safety, a definite weight of cargo, fuel and stores and a definite number of passengers at a specified minimum speed at a certain maximum draft of water, with due regard to economy in construction costs in the hope that her owners will be able to make a profit. In the design the architect must comply with certain rules and regulations which materially affect the design; examples include the U. S. tonnage regulations, the regulations of the Panama and Suez Canal authorities, the Public Health Service regulations for rat proofing, the Steamboat Inspection requirements, the load line regulations, and the construction rules of the American Bureau of Shipping or other classification society. The three latter can properly be considered safety regulations.

The principal perils of the sea are:

a. Foundering through stress of weather, i.e., water entering the ship on account of structural defects, loose rivets, seas smashing hatch covers, etc. Examples under abnormal weather conditions in the North Atlantic last winter were the freighters "Usworth," "Blairgowrie," "La Cresceuta" and "Millpool." These disasters were the subject of a searching investigation by the British Court of Inquiry.

b. Collision. A recent example was the case of the "Mohawk," which was lost January, 1935.

c. Stranding or grounding. A recent example of this particular type of casualty was the "Dixie" case in which fortunately no lives were lost.

d. Fire. Recent examples were the "Morro Castle," which burned at sea with serious loss of life in September, 1934, and the French ships "Georges Philippar" and "L' Atlantique," which also were totally destroyed by fire.

It should be emphasized that abnormal weather conditions are to be anticipated. Collision, stranding, and fire are accidents which may never happen. So it is necessary to differentiate between essential safety considerations for normal operation and provisions for the safety of life after a serious accident has happened.

Since the primary concern of any government in merchant shipping is to protect the interests of the traveling public and the crew, it follows that all maritime countries lay down rules for safe navigation, efficient manning and the licensing of officers and promulgate standards for the subdivision of passenger ships, for fire protection and for life saving appliances, etc. Despite certain handicaps, the Steamboat Inspection Service has done good work, and it will be in the best interests of all if congress, through legislation and appropriations, provides the director with the means to reorganize and maintain his department at a high degree of efficiency and to pay his inspectors remuneration commensurate with their responsibilities.

I would like to say a few words about the American Bureau of Shipping. The principal maritime nations have their own classification societies, such as Lloyd's

Register of Shipping. While the activities of some of these societies are in a sense international in scope, they are essentially national in character.

The influence of the American bureau naturally declined with that of the American merchant marine during the period following the civil war era, and at the beginning of the present century both had the same relative status in the maritime world. The World war and the tremendous growth of the merchant marine which followed compelled the reorganization of the American bureau in February, 1916, under the leadership of the late Stevenson Taylor. The growth and progress of the society since that date is attested to by the position it has attained among the classification societies. The United States government indicated its approval of the Bureau in the Merchant Marine Acts of 1916, 1920 and 1928, and again in the Load Line Acts of 1929 and 1935.

In the bureau shipowners, underwriters and shipbuilders are adequately represented, and the board of managers includes two representatives appointed by the United States government. The bureau has no capital stock and pays no dividends, and the members of its committees do not benefit financially from its operations. Fees are charged for the consideration and approval of plans, for the services rendered in connection with the supervision of construction, for the testing of materials, and the carrying out of periodical and damage surveys which assures the vessel being maintained to a proper standard. The funds of the bureau are used solely for its maintenance, and any surplus income is used for the extension and improvement of the service. In addition to the "Record," which is a registry of American shipping, the bureau publishes rules for the construction of ships and their machinery. The bureau as a classification society is primarily concerned in providing standards for the seaworthiness of ships and the reliability of the machinery, and while the work of the society parallels to some extent it does not conflict with the work of the Steamboat Inspection Service.

Classification societies constitute an outstanding example of an industry setting up standards for self regulation, and the important feature of classification is that it is entirely voluntary on the part of the owner. The best interests of safety for the American merchant marine will be furthered in my opinion by an increasing cooperation between the Steamboat Inspection Service and the American Bureau of Shipping.

Just as uniform interstate safety regulations are beneficial, so is international agreement desirable in matters relating to the safety of ships. Although the need for such common standards was universally admitted, it was not until 1913, as a result of the Titanic disaster, that the first international conference to consider safety at sea was convened in London. A convention was signed by representatives of the maritime countries attending but, principally owing to the war, this convention was never ratified, although several of the nations adopted part of its requirements in their various national regulations. For example, the provisions relating to life saving appliances were embodied in the Seaman's Act, and administered through the Steamboat Inspection Rules. The ice patrol in the North Atlantic operated by the United States government and financially supported by all maritime nations was one of the beneficial results of this convention. Certain matters relating to such highly controversial questions as subdivision had been left as subjects for further study, and it was not until 1929 that it was found possible to hold another conference. Ample notice having been given, the delegates were well prepared to consider such technical questions as subdivision of ships, life saving appliances, fire extinguishment, wireless telegraphy, and collision regulations. There was naturally wide diversity of opinion as to many of the subjects considered, but unanimous agreement was finally arrived at. As a result of thorough preparation and the work of various technical committees which met in Washington preceding the conference, the American delegation was distinctly influential in obtaining standards of safety which certainly represented the highest obtainable by international agreement at that time. The Safety Convention has since been ratified by all the principal nations with the sole exception of the United States.

The United States was the last of the great maritime nations to enact a compulsory load line law, but the passing of the Load Line Act of March, 1929, applicable to sea going ships in the foreign trade paved the way for international agreement on this important subject. Prior to 1929 American ships in the foreign

trade were marked with load lines by one or other of the classification societies in order to conform with the laws of foreign nations. The American bureau of Shipping had been instructed by the Shipping Board to mark load lines on all the ships built for the Emergency Fleet Corporation in conformity with the Rules of the British Board of Trade, and the load line certificates issued by the bureau of American vessels were recognized by the various foreign governments, pending legislation in the United States. The International Load Line convention held in London in 1930 was an essential corollary of the safety convention, and at that conference the delegation from the United States also took a prominent part, being in a position to submit special data in respect to American practice in the loading of tankers and lumber carriers. Agreement was reached on all the various matters before the conference, and the convention has since been ratified by the various governments concerned, our own government being the first.

A legal limit on loading is fundamentally a safety provision, since standards of structual strength, subdivision and stability are all intimately associated with a defined maximum draft which cannot be exceeded under service conditions without reducing factors of safety.

The Department of Commerce Load Line regulations, which are similar to the requirements of the Load Line convention, besides giving formulae for calculating minimum freeboards, include certain conditions of assignment such as a minimum standard of structural strength and stipulate efficient means for closing hatches and other openings in the deck and sides. The rules also provide for surveys for renewal of load line certificates every four years, also annual surveys to ensure that the means for closing openings are maintained in an efficient condition and that no change has taken place in the ship's structure which would affect the conditions under which the original freeboard was calculated. It should be emphasized that the load line requirements are based on the experience of many years of loading all types of merchant ships trading in all parts of the world. The rules provide for different loadings for the various seasons of the year, and also permit of deeper loading for tankers, lumber carriers and other special types of ships, based largely on American practice.

Congress in August, 1935, enacted a supplementary load line law for vessels operating in the coastwise and intercoastal trades, thus eliminating the anomaly that a ship leaving New York for Havana was required to have a load line marked on her side, while a ship leaving New York for, say, San Francisco was exempt. It is of interest to note that the new load line law will also apply to vessels engaged in Great Lakes service, but with the very essential proviso empowering the secretary of commerce to make departures from the provisions of the International convention, which definitely exempted Great Lakes vessels and which can only be properly applied in their entirety to ocean going ships. The act does stipulate, however, that the load lines of coastwise vessels should be determined under the provisions of the international treaty.

To place a legal limit on loading which ensures that a ship will not be loaded in service beyond the maximum draft for which she was designed is not only a fundamental safety provision, but is in the best interests of the ship owners themselves, as its sets up a standard for commercial fair dealing as far as loading is concerned. The new load line act will be welcomed by shipmasters, who will only be too glad to be relieved of their personal responsibility in the matter. It also takes the question of overloading out of the courts as one of expert opinion, since any ship loading beyond her legal load line will be held to be overloaded at least technically if not actually so for the conditions prevailing on a particular voyage.

To design a floating structure to be propelled through the water with varying loads and every varying support, capable of withstanding the stresses to which the structure is subject under all conditions of wind and weather is an important problem in the economics of ship design in that any excess weight of material over and above what is required for structural efficiency with an adequate margin for corrosion reduces the deadweight carrying capacity by that amount. A ship is an exceedingly complex structure, developed through years of experience. That the naval architect has a comparatively easy task in designing a safe structure is largely due to the work of the classification societies, whose rules are recognized as safe standards. There are few merchant ships built in this country which are

not specified to be built to the Rules of the American Bureau of Shipping, even in those cases where classification is not demanded by the owners and the surveyors do not supervise the vessels during construction. Classed ships are kept under close observation by the surveyors during docking. Damage and periodical surveys are required for maintenance of class, and any structural defects which may develop under service conditions are carefully noted with a view to amending the rule requirements where necessary. Every effort is made by the bureau to keep the construction rules in line with sound modern developments in shipbuilding with due regard to economy of material and cost of construction. In the past the classification societies have been sometimes criticised as being unduly conservative, but that is certainly not true today when one considers, for example, the encouragement given to the application of welding in ship construction. The naval architect has plenty of scope to develop sound, scientific and economical structural design within the standards of modern classification rules.

How to divide the ship by transverse bulkheads or partitions into watertight compartments such that the ship will remain afloat in the event that her under water hull is punctured in collision constitutes an important problem. For a given ship this requires the determination of the floodable length, which varies from point to point along her length and depends on her form and load draft. It is obvious that the amount of water which can enter a hold will depend upon the volume of the spaces unoccupied by cargo and the capacity of the cargo itself to absorb water, which varies with different commodities, so that all flooding calculations are based on certain assumed average permeabilities. It will serve no purpose to define "floodable length," "factors of subdivision" or "permissible length of compartments," all of which are common terms to the naval architect. I may explain, however, that a one-compartment ship is one which will remain afloat after bilging when any one compartment is open to the sea, a two-compartment ship with any two adjacent compartments flooded, a three-compartment ship with any three adjacent compartments flooded, and so on. Also if a one-compartment ship is unlucky enough to be damaged at a bulkhead in such manner as to destroy the integrity of the bulkhead she will inevitably sink. The desirability of a two-compartment standard is therefore obvious, and it becomes important to know just why this should not be a minimum requirement for all sizes and classes of ships carrying passengers. The Safety Convention agreed on the general principle that all passenger ships should be subdivided as efficiently as possible "with due regard to the nature of the service for which they are intended." The practicability of increasing the standard of subdivision as the length of the ship increases, also as the ship tends to depart from the ordinary cargo type carrying comparatively few passengers and approaches the highest class of passenger ship carrying little or no cargo, was duly recognized by the convention. Standard curves showing the required degree of subdivision were laid down for each of those extreme types associated with a method of determining the required standard for intermediate types by means of a criterion of service numeral which had been the subject of considerable investigation since the 1914 convention. Efficient and economical handling and stowage of general cargo requires large hatches in association with a reasonable length of hold, and fortunately the problem of making adequate provision for such an arrangement becomes easier as the length of the ship increases. In the smaller classes of ships of the ordinary cargo-passenger type it is not always practicable to obtain even a one-compartment standard throughout, and the convention recognized this fact by leaving it to the government concerned to endeavor to obtain at least a one-compartment standard wherever practicable, with due consideration for the operating requirements of each individual case.

It should be recognized that the convention deals primarily with ocean going ships engaged in international voyages. There are, however, ships engaged in coastwise and special trades operating in crowded waters where a higher standard of subdivision than required by the convention is not only highly desirable but fortunately quite practicable, especially in those cases where the bulk of the cargo and passengers are carried above the bulkhead deck. Such types together with ferries and excursion boats which carry large numbers of unberthed passengers, should receive special consideration by the administration, with a view to the highest practicable standard of subdivision being adopted in each individual case of new construction.

It is, of course, useless to provide a high standard of subdivision if watertight doors in bulkheads and airports in the ship's side are left open or cannot be closed after a serious accident. Passengers prefer and continue to demand natural in place of artificial ventilation, and a certain number of bulkhead doors are necessary for the ordinary running of the ship. The Safety convention requires certain watertight bulkhead doors located below the load line to be power doors capable of being operated from the bridge, also hinged airports in the vicinity of the water line, but the fact still remains that such openings in the bulkheads and the sides of ships are a potential danger and every endeavor should be made to keep their number down to a minimum.

Stability is the property of a ship which makes her return to the upright position after heeling over in a seaway. The provision of suitable stability characteristics constitutes a major problem for the naval architect, especially in passenger ships, where easy rolling and comfort for the passengers is absolutely essential. The average passenger will always prefer comfort to safety, and for a particular ship to get a reputation for being uncomfortable on account of excessive rolling is just too bad for her owners. The loss of a ship by capsizing through lack of a proper measure of stability is fortunately very rare, since stability can be controlled by judicious handling of water ballast and fuel in passenger ships and by the proper disposition of the cargo in cargo ships. So far no maritime country has considered it necessary to lay down definite regulations governing stability. The Steamboat Inspection Service for some years past has required every new or converted passenger ship to be inclined prior to entering service, and since the convention it is now a requirement of the other maritime countries. The inclining experiment determines the vertical position of the center of gravity from which the elements of the ship's stability can be ascertained. It is however a common requirement that the operating personnel be supplied with such stability information as is necessary to permit efficient handling of the ship. There are wide differences of opinion among naval architects as to what constitutes a satisfactory measure of stability for a particular ship and service in terms of metacentric height, and experience has shown that a tender ship with the lowest metacentric height compatible with safety is more likely to be comfortable at sea and generally more seaworthy than the stiff ship having a high metacentric height and consequently a snappy comeback. As a matter of fact, provided cargo is properly stowed to avoid shifting, water ballast tanks are kept filled or empty, fuel tanks are suitably subdivided to restrict free surface, the ship has sufficient freeboard and is intelligently handled, there can be no danger of the ship's capsizing so long as she remains intact.

It should be emphasized, however, that the provision of a high standard of subdivision which will preclude a ship's sinking bodily will be quite useless, if the ship will eventually capsize through the flooding of main compartments or the unsymmetrical flooding of empty wing fuel tanks. Even if the subdivision is such that the ship will inevitably sink, it is extremely desirable that she will not take such an extreme list as will render it difficult or even impossible to safely lower the life boats on one side, thus cutting the available boatage by half. To investigate in a new design the amount of transverse stability in any assumed damaged condition is therefore extremely important from the point of view of safety after an accident. On the other hand, to require an excessively high standard for stability in some assumed condition which may never occur during the whole life of the ship, might easily result in excessively dangerous rolling in the normal operating condition, so that the problem seems rather to be one for careful consideration by the proper government authority on the merits of each individual case, than the setting up of definite stability standards for all classes of passenger ships which might easily handicap sound design.

How to minimize the risk of fires at sea is a problem which, although engaging the minds of naval architects for many years, has been given special attention of late. Fires in cargo holds, which are fairly common, do not usually involve the loss of the ship or of life, since hold fires can be confined and controlled by the closing of ventilators and other openings and the use of steam or gas smothering. There have been cases of ships traveling thousands of miles with a cotton fire in a hold which could only be completely extinguished on arrival in port. An outbreak of fire in the superstructures of large passenger ships is a much more serious matter on account of the large amount of combustible material in passenger spaces and the difficulty of controlling the fire unless immediately detected. The subject was given careful consid-

eration at the Safety Conference, and the convention required, in addition to the water main system, detection and alarm systems in the passenger quarters, the provision of special extinguishing apparatus in oil burning vessels and fire resisting screen bulkheads to prevent the spread of fire in the superstructure. The convention laid great stress on the maintenance of an efficient patrol system, and there is no doubt that this will continue to be of primariy importance despite the installation of alarm and detecting systems and other automatic devices.

Construction Gives Answer

The major fire losses at sea already referred to and which have all occurred since the Safety Convention emphasized the necessity for the use of fire retarding materials in construction to the utmost practicable extent. Experience has shown that once out of control fires in passenger quarters spread with alarming and dangerous rapidity, and the solution of the problem lies in improved construction in an endeavor to confine the fire to the particular space where it originated and where it can be readily extinguished, and it is along such sound fundamental lines that progress toward the elimination of serious fires at sea can be anticipated.

In the design and operation of merchant ships the question of economics must necessarily be a primary consideration, whether the ships are privately owned or whether they are owned and operated by the government. After all, the overwhelming majority of passenger ships operate throughout the whole period of their useful life without the loss of a single passenger due to an accident to the ship herself, so that the risk is very small indeed. The introduction of radio telegraphy alone has largely contributed to increased safety of life at sea, but the fact that sea travel is comparatively safe is of course no reason why every effort should not continue to be made to render ships still safer. It is to the shipowner's interest to own and operate safe ships, and owners have no desire to evade reasonable regulations which make for the safety of their property. American shipping in the foreign trade has to meet world wide competition, and is already badly handicapped by relatively high construction and operating costs as compared with foreign countries. Even in our own coastwise and intercoastal trades owners of passenger ships have to meet the competition of railroads, motor vehicles and airplanes. One sure way of legislating shipping out of business would be the setting up of unreasonably high standards on the plea of safety and thus materially affect the potential earning capacity to the extent of ruining the ship as an economic unit.

Adopt New Equipment

I have endeavored to outline briefly the problems confronting the naval architect in the design of ocean going ships not only for safety under normal operating conditions, but with due regard to the provisions of the utmost safety for life after a serious accident has occurred to the ship herself. A ship cannot be made fool proof, and the promotion of safety is best served by doing everything possible to prevent accidents from happening. Our American shipowners have not been slow to adopt new equipment which adds to the safety of navigation, such as the gyro compass, radio direction finder, fathometer, etc., and it is a far cry indeed from the sailing ship days when the master was his own weather prophet with very little to guide him but his own skill and experience. Ships and their machinery are getting more complicated and require for their safe operation skilled officers and engineers who really know their own ship. There is no sound reason, with the technical educational facilities available today, why the master of a ship should not be expected to have at least an elementary knowledge of ship construction and of the fundamental principles underlying subdivision and stability, including the assumptions made in the practical application of these principles, and the desirability of requiring higher standards for examination of ship's personnel is worthy of consideration by the proper government authority. I would like to see candidates examined on their knowledge of major sea disasters, as nothing would develop a keener sense of personal responsibility for safety than a study of the official records of such accidents.

National Safety and the Inland Waterways Corporation

By G. S. WILKIN

Special Representative, Inland Waterways Corp.

While the Inland Waterways Corporation operating the Federal Barge Lines is a member of the National Safety Council and observes standard practice for accident prevention, there is not the same urgency in its case as in many other industries. Passenger traffic has long since forsaken the rivers and with it went the necessity for speed. The main objective in river transportation today is low costs which are attained by huge tonnages moving at slow speeds. The Robert E. Lee made the trip from New Orleans, Louisiana, to St. Louis in 3 days, 18 hours and 14 minutes. This is record speed for a modern tow *moving upstream*.

Inasmuch as speed is one of the most important factors in the causation of modern accidents and this element is absent in river transportation the accident rate is low compared with other modes of transportation. There are innumerable opportunities for accidents, however, in the handling of thousands of tons of cargo per tow consisting of bales of sisal and cotton and cotton linters weighing 500 to 600 pounds each; tierces of olives weighing from 800 to 900 pounds each; bales of burlap from 1600 to 1800 pounds; crates of machinery weighing a ton or more; all classes of steel, pipe and agricultural implements, bulk cargoes of grain, ore, sulphur, salt, coal, coke, etc.

These cargoes are all handled at terminals by cranes, derricks, trucks, escalators, marine legs, belt conveyors and by hand to and from automobile trucks, railroad cars, barges and ships for domestic and foreign trade. Every precaution is taken to keep machinery and equipment in good condition and to observe the established rules of accident prevention. The Barge Line will continue to cooperate with the National Safety Council 100 per cent in its efforts to reduce injuries and loss of life by avoidable accidents.

(Mr. Wilkin accompanied his paper with a sound motion picture portraying the operations of the Federal Barge Line.)

The Application of Safety in United States Navy Yards

By LT. COM. W. P. BIGGS, U. S. N. R.

Safety Engineer, Navy Dept., Washington

The Navy today employs more than 60,000 civilian workmen in more than 100 trades and occupations. Among articles manufactured by them are guns of all sizes, steam, Diesel and gasoline engines, boilers, explosives, anchor chains, rope, electrical machinery and equipment, radios, paint, mirrors, bedding, metal furniture and clothing. Some ships are built at navy yards, and all are repaired and dry docked there. Cranes as large as 500 ton capacity handle heavy weights.

A great deal of research, invention, testing and experimenting is done to develop new or better equipment. Work of this nature is done at the Naval Research laboratory, the Engineering Research laboratory, the Federal Testing plant, the Material Testing laboratory and by many engineers and technical men at naval stations.

The office of Safety Engineering was established in 1921 under the assistant secretary and at each of the Navy yards an officer was given the duties of local safety engineer. For several years efforts consisted mainly of the installation of safety devices, the development of goggles and safety clothing, and the collection of accident statistics. During this time machines were equipped with every conceivable device to prevent injuries. Passages, staging and other working places were made as safe as possible. Men were provided with all manner of safety clothing and equipment—yet accidents continued to occur nearly as often as before.

In 1927 safety rules were formulated, printed and distributed, and numerous letters of instruction and information written. Inspections of yards were made by the department safety engineer during that year and have been continued and extended to other stations since that time. Near the end of 1929 it was decided to try the effect of an intensive educational campaign at two yards. This campaign consisted mainly of safety posters, pamphlets, news photographs and so forth and proved so successful that congress appropriated money for its extension to all yards for the fiscal year beginning July 1, 1931.

In 1931 it was decided to try the effect of competition and the twelve largest yards and stations competed for a bronze accident prevention trophy.

Good accident records made by the various shops in 1931 were recognized by the award to shop masters, quartermen, leadingmen, and to the shop as a whole of engraved certificates signed by the secretary of the navy. There were 150 certificates given, divided among 21 shops which employed 2,350 men. This year we distributed certificates to 403 men and 136 shops, employing 8,800 men. In addition to the certificates there is also awarded a gold lapel button, and each year there is added a bar marked "2 years," "3 years," etc., if there has been no lost time accidents during that time. The requirements of these awards are that the shops have no lost time accident during the year and that it do enough work to have a normal expectancy of one or more such accidents.

The interest shown is very gratifying. At some of the locations separate competitions, intended to create interest among the various employees, were conducted. A drawing was prepared showing unsafe practices, and the person finding the greatest number and who submitted the best safety suggestion received a reward. At one of the yards interest has spread to the local community, the merchants contributing additional prizes and citizens sending in solutions. Our accident frequency rates have continually improved.

There are 37 yards and stations which submit accident reports to the Navy department. These reports consist of two sheets. Sheet one contains standard data. Sheet 2 contains the data used in the competition.

These 37 stations are divided into three groups according to size. A hazard factor based on past performances was computed for each of them. The requirements and rules are as follows:

Rules are devised to accomplish the following:

1. Give severity an average weight of 3 as compared with 10 for frequency.
2. Make the competition complete for each year.
3. Reduce the effect of luck in accident severity.
4. Require stations with excellent past records to maintain these records in order to win.
5. Require stations with poorer past records to improve these records in order to win, the worse the record the greater the improvement required.
6. Enable a station with a poor past record to win although it makes a poorer score than that required of other stations with better past records.

This was accomplished by means of the following formula:

$$\text{Score} = \frac{106 \times \text{No. L.T.A. plus } 104 \times \text{Days Lost.}}{\text{Hours worked (from Sheet 1)}}$$

In this formula "frequency" is lost time accidents per million hours worked; "severity" days lost per 10,000 hours worked subject to the following rules:

(a) Only days lost by accidents which occur during the current years are counted.
(b) One-tenth standard penalties for specific losses, are applied.
(c) Not more than 125 days' penalty is applied for any injury for which a standard penalty is not listed.

It was found under these rules that the average lost time accident carried a 30-day penalty.

The sum of the frequency and severity rates based on these rules was computed for each of the stations concerned. The basis rate for each was found as follows:—If the sum of frequency and severity rates is less than 20, it is considered a good record. Therefore; the basic rate for a station whose best rate was over 20 is that best rate.

The basic rate for a station having one or more rates below 20 is the average of the two lowest rates.

The basic rate for a station having three or more rates below 20 is the average of three lowest rates.

The "standard frequency plus severity rate" is the mean proportional of the highest and lowest basic rates.

The hazard factor for each station whose basic rate is less than the standard is "standard rate divided by basic rate."

The hazard factor for each station whose basic rate is greater than the standard rate is the "square root of standard rate divided by basic rate."

In order to bring competition close to the workers and more effectively to arouse their interest, an inter-shop safety competition was inaugurated. In it, all shops at each of the group I stations compete against each other and the similar shops at these stations also compete against each other. For example, all shops at the Norfolk Navy yard compete against each other and the sheet metal shops at Norfolk, New York, Mare Island, etc., compete against each other.

In order to reduce the labor of preparing reports, man months worked is used instead of hours worked, in determining the accident exposure. The average lost time accident and its 30 days' penalty was found to have a weight of 10 of which the frequency was 7.

Formulas are used to determine winners in this competition.

the first is—$\text{Score} = \frac{10 \times \text{M.M.W.} \times \text{S.H.F.}}{7 \times \text{L.T.A. plus D.L./10}} \times 100$. The numerator of the fraction is called the "credit" and represents accident exposure. The denominator is called the "penalties" and represents actual performance.

M.M.W = Man Months worked.
S.H.F. = Shop Hazard Factor.
D.L. = Days lost due to accidents.

The rules for lost time accidents and days lost are the same as for the inter-station competition.

The shop hazard factor is found as follows: All actual trades are included in or assigned to one of 32 trades for which statistics are kept. The records of the past years were consulted and the all navy average man months worked per lost weight of 7 as compared to 3 for severity the reciprocals of seven-tenths of these averages are the "trade hazard factors." The shop hazard factor is found by first finding the average composition of the shop force for the preceding year, then multiplying the average number of men in each of the 32 trades during that year by the trade hazard factor, adding these products and dividing by the total average number of men in the shop during the preceding year. The shop hazard factor thus found is not changed during the year.

It may be seen from this formula that a shop which does as well as the past average has a score of 100.

As the competition is for a year, it is evident that this formula favors the shops with small to medium accident expectancies since they have good chances of finishing the year with no accidents. If they do this their scores are infinity but the winner is the shop with the greatest credit.

To encourage the large shops a so-called improvement formula is used namely:

$$\text{Improvement} = \frac{\text{Credit} - (\text{penalties plus } 10)}{\text{Credit}} \times 100.$$

In this formula all shops are charged with one average accident in addition to actual penalties incurred. This greatly handicaps the very small shops but the handicap diminishes as the shop accident expectancy increases.

At the end of the year recognition is given to the winner under each of the formulas.

Also two honor rolls are displayed on the bulletin boards namely:

An honor roll containing the names of all shops that have had no accidents for the month and an honor roll containing the names of all of the shops that have had no accidents for the year to date.

In addition the Navy department awards certificates similar to those previously mentioned to the winning shop of each class.

Safety on Engineer Department Floating Plant

By ELLIOTT VANDEVANTER

Major, Corps of Engineers, United States Army, Washington, D. C.

Three years ago at my first safety luncheon at Pittsburgh, I was greeted by n old friend who remarked in a loud voice, "What the Hell! If the Army's gone o safety we'll have to hire pacifists to defend us." This of course made me feel ight at home.

But the Army went safe long ago. They are, consciously or unconsciously, very afety minded. For example, only physically fit men are accepted. They are trained o practice strict sanitary regulations, are well fed, clothed suitably in olive drab niforms which blend into most backgrounds, and physically inspected at frequent ntervals. Recruits are given long training before they are allowed even to handle rifle and further instructed in its use before permitted to fire it. They are trained n the principles of camouflage and to advance toward the enemy by short rushes aking advantage of anything which affords cover. All are given first aid instruction. Medical and hospital services are provided and the greatest care is given to evacuaion of the wounded. The economy of force is a cardinal principle of war. What n excellent safety organization! The Army, in time of war, has a hazardous job vhich it must carry out as safely as consistent with attaining its objective.

The engineer department also has a hazardous job which it tries to carry out with efficiency and due regard for safety. Fortunately, the two usually go hand in hand. An important element in the success we have had is that we have tried to mpress our employees with the idea that a man who does a dangerous job in the safest way is not a coward, but a wise man who realizes the danger and uses the brains God gave him so that he may save his life or limbs. There is just as much kick in doing a job safely as in taking a chance, even if you get away with it.

Our activities are principally in connection with dredging and improvement of the navigable rivers and the harbors of this country and its possessions. While your vessels are sailing the ocean, ours are working most of the time in the constricted lanes of traffic, subject to constant hazards. Bank revetments, breakwaters, control likes, etc. are usually constructed with floating plant. There are five main classifications into which our dredges fall: seagoing hopper dredges; hydraulic cutter type; hydraulic dust pan type; dipper dredges; and bucket dredges.

Seagoing hopper dredges are somewhat similar to tankers or perhaps more like the self-unloading vessels on the Great Lakes which carry rock or ore. They are built with steel hoppers extending through the bottom of the ship and fitted with doors operated from the top of the hoppers. Material is pumped from the bottom of the channel through suction or drag pipes and emptied into the hoppers. The solid settle and water are discharged overboard through an overflow weir and chutes. When the hoppers are full the vessel carries her cargo of from 300 to 4,000 cu. yds. of material, to deep water and dumps it.

The hydraulic cutter type dredge is used mainly for river work and with few exceptions the barge type hull has been adopted. This type swings from side to side, making a segment of a circle several hundred feet long, thus sweeping the suction pipe over the material. At the same time a revolving blade cutter loosens the material so that it will be more easily drawn into the suction pipe. This material is discharged through a pipeline sometimes several miles long. On water the pipe is supported on pontoons.

The dust pan dredge is similar to the cutter except that its suction pipe is flared into a wide dustpan shape and water jets are used to stir up material. It also works in long straight cuts instead of swinging and usually dumps the material back into the river through a comparatively short pipeline, to be carried off by the current. It was designed primarily for opening a channel through bars rapidly to keep navigation moving.

The dipper dredge is primarily a large steam shovel mounted on a barge.

The bucket dredge is just a derrick boat with a clam shell or orange peel bucket.

Both of these require dump scows to carry the material to the dump. Since they are most useful in hard material they are frequently used in rock work.

We have constructed snag boats for removing snags; concrete mat sinking plants; concrete mat casting plants; concrete mixing plants and an asphalt mat mixing and sinking plant, together with numerous tugs, tow boats, survey boats, etc.

Many stern, and several side wheelers are found in our river fleets although most of the recent boats have been tunnel type, propeller driven. Steam, diesel, and electric motor power is used, with steam predominating.

Now as to safety measures, we have little new to offer. We have followed the beaten path, safeguarding our machinery, putting our pumps in watertight compartments, erecting railing where needed, painting all tripping hazards yellow, hanging rope life lines from all plants where possible. We have not been able to devise a method of keeping oil off the engine room floors, particularly where triple expansion or vertical compound engines are used. Nor have we developed a satisfactory non-slip deck, the nearest approach being a bitumastic composition.

We have put safe and substantial walkways with hand rails on our pontoon lines, illuminated them at night by electric bulbs, furnished kapok vests for all who are exposed to the hazard of falling overboard, and insisted on their being worn except when the heat made it impracticable. To alleviate this condition, a light and more open vest has been designed for river use. In some districts safety shoes are used by about half the men: in others comparatively few employees wear them. All of our river dredges keep a skiff with kapok vests, ring buoys, oars and grappling hook moored at the stern, ready for rescue work. Used for nothing else, it is always available. Semi-monthly man overboard drills are held. On hopper dredges, abandon ship drills are held at least monthly. Fire drills are held on all dredges, tow boats and plant equipped with fire pumps, monthly.

The chief engineer of each vessel makes frequent inspection of the machinery, and has repairs made at once if it can be done aboard ship. All of our dredges have a machine shop aboard. These inspections are checked by the district plant man. Frequent inspections are made by the division engineer's plant section and we have a representative of the office of the chief of engineers who inspects all plants once each year. Most of our floating plant is overhauled annually.

The safety literature issued by the National Safety Council has been most effective in assisting in putting over our program. In most districts posters are circulated from boat to boat. Meetings are held by the chief or captain every week on some boats, and at least monthly on all.

The care and cleanliness of our plant are as a rule excellent. In some cases quarters are crowded due to the requirements for using more shifts than they were designed to accommodate.

We have kept a separate record of our marine work this year and I find that the frequency and severity rates are higher than for construction work. Our frequency rate, however, has decreased consistently from 29.47 in July, 1934, to 18.09 in August, 1935. Compared with the records of most of our members this is a poor showing, but as the result of about two years' work, we are proud of it.

Farewell Until 1936

By ROBERT F. HAND

Vice-President, Standard Shipping Company, New York City

Another Congress of the National Safety Council is nearing conclusion and again the Marine Section has done its full share to make it a success!

As a farewell message to the members of the Marine Section, I should like to say that membership in the Council is no different from membership in any other organization with respect to benefits to be obtained. We get out of our memberships no more than we put into them. It is a case of "give" and "take." Suggestions are made by some which benefit others and vice versa. The majority of us belong to

numerous associations and we know that in the main, the members of these other organizations remain passive. It is always the relatively few who by their active participation carry forward the work of the group.

I should like you gentlemen to take away with you from these meetings a suggestion which has for its purpose the desire to increase active interest in the Marine Section. The attendance at the regular monthly meetings of this section's executive committee has diminished appreciably in the past few years. On the occasion of each Congress it improves temporarily, but why cannot this remain constant throughout the year?

The small attendance at the regular non-Congress meetings is not due to any lack of leadership. Each general chairman and the members of the executive committee who have been present regularly at the monthly get-togethers have been doing their full share to carry out the duties of their respective official positions. But interest among some of the members of the executive committee, and, in fact, of the entire Marine Sectional membership generally, has been "lagging."

Is not this then the crux of the situation? Does it not mean that in order to increase attendance at these regular non-Congress gatherings, it behooves the general chairman, the vice-chairmen and the sub-committee members to bestir themselves and prepare an agendum of business at each session which will attract those usually absent members who, however, would be able to attend on account of close proximity to the meeting place?

I commend to you, therefore, the suggestion that a ways-and-means committee be appointed with a view toward developing what can be done to arouse interest among our passive members, and this in turn with a view to bringing them out at our regularly monthly meetings.

We extend to all of you a happy "adios," in the hope that the coming year will find a larger attendance achieved. Unquestionably this would result in a renewal of energy in the section, which is essential. The greater the number of persons who attend our meetings, the greater will be the advantages and benefits to be derived.

ADJOURNMENT

Meat Packing, Tanning and Leather Industries Section

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Engineering Committee Chairman—HAROLD M. TOOMBS, Armour and Company, Chicago, Ill.

Membership Committee Chairman—A. A. SIEBEVELD, The E. Kahn's Sons Co., Cincinnati, Ohio.

Poster Committee Chairman—PHILIP G. RHOADS, J. E. Rhoads & Sons, Wilmington, Del.

Program Committee Chairman—HENRY D. TEFFT, Institute of American Meat Packers, Chicago, Ill.

Publicity Committee Chairman—H. G. SCHAFFNER, Schaffner Bros. Co., Erie, Pa.

Statistics Committee Chairman—J. L. NELSON, Tanners' Council of America, New York, N. Y.

Members at Large—

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H. L. CLOVER, International Shoe Co., St. Louis, Mo.
E. E. DREWS, Libby, McNeill & Libby, Chicago, Ill.
HARRY W. EKINS, Brown Shoe Company, St. Louis, Mo.
T. H. JONES, American Hair and Felt Co., Chicago, Ill.
W. F. MCCLELLAN, Armour and Company, Chicago, Ill.
A. C. MICHENER, John Morrell and Co., Ottumwa, Iowa.
DEAN MONEYMAKER, International Shoe Co., St. Louis, Mo.
R. R. ROACH, Geo. A. Hormel & Co., Austin, Minn.

Officers Elected for 1935-36

General Chairman—E. J. MCCANN, Jacob E. Decker & Sons, Mason City, Iowa.

Vice-Chairmen—

WILSON PALMER, United Shoe Machinery Corp., Beverly, Mass.
C. B. MAGRUDER, The Wm. Schluderburg-T. J. Kurdle Co., Baltimore, Md.

Secretary—PHILIP G. RHOADS, J. E. Rhoads & Sons, Wilmington, Del.

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Program Committee Chairman—HENRY D. TEFFT, Institute of American Meat Packers, Chicago, Ill.

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JOHN LAUERMAN, Armour and Company, National Stock Yards, Ill.
W. F. MCCLELLAN, Armour and Company, Chicago, Ill.
A. C. MICHENER, John Morrell and Co., Ottumwa, Iowa.
DEAN MONEYMAKER, International Shoe Co., St. Louis, Mo.
R. R. ROACH, Geo. A. Hormel & Co., Austin, Minn.
A. E. SINCLAIR, Kingan & Company, Indianapolis, Ind.

MONDAY AFTERNOON SESSION

October 14, 1935

The first session was called to order by General Chairman John Lauerman, Armour and Company, National Stock Yards, Ill., who presented a resumé of the year's activities, commending the work of the section committees.

The Qualifications of a Safe Worker

By DR. C. L. FERGUSON

Medical and Personnel Director, Shelby Shoe Co., Portsmouth, O.

After reading the first installment of Admiral Byrd's intimate diary of seven months exile buried beneath Antartic snow, one should be profoundly interested in the title of this paper, because Admiral Byrd has demonstrated to the world that he is a safe worker. I believe we shall not go far astray if we study his qualifications; but first, let us obtain a mental picture of his voyage.

"Was this 9000 mile voyage hazardous?" Can you conceive of any industry anywhere more dangerous? Can you think of conducting a business demanding any more scientific planning, concentration and executive ability than did this trip, which, day by day, became more dangerous until the expedition started homeward? Not until then did the load of responsibility lessen.

What were some of the dangers? Admiral Byrd was confronted with storms, water, ice, fire, freezing, disease, starvation and suffocation while moving into an unknown world.

To combat these dangers and come out alive, takes something more than the mere flipping of a coin. It takes determination, knowledge of the task, study, planning, courage, proper teaching of subordinates, ability to make proper decisions, and knowledge of human nature.

One of the incidents which impressed me most was the final decision regarding how many men should live in the little 7 x 9 x 13 shack, 123 miles south of Little America. The Admiral knows his psychology and he made use of it here. He intended that three men, a meteorologist, a radio operator and he himself be the personnel. For very good reasons, three men could not go; but why did he decide to stay there alone when two men would have been, according to the opinion of most people, companions for each other. Please note what he had to say. "It just wouldn't work with two men. Three men could live like human beings. But two? No, it's too risky. Put two men out there and you invite a tragedy. Anybody who knows Artic history knows that. A third man in a crowded shack is always an equalizing force, a neutral point of man, a court of appeal, the man outside the quarrel. After a couple of months two men might be at each others throats."

Had Columbus sailed with one man instead of several, the date 1492 might not have been worth remembering.

The qualifications of a safe worker applicable to Admiral Byrd can, equally well, be applied to any safe worker.

As I think of additional qualifications for a safe worker, I would naturally mention good health, which means the proper functioning of all parts of the body. To think of the many ills the body falls heir to, makes one wonder why there are not more accidents in industry because illness certainly is a contributory factor.

Did you ever look over the daily record of an industrial medical department? Employees come to work with acute appendicitis, indigestion, stomach ulcer, T. B., rheumatism, tonsilitis, malaria, typhoid, flu, syphillis, gonorrhea, malnutrition, toothache, and a host of other diseases. Would you want a sick man with any of these diseases as your airplane pilot? Would you put your O. K. on this man's ability to take charge in the cab of the 20th Century Limited? If a man has good health, his mind should function properly. Excluding mental diseases, the most important factor to consider is worry, which is defined as a perplexing state of mind. Those of you who have charge of men or women can recall accidents which, when properly investigated, revealed worry to be the cause; yet the worker was in good health. One of many things concerning his home, job, responsibilities, etc., has gone haywire. Too many stimuli are going to his brain, causing him to be absent minded. Certainly, an absent minded person is not a safe worker—a statement which reminds us of what the writer thinks a key qualification, that is, the power of concentration.

A safe worker must be capable of keeping his mind on his business. Sometimes the distraction of one-line of thought for an instant is sufficient to cause a serious accident. Often we have heard the injured worker say, "Oh, I forgot," or "I really don't know what happened," or "I looked up," or "I did this or that at the wrong time."

Along with one's ability to concentrate, one should have an even temperament. Loss of temper often causes accidents.

While these health and mental qualifications are prerequisites for a safe worker, yet their possession does not mean that the worker will be a safe one. I am now thinking of the accident-prone worker while a fellow worker gets hurt perhaps once or twice in ten years. The first is a menace to himself and to those about him. He has a peculiar make-up, the nature of which has not, to my knowledge, been solved and which defies any one to pick him out by a physical examination, previous to employment.

In summarizing the qualifications of a safe worker I should like to picture him as being in robust health, dominated by a keen mind, educated beyond the requirements of his job, having determination, courage, willingness to cooperate and an evenness of temperament which permits him to use good judgment and get along well with his fellowmen.

Safety Exchange: Our Outstanding Contributory Causes for Safe Plant Operations

By E. L. NEUBAUER

Vice-President, Field Packing Co., Owensboro, Ky.

Some time ago we considered accident insurance as another necessary evil, but we were a little proud that we didn't have to bother with the details. Our reports were made out at the insurance office. They paid the doctors' bills, drug bills and hospital bills without worrying us. It was easy for our men to get compensation. But one year we found that accidents in our Owensboro Plant had cost the insurance company forty-two hundred dollars in compensation. This not only greatly increased our rate, but by a conservative estimate cost us two thousand dollars in lost efficiency and loss of product due to men off and the necessity of changing men from one department to another.

We started an investigation not only of the employees and their accidents but also of the management. The management had eliminated hazards and put up posters, but this had not worked. An entire change of attitude toward accidents seemed necessary. It was also necessary for the workmen to change their attitude. They weren't alert to hazards. Many of them purposely had minor cuts and a few of them faked accidents.

To analyze the problem thoroughly we asked the insurance company for records of each accident. We then classified these into kinds of accidents, frequency of accidents and frequency of each man having accidents. The analysis showed that a number of accidents were caused by bad eyes, hernia, weak heart and fallen arches. We were confident that a great deal of compensation was being paid out to treat injuries not actually sustained while working at the plant. For example, we had one man who was being paid for a rupture that he claimed to have received while lifting a hind-quarter of beef. Upon investigation, it was found that this man had been suffering with hernia for years. We had the case of a man who dropped white wash into his eye. It was necessary to remove the eye. Naturally it was thought that the white wash had caused the trouble but it was found the man had gonorrhea in his eyes.

Our first constructive act was to have a competent physician give all our employees physical examinations. It was necessary to consult with the physician on each of these reports. We had to discharge some of the men; others, who were competent workers but were accident hazards due to physical unfitness, were changed to other departments.

We made it a practice not to work men in the coolers who wore glasses, because of the possibility of accidents and errors when their glasses became clouded.

We found it advisable not to work men with weak hearts. They are great accident hazards. They might fall into a machine. I remember two men whom we discharged due to weak hearts. Both died the following year. I shudder when I think what could have happened if one of these men had had his attack while on duty around an open rendering kettle. A comparison of the doctor's reports with the accident reports showed that men with weak arches were subject to accidents due to fatigue.

Our next constructive step was to set up a card index system showing each employee's accident record. We let it be known that we were keeping close check on their accidents and if they had them frequently they would be discharged. Men with frequent accidents were called on the carpet. We told them frankly how we felt about safety. The moral effect of this was most powerful. We also found it effective to place slips signed by an officer of the company in their pay envelopes, giving them the attitude of the management. This individual message going direct to each employee caused them all to think and especially the careless ones. Accident reports made in our office were signed before an officer.

We next installed first aid cabinets in the operating departments. It was difficult to get some of the men to treat minor accidents. This made it necessary to have a rule that if an employee had a minor accident, and through failure to report it, infection set in, he was automatically discharged for one month. This seems hard but it was effective.

Our next move was to impress on the foremen the necessity of proper instructions to new men and to old men changing to new jobs. The responsibility was placed on the foremen. The thoroughness of their jobs showed up in the accident reports.

Our final check was on the doctors. It had been the practice to let the men select their own physicians. Some of them did not understand the importance of getting men back to work as soon as practical. Men were making too many trips to the doctors office with minor accidents and they were staying away from work unnecessarily. It was necessary for us to select a company doctor. We told him frankly our experience and that if he wanted our business these men must be cured promptly. We wanted him to be tough, hard boiled. We were sending men to him so they could get back to work and not be sent home for two or three weeks with a minor accident.

Perhaps we were a little hard about some things but our situation was serious and it was necessary to get results. Our results were very satisfactory. The insurance company paid out only seven hundred dollars during the year compared to forty-two hundred the previous year. This made quite a saving to us in insurance as well as a saving through increased efficiency. We used about the same tactics at Bowling Green as we did at Owensboro with practically the same results.

Safety Exchange: Our Outstanding Contributory Causes for Safety Plant Operation

By A. B. ROGERS

Safety Engineer, Elk Tanning Co., Ridgeway, Pa.

In our plants the most important activity of our Safety program is first aid. With the establishment of first aid training came an awakening in safety by everyone in the organization. Nearly 3000 employees have taken the Red Cross Standard First Aid course. After three years we have found that the knowledge of First Aid makes a man think how an accident can happen. This sets up in his mind the desire to avert accidents. Through a better understanding of the human body, he instinctively tries to avoid injury which might result in a permanent physical handicap.

The employee's knowledge of First Aid is not limited to the plant, but is extended to home injuries.

Each of our operations has been equipped with a clean first aid room. Injuries are treated by a man who knows how and when to place an injured person in the hands of a doctor. A permanent record is made of every injury and each treatment.

Over 1,200 injuries are treated each month in the first aid stations maintained by our company. At least four men's lives have been saved in the past two years on our lumbering operations, when digital pressure or a tourniquet were applied to a severe axe cut.

The problem of enforcement has not been difficult. We have made it clear that all injuries must receive immediate attention at the First Aid room regardless of how trivial they might appear. The foremen are requested to be on the lookout for any men using home remedies or neglecting to come to the First Aid room. At some of the plants it was necessary to post notices to the effect that anyone failing to report would be summarily dealt with, first, by a talk from his foreman or superintendent, second, a three-day furlough, and third, discharge. We have never been forced to discharge anyone for violation of this rule, and very few men have been furloughed. They all realize that they derive more benefits from the First Aid program than the company and that it is to their best interests to comply.

From 1931 to 1934 the Elk and Union Tanning Companies, operating fifteen tanneries, improved their accident frequency rate 67.3 per cent and their severity rate 85 per cent while working an average of 4½ million man hours per year.

During 1934 the Union Tanning Company made the largest improvement in frequency among large tanneries—64 per cent; also the largest improvement in severity—71 per cent, in the annual Safety Contest sponsored by the National Safety Council. We have continued to show improvement for the first nine months of this year, the combined frequency rates of the two companies being reduced over 25 per cent. Six plants with over a million man hours, have operated without a single lost time accident.

Three of our plants have the distinction of having operated 400,000 man hours without a lost time accident. One tannery ran nearly 29 months before having an accident. Our Glue manufacturing plant has piled up 460,000 man hours in 26 months without an injury and is still going strong, and a hazardous sawmill operation has an unbroken record for nearly one year with over 400,000 hours exposure.

First Aid and Safety

By HENRY G. SCHAFFNER

President, Schaffner Bros. Co., Erie, Pa.

It is my belief that first aid should be taught to industrial workers not only as a precautionary measure, but, as an interesting and intensive training toward accident prevention.

The main purposes of first aid training are:

1. To prevent accidents. To make the individual see an accident in the terms of pain to himself, and his pocketbook.

2. To equip the individual with important knowledge.

I recommend that the American Red Cross standard course be given. It develops safety consciousness, and the men carry home the fundamentals of their training.

Second, safety education can gain a new momentum in presenting its problems in new and different terms. During the years past, safety has been posted, it has been talked, and in some cases applied in various types of meetings and gatherings, but we must not let safety go stale or get shopworn; it must be attacked from new and different angles and I believe that first aid training can do this very thing.

Many in the packing and leather industry may say, "Well we have a nurse or doctor to care for our accident cases and we have an emergency room for treatment. Our employees do not need to know first aid."

True, your personnel and equipment is a valuable asset in preventing human suffering and I do not mean that they should be dispensed with, but rather, the trained first aider may be of great assistance to them in the performance of their duties.

Some of you may ask, now can we go about starting classes. Who will teach them.

May I suggest that if there is no one in your organization, that is an instructor, communicate with your local Red Cross chapter and they will provide a trained instructor.

The application of first aid to the packing industry should be stressed. In the packing house, hazards are many; dangers of infections are great; knife lacerations frequent; (severe bleeding is dangerous), falls on slippery floors painful and serious; burns and scalds dreaded; gas and ammonia poisoning not infrequent; electric shock and asphyxiation happen; and traffic accidents bound to occur.

Our Outstanding Contributory Causes for Safe Plant Operation

By A. E. SINCLAIR

Plant Supt., Kingan & Co., Indianapolis, Ind.

Our Company is an old one and old notions are difficult to supplant. One of these was that the best way to care for a cut was to apply tobacco juice and turpentine. Another was that cuts stamped one as being a finished butcher. Well do I remember the first cut I received. It was a good one—right to the bone in the joint of the first finger of my right hand—when a knife slipped through that hand. The foreman said: "Well, kid, you only need 99 more cuts to be a butcher."

With this background our safety work started under a handicap. At first we equipped a few knives with guards which tended to prevent the knifemen's hand from slipping from the handle to the blade, constantly experimenting to find a guard that would best suit each operation. Now almost all of our knives are equipped with guards, but in some departments grindstones have worked overtime to grind the guards down, or off. We are trying to discourage this practice by making our men safety conscious. For the last several months one of our mechanics has been working on an aluminum handle for knives, which has many safety features cast into the handle.

After protecting the hand that held the knife, we looked around for some means of protecting the other hand. We located wire mesh gloves which protected the thumb and first two fingers, and others which protected the whole hand. Here, too, many obstacles presented themselves, especially among the older butchers—they contending that the mesh of the gloves hurt their knuckles, but this obstacle was overcome by the use of a light cotton glove.

For the many who have to have their arms in front of knives on such jobs as ribbing bellies and raising shoulder bones, we have leather gauntlets which are studded with metal to protect the arm. Also our rubber boots have safety toes. In some departments, notably the beef cooler, there is a constant danger that hooks which hold the beef on the rail will fall and injure the men's heads. We have insisted that men working in coolers wear a safety helmet. On the day we equipped the men with them a hook fell six or seven feet and struck a helmet. We shudder to think what the consequences might have been had the man not been wearing the helmet.

To overcome the reluctance of the employees to use the things we provided, we turned to the Safety and Working Conditions committee under our Employee Representation Plan. We were fortunate, as chairman of that committee was a man who was vitally interested in safety. The committee now makes a weekly inspection of the plant for safety and sanitation, and investigates every lost time accident. Its recommendations on safety have been accepted by the management to date. Thus we have got our ideas of safety over to our employees. The next step was to educate our supervisory forces.

We have recently started bi-monthly meetings of our supervisory forces, discussing with them better management and naturally safety takes up a share of these discussions. Valuable suggestions are made during these meetings and I sincerely believe that the men are far more interested in safety than before. To co-ordinate the two efforts, we use the poster service of the National Safety Council. The safety committee chooses the posters to be ordered. It is also in charge of placing them.

But even with this program accidents seem to happen, and we have recently revamped our entire First Aid department providing a more up-to-date room than we have had before. All employees are given a physical examination before employment, and their physical examination record is kept on file. In addition we keep a record of every cut, the kind of dressing, and number of redressings for each employee. This is filed along with the physical examination report. We have a doctor at the plant from 7 to 9 o'clock each morning. He examines employees after

they have been absent for three days and after any lost time accident. Also any wounds dressed by the registered nurse after the doctor has left, must be inspected and redressed by the doctor. In this way we have been able to cut down our lost time accidents, and also the number of infections.

As a concrete example of our progress in Safety, I am tabulating the decreases in our severity rate since the first of April this year:

April	66.75
May	43.5
June	29.
July	22.2

Our frequency rate for—

April	33.8
May	54.
June	31.
July	23.6

So I state that "Safety Conscious" is a motto in our plant and we can rightfully say that we are making progress.

Our Outstanding Contributory Causes for Safe Plant Operation

By A. A. SIEREVELD

Industrial Relations Manager, The E. Kahn's Sons Company, Cincinnati, Ohio

At the end of 1933, we had a frequency rating of 28.5 and a severity rating of 2.60. Early in 1934 we inaugurated our safety program, with the result that at the end of that year, we showed a frequency rating of 15.5 and a severity of .39. At the end of August just passed, we had a frequency of 2.60 and a severity of .20.

The new man is instructed by the foreman, as to safety in connection with the operation that he is assigned to perform. He is told about the physical hazards and the importance of reporting for first aid immediately for the slightest scratch or bruise. The employee is put to work under the supervision of the foreman or his assistant and is kept under surveillance until the foreman is satisfied that he has the skill to work safely.

Employees have co-operated by reporting to the first aid station. Infections are unknown. Regardless of the seriousness of an injury a surgical report is made out in duplicate, at the time of the first treatment.

While the nurse is administering first aid, she attempts to find out the circumstances of the injury. The employee's name, his clock card number, the time and date of the injury, his foreman's name and the name of the department he was working in at the time are recorded by the nurse. Pertinent questions asked include: Who was responsible for the accident? Give the exact location. How long have you worked at job? How did the accident happen? An analysis of the report tells the nurse what action to take.

If the accident is minor, the report is held at the first aid station until the safety engineer calls, which is several times each day. In accidents of a more serious nature, the safety engineer is called immediately to start his investigation. Other information on the surgical report is: The nature of the injury, the treatment administered, a classification of the injury as minor or major; a symbol number, giving the exact location of the part of the anatomy affected, the probable duration of disability, the disposition of the case,—whether the employee went back to work, was sent home, or to a hospital; the date he should return for treatment and the name of the doctor or nurse.

We have the services of a part-time doctor. He visits the plant each day and is subject to call. The original copy of the surgical report is given to the safety engineer, the duplicate to the foreman. The engineer and foreman follow through for the correction of the condition.

Once a month each foreman holds a safety meeting with his employees. Each surgical report is brought up for discussion and the remedy applied is stressed. Often an employee who had an accident will volunteer to give his experience. Foremen borrow from other foremen or from the safety engineer, surgical reports of accidents that have occurred throughout the plant. There is no danger of a lack of material for discussion which might make a meeting uninteresting.

We divided the plant into ten divisions and for every 80 employees in a division one is elected to serve on the employees safety committee.

There are eleven representatives on the committee. Their term is two years, and half are elected each year. Thus five or six men, experienced with the procedure, work with the new men. The committee elects its own chairman and the safety engineer acts as secretary. The proceedings are presented to the management along with suggestions and recommendations. The programs for the meetings are arranged between the chairman and the safety engineer. Each safety committeeman is allowed time from his regular work each month to visit the departments in the division he represents to inspect them and to carry out requests. Our foremen are willing to co-operate in anything suggested by the committeemen.

In addition to the employees safety committee, three foremen are appointed each month by the plant superintendent at a regular foremen's meeting. Their duties are to make a thorough inspection of the plant and to turn in at the next foremen's meeting a report of their findings. The safety engineer is a permanent member of this committee. No foreman is told in advance when the committee is coming through. On entering a department the committee invite the foreman to make the inspection with them. Unsafe practices, potential hazards, unguarded machinery are all talked over with the foreman. Such items are listed along with the corrective action taken and read at the foremen's meeting. This report and the plant accident experience for the month is reviewed. Each foreman is called upon to explain the accidents that occurred in his department and what was done to prevent their recurrence. Through this medium every foreman is familiar with the safety problems of the other foremen and it gives them knowledge to impart to their employees at the departmental meetings. At each foremen's meeting the frequency and severity rating are posted by departments so as to allow them to compare experience.

Four times a year the safety engineer makes a complete inspection of the plant. All equipment is inspected for violations of the state code. The findings are presented to the management with recommendations and estimates of costs. New installations are gone over with the safety engineer in advance.

Once each week safety posters are placed on a well lighted bulletin board located where all employees pass it. Each day the names of those who have a birthday appear. This combination attracts attention and it stimulates friendliness.

Just inside of our main entrance we have a large blackboard with all the departments listed alphabetically. The board is ruled off by days for one month. Each day, if there are minor or major accidents, a posting is made against the department in which it occurred. The minor accidents are posted in white figures, the major in red. The idea for this board was suggested at a foremen's meeting. At first there was opposition to the idea on the grounds that it would have a tendency to keep employees from reporting injuries because they would not want to be responsible for a mark posted against their department. But as far as we can learn no one has failed to come to the first aid station for treatment.

Through an outside company we purchased a service of bulletins that fit into our scheme of safety education. At strategic places we have metal frames in which we place two types of messages. One is to cause the employee to think; the other is a safety message. We believe that these messages have assisted in bringing about a better safety atmosphere. In addition we have two hundred enamel signs with the word "THINK" on them. No matter where one travels in the plant he is confronted with one of these signs. And when we stop to consider it, is it not true that to achieve and to succeed we must always come back to that verb "THINK"?

TUESDAY MORNING SESSION

October 15, 1935

New Safety Kinks in the Meat-Packing Industry

By A. E. HOLSTEDT

Manager of Industrial Relations, Wilson & Co., Chicago

The Guillotine. Many plants find it necessary to hold over fresh meat that cannot be immediately processed, such as sausage, canning stock or material for dog food. The meat is frozen in containers that make a rectangular cake, about 2'x2'x8", or in small barrels, and the leaching is quite a problem unless these shapes can be cut down into smaller pieces.

The ideal machine for this purpose is the guillotine, and such a machine is apt to come from the manufacturer entirely unguarded. Our company secured one of these during the rush of drought cattle and the knife was so wide open that two men might have slipped under it together.

To guard this, it was necessary to consider the various sizes of the pieces to be cut and try to keep the operator reasonably well protected while cutting the barrel size pieces, as well as the flat slabs. When the flat slabs are cut, set on edge, the gates may be closed so that only enough aperture is left to allow the pieces to enter. When the barrel size pieces are cut, the gates must be open, but in this position the gate extending out acts as a barrier to keep the operator at a distance from the knife, and prevent falling into it in case of accidental slipping or tripping. The other side of the blade is also guarded to protect those removing the cut meat. This is designed on the principle of *reasonable* protection. It removes the danger of accidental injury, but is not proof against deliberate disregard of instructions. The nature of the operation makes it impossible to make it fool proof.

Head Splitter. The packing industry has always used a head splitter much the same in design as that which must have been used by Noah in keeping down the population in the Ark. As far as we know, not a single improvement has been made from the safety standpoint. Even the hand method of splitting with a cleaver was safer than the present splitter. The Wilson plant in New York decided to make an attempt to guard their beef head splitter. The guard also acts as a stripper, preventing the head from sticking to the knife after splitting.

Both the safety man and the production man may find some fault with this guard. It may be argued it is not 100 per cent safe, and also that it is apt to slow down production. However, this is the first concrete evidence, as far as I know, that anyone has had the courage to start something on head splitters. If any plant has worked out a better one, or if any improvements can be suggested in this one, the National Safety Council and the Institute of American Meat Packers would appreciate being informed, so that the industry may benefit. After seeing this guard, the authorities in the State of New York have ordered all of the packing houses in the state to have their head splitters similarly guarded.

Hashers. Hashers in sausage and canning departments have probably been the cause of more amputations of fingers and hands than any other single item.

Swift and Company have designed a guard in the shape of a hood, completely covering the hopper, and extending out about three feet to one side. The loading is done through this long hood, and it is impossible to reach the arm in far enough to come in contact with the screw. This hood is also equipped with an automatic power cut-off to that when the top is lifted for cleaning it is impossible to start the motor.

With this type of guard it is necessary to have a hasher designed so that the material dropping into the hopper is taken up by the screw without tamping. Many older type hashers will not feed properly. The material bridges over the screw and will not feed without being pushed down. This complicates the problem and other devices have been developed for this type of hasher. Two suggestions have been offered for making this hasher safer, both of which are in use in various plants. The hopper extension is good only where the machine is mounted high enough so that a man standing on the floor cannot reach his hand into the screw. In the other method the tamper hangs on a counter weight conveniently accessible, and still not in the way for loading. A reasonable amount of supervision and discipline must be relied on to insure against improper use.

Entering into this question is the factor of responsibility for safety of employees, and also the economic factor. If reasonably safe equipment still results in injuries and high compensation costs, then it is just good business to make the equipment unreasonably safe.

Charging Cabinets for Cooking Tanks. Tanks for cooking lard, and also inedible fats, usually have the charging manhole flush with the floor. In the process of charging, there is always a chance of some one falling into the tank of boiling lard, and also danger of foreign matter from the floor being kicked into the tank.

The steam escaping into the room will, under certain weather conditions, produce dangerously poor visibility. This also results in excessive room temperatures in the summer time. To avoid all of these conditions a charging cabinet is used. Each tank is provided with a vent stack. The charging cabinet is set over the manhole, and a slip joint on the vent stack drawn down to connect with it. The charging door is on the side, in front, so that even when it is open most of the steam is drawn up the stack.

Non-Slip Shoes and Boots. With much of the equipment of packing plants adequately guarded, we are apt to find that a large proportion of the remaining lost time accidents are due to slipping and falling. Slippery floors have always been a problem in the packing house.

The use of abrasive material in concrete floors has proven fairly satisfactory, especially where no great amount of trucking is done. However, the rebuilding of floors is not only expensive, but often quite inconvenient, and the idea has been conceived of placing the abrasive in the shoe sole instead. If I am not mistaken, this idea originated with Swift & Company several years ago, but due to difficulties encountered by the rubber company in making samples, it was not followed up. We have since been able to enlist the active interest of safety shoe manufacturers, and a number of different sample shoes with carborundum charged soles, are now being tried out.

Another variant of this method consists of small plates covered with extremely hard steel particles, attached to the heels and soles. It is not yet certain what the results of these experiments will be, but boots with abrasive soles have been worn as much as two months on the beef killing floor, and last reports were still quite effective.

Finger Guards. A concern that used to make mesh bags for the ladies, now manufactures a mesh glove to protect the left hand against knife cuts. A partial glove, covering the thumb and first finger, or the thumb and two fingers, seems to be the most practical for most cutting and trimming operations. As might be expected, opposition on the part of the employee has hindered the general introduction of this device. We have one plant, however, where the employees have become accustomed to them, and now would not do without them. The only serious complaint against the mesh glove is that it tends to chafe the fingers. This, however, seems to disappear as soon as the skin between the fingers becomes slightly toughened. The only other objection was from a woman operator who complained that it dulled her knife. It is probably true that the flesh and bone of her own left hand would not dull the knife quite as much.

Aprons. A similar metal mesh is used in a new beef boner's apron. Abdominal injuries are not frequent, but when they do happen they are usually quite serious, as the knife is apt to penetrate the bowel. I understand there is more than one death on record due to this cause.

The metal apron is an improvement over the leather, as it is lighter weight, more sanitary, and a more complete protection against knife thrusts. Tests we have made indicate that it would take a strong blow from a cleaver to penetrate it.

Cleaver Rack. Severe injuries have occurred due to improper disposition of the spare cleavers used by the beef splitters. If placed on the splitter's platform, the workmen may walk into them, or if laid on a shelf, they may fall off. In our Chicago plant a rack has been provided so that each cleaver is securely nested in its own compartment, and the whole rack protected with a wire mesh guard.

Car Loading Plates. The plates or gang planks laid from the dock to the freight car during the loading operation, will sometimes slip off the dock and cause both the man and his load to fall down between. One loading foreman has solved this problem by the simple expedient of drilling a series of holes in the proper location, through which bolts are dropped, so as to limit the movement of the plate and prevent its dislodgment.

Salt Tablets. Since the medical profession has quite unanimously endorsed the use of common table salt as a preventive against heat exhaustion, its use has spread rapidly.

There seems to be no doubt that replacing the salt lost through perspiration helps to prevent the collapse which might otherwise occur under conditions of extreme heat and excessive water drinking. The suppliers of salt tablets and dispensing devices have covered this subject so thoroughly in their advertising literature that anyone wishing further information will have no trouble securing it.

The Safety Man's Technique. The results of the safety man's efforts depend to a considerable extent on his method of approach, and the cooperation he develops among both management and workers.

For a long time we were unable to interest very many of our skilled butchers in knife guards. The resistance of the average workman to any change is well known, and such matters must be approached with the understanding that where a high degree of manual dexterity is required, even the slightest change in method or tools is genuinely upsetting. You will never know how true this is unless you have done one of these jobs yourself.

Our plan was to work through the safety committee, some of the members of which were employees working at highly skilled knife jobs. After a good deal of discussion, including analysis of knife accidents, and visits to the doctor's office to see some of the bad cases, the committee asked to visit other plants where guarded knives were in general use. This was granted and a committee of our knife men visited another plant. The result was that the employees' safety committee asked the company to prohibit the use of unguarded knives.

The safety man often encounters a great deal of delay in complying with his requests for machine guards, etc. Often this is due to the fact that the safety man is not sure just how the guard should be designed, or to lack of sufficient information.

In the case of the guillotine previously mentioned, I sat down and made rather complete, though rough free-hand sketches, supplemented this with more detailed explanations, and sent the whole to the chief engineer with a request to handle on an emergency basis. In four days, the entire set of guards was made and installed. Had I simply told the Engineering Department that this machine must be guarded, it would have meant that orders would be given for an engineer to go down and take a look at the machine to see what was required. The engineer would then work up some designs and give them to the draftsman to draw up. When the designs were properly approved, and blue prints made, these would be sent to the shop with the necessary orders. The job would then take its turn, the various operations possibly being performed by a number of different workmen, and by the time the guards were finally installed it might have been weeks, and possibly months since the inception of the idea, and the delay could not be charged to lack of cooperation.

Elimination of Electrical Hazards

By F. G. SCHOENFELD

Swift & Co., Chicago

This subject is such a broad one that I shall confine my remarks to what is being done by one of the larger meat packers to protect employees who use and service electrical equipment.

Since in a packing plant there are extreme moisture, low temperatures, steam vapors, brine laden air, and salt brine solutions, the electrical equipment is subject to greater than normal deterioration and must be carefully guarded. Only the best

of equipment is purchased and every precaution taken to insure the safety of employees in the use of it.

Metal conduit for either power or light wiring is of the hot galvanized steel type which has been found resistant to corrosion. In cases where from a corrosion standpoint conditions are extremely bad, aluminum conduit is used. All metal conduit lines when first installed are given a protective coat of a good grade of paint and this is repeated at regular intervals. Deterioration of neglected conduit usually develops at the threads where the conduit is coupled together or where it is attached to the switch or distributing cabinet by lock nuts.

The grounding of the winding of a motor is extremely hazardous unless the motor frame has a positive, dependable connection to ground.

All rubber covered wire installed in metal conduit is of the 30 per cent insulation type. Experience indicates that longer life and greater freedom from trouble results from the use of this wire than from the Code or 20 per cent insulation wire. The insulation on 30 per cent wire contains a minimum of 30 per cent by weight of new rubber and has a much higher insulating value than the code wire which has only 20 per cent by weight of rubber and this rubber may not be new. The importance of eliminating short circuits or grounds within the conduit system justifies the increased cost of such wire.

In coolers with abnormal moisture and in other wet locations the light wiring is of the open type installed in a protecting wood trough of V shape. The wire used is a No. 12 special having 5/64 inch of rubber insulation with a triple braid covering.

While a few of the plants of this company use a motor operating voltage of 440 or 550 A. C., the majority use 220 volts. Wherever possible all future extensions or additions will be for 220 volts because this voltage is less hazardous from an operating standpoint and less troublesome from an equipment upkeep standpoint.

While the use of 220 volts for motor operation does increase the initial cost of the supply lines this increase is kept at a reasonable point by installing transformers at various load centers and supplying them at 2,300 volts from the main source of supply.

Many large size motors are operated at 2,300 volts but such motors are installed in the engine rooms where they are attended by employees who realize the increased hazard with this voltage.

All lights are operated at 120 volts using a 3-wire grounded neutral distributing system.

The supply lines for power and light enter any building at the elevator or stairway vestibules at the point of entrance an enclosed safety type fused switch is used. The feeders are carried to the various floors through conduit and on each floor a steel distribution cabinet is used.

Each motor or group of motors, where such grouping is possible, is provided with a set of feeders from the distributing cabinet and they are connected at the cabinet through either an enclosed safety type fused switch or through fuses of the dead front panel type. In either case fuses at the distributing cabinet can be replaced when necessary without hazard to the employee.

For starting equipment at each motor some of the following combinations are used, the choice depending upon the size of the motor and its location.

1. Enclosed safety type fused switch installed so that the switch blades and the fuses are "dead" when this switch is in the "off" position.
2. Enclosed safety type fused switch and a starting compensator having a no-voltage release device, installed so that fuses, switch blades, and compensator are "dead" when switch is in the "off" position.
3. Enclosed safety type fused switch and automatic push button controlled starting equipment installed so that fuses, switch blades, and automatic starting equipment are "dead" when switch is in the "off" position.
4. In any of the above cases the safety type switch might be replaced by an oil type switch or combined oil switch and circuit breaker.
5. Where prompt stopping of a motor from more than one point is desired and where a starting compensator is used a push button circuit is installed in series with the no-voltage release device. This circuit is installed in well grounded conduit.

All enclosed safety switches are equipped with door interlocks to prevent the door being opened when the switch is in the "on" position. Some types of door interlocks have proved impossible to keep in condition. In such cases the doors are sealed with an ordinary car seal to prevent their being opened when the switch is in the "on" position. When necessary to replace fuses, the seal is broken and replaced by the authorized employee.

Each safety switch, distribution cabinet, etc., is provided with an enameled sign warning employees of the danger of coming in contact with live parts.

The replacement of fuses when they are not protected with switches on the line side of the circuit is so hazardous that carelessness on the part of experienced employees has resulted in fatal accidents. Even though insulated tools were available there have been cases in which the use of bare hands to replace fuses has resulted fatally.

A policy to protect all fuses with suitable switches has eliminated hazards in connection with fuse displacement.

The use of the dead front type of fuse panel eliminating the need of a switch has also proved satisfactory from the standpoint of insuring safety in replacement of fuses. In this type of equipment the fuse or fuses are held in an insulated case that can be removed entirely from the fuse cabinet and the fuses replaced in entire safety after which the case is again installed in the cabinet.

One of the greatest hazards to employees is lack of proper grounding of motor frames, compensator cases, switches, distributing cabinets, and conduit lines. Contact with any of this equipment in the event of the motor winding or the supply lines developing a ground may result in a fatal accident.

Particular attention is, therefore, given to maintaining a dependable ground at all times.

At each building where power is distributed there is a 3/16" x 1" flat copper bar and all distributing and switch cabinets in the vestibules on each floor are connected to this ground bar. At ground floor level this bar is connected to a 2 inch galvanized pipe perforated with 3/8 inch holes and filled with crushed coke and driven 6 to 8 feet into moist ground.

Every effort is made to obtain a good contact where conduit lines connect to any metal box or cabinet to insure continuity of the ground system and if there is any doubt in any case the joint is shunted by a wire attached to the conduit by a standard ground clamp and to the cabinet or switch case by a soldered bolted lug.

Each motor is connected to the conduit system through a piece of flexible metal conduit attached to a steel box bolted to the motor frame and to the switch or compensator case. In addition, this flexible conduit is shunted by a wire ground attached to the motor frame and to the switch or compensator case by soldered bolted lugs.

Practically all current for lighting is distributed at 120 volts through 3-wire grounded neutral systems. Service lines where they enter a building are provided with an enclosed safety type fused switch. Feeders are run to the various floors where a steel cabinet is installed for the fuses and switches controlling the various circuits on each floor.

In this system of lighting current distribution the neutral wire has white insulation to identify it and it is not fused at any point. At each switch cabinet this neural wire is connected to a common ground through a screw connection so that it can be disconnected easily for testing. The neutral or ground wire is connected to the screw shell of all lamp sockets.

All lamp sockets are connected by metal conduit to the outlet box and the conduit system either through a stiff or a swivel connection so as to insure continuity of the ground system direct to the socket. Sockets connected to the outlet box in the conduit system by drop cords are not used as this makes the lamp socket a possible hazard for the outer shell may become grounded.

Each single-pole switch in each lighting circuit is connected only in a live line of the current supply so that when the switch is off the lighting circuit has no potential above ground.

While power and light equipment and their circuits can be so installed and maintained as to reduce the hazards to a satisfactory minimum, portable machines, tools, and extension lights cannot be so installed.

We found it possible to obtain extension lights having a 60 per cent para rubber insulated cord and a rubber covered and protected plug and socket. They are equipped with a wire guard and a 50-watt mill type lamp. These extensions can be equipped with a semi-waterproof socket with a wire guard or a fully waterproofed socket with a vapor and waterproof glass globe.

All of these extension lights are limited in length to 25 feet and for general plant use they are operated at 120 volts from the regular lighting supply.

All extension lights are inspected at regular intervals.

While these extension lights have proved very satisfactory over a period of years, their use under some conditions was still considered hazardous.

When an employee enters a rendering tank or a boiler shell or drum through a manhole a shock from a defective extension light operated at 120 volts could prove serious due to the effective grounding of the apparatus through connecting pipe lines and the area of contact of the employee's body with the shell of the tank or drum.

In all boiler rooms and tank houses there has been installed a 32-volt circuit for extension lights which insures the safety to employes entering tanks, boiler shells or drums.

Most packing plants use a semi-portable type of saw for hams, scribing loins, etc., which, operated in a limited space presents no difficulties. In our plants these saws are operated on 3-phase, 110-volt current supplied from the regular 220-volt power supply through a small step-down transformer having a completely separated primary and secondary. Connection to the power supply is made through a 3-pole non-reversable plug having a grounding contact. A four-wire cord is used for connecting to the current supply, the fourth wire being used to ground the motor frame and saw.

Portable tools such as drills, saws, etc., presented a problem when they were operated at 110 volts because of not being able to guarantee that the tool would be properly grounded during operation. The motor frame and the tool was supposed to be grounded by a ground-wire that was to be attached to some grounded object by a test clip. In practice it was found that the tool operators would not in all cases attach this clip. The protection provided by proper grounding was, therefore, not dependable and the situation called for some other method of eliminating the hazard.

It was finally decided that the use of portable tools designed to operate on 32-volt, single-phase, A. C. current would be satisfactory and reduce or eliminate entirely the hazard resulting from operation at the higher voltage. A potential of 32 volts was considered low enough to prevent injury of any employee.

The 32-volt, single-phase current for the operation of these portable tools is supplied by a small transformer attached to and made a part of the connecting cord. The cord used is a No. 16, 60 per cent para rubber insulated cord of the type used for extension lights.

Over a four-year period the use of this reduced voltage for portable tools has proved satisfactory and no cases of injury by shock have been reported

Chief Safety Factors

In summing up the following points have been found to be the greatest factors effecting such safety:

1. Use of good material and equipment, especially wire and metal conduit.
2. Positive and dependable grounding of all motor frames, compensator and switch cases, distributing cabinets, and conduit lines.
3. Installation of switches in the line side of all fuses in power circuits or the use of fuses of the dead front panel type so that fuse replacement can be made in safety.
4. Use of 32-volt portable extension lights when employees must enter any closed vessel such as a tank or boiler drum or shell.
5. Use of 32 volts for operating portable drills, saws, etc.

Inadequate Illumination + Glare = ?

By J. M. SMITH

Illuminating Engineer, Nela Park Engineering Department, General Electric Company, Cleveland, Ohio

The change from an outdoor existence to a life lived predominately indoors is perhaps the most outstanding transition which the human race has undergone within our knowledge.

We moderns, forgetting that our eyes have been in the process of development for hundreds of thousands of years, have created all sorts of jobs for them under vastly different conditions from those nature intended.

Instead of distant vision, we have close vision—15 to 30 inches. Instead of broad daylight we have extremely low levels of indoor natural and artificial light, and, not content with all this, we have, on the average, lengthened the working day that our eyes must serve us.

The ideal distance for seeing is 20 feet or more—no doubt because so far as our ancestors were concerned objects seldom required close scrutiny. The major task which the primitive man had was to see ferocious animals so he might protect himself or to kill for food.

The eye is provided with muscles for converging the eyeball into position for near vision, but nature intended these to be used for short periods and not to be under strain for many hours each day. Therefore, it is just as logical that fatigue should result from this continuous concentration as from holding your hand at arm's length for more than a few minutes' time. It made little difference to the Indian skinning a buffalo whether substantial bits of flesh were left on the hide. The modern leather worker has to split a hide into many layers and match and grade the leathers so that milady may have a faultless pair of shoes, or so that the old masters may be bound in a perfectly matched leather binding. Today the craftsman must be able to withstand continuous visual concentration.

Nature planned for the eye to cease functioning at nightfall and have a period of rest. We have steadily increased the hours of hard labor for the eyes to about 16 hours a day. Even 100 years ago very few people knew how to read or write; there were no movies, no automobiles, no basement machine shops—all of which afford mental relaxation but increase the burden on the eyes.

What are the elements which go into the process of seeing? They are three: The eye, the seeing task, and light. We can do very little for the eyes themselves, beyond sharpening them with the aid of glass. We can do very little about the seeing task itself. If we are working on a lathe, we must continually keep our eyes on the task. We cannot change the type or the color of a newspaper. The one variable is the light, and that we can control. How important, therefore, to study the effects of this factor and to know how much light we are actually getting.

Nature on a bright summer day gives us upwards of 10,000 footcandles of illumination. We find no discomfort as we play tennis or golf. Even on a rainy day there are several hundred footcandles outdoors. The fellow reading under a tree or tinkering with his automobile in the shade has illumination of perhaps 500 footcandles.

In the modern factory building, with large windows covering most of one side, on a bright day there is about 100 footcandles near the window sill. On a cloudy day the value would be much less. And the light value decreases very rapidly as the distance from the window increases. Even on bright days, there is inadequate illumination except at the windows.

You can perceive that artificial lighting is necessary for the plant even though it operates only during daylight hours. In Cleveland an analysis of the weather bureau records for the past thirty years revealed that the average day consists of six hours of sunshine, six hours of cloudiness, and twelve hours of darkness. This, of course, varies with the season of the year and shows that artificial lighting is more necessary in the winter months.

There are also continual variations in natural illumination indoors which result from clouds, smoke, change in the sun's position, and so forth. Natural light cannot, therefore, be relied upon to furnish satisfactory illumination.

With the knowledge which the science of seeing gives us today we recognize the fact that higher levels of illumination should be employed. In order to meet the seeing requirements, the task must be studied, determining the detail required, what contrast conditions exist, and how much time is allowable. After these factors are ascertained the lighting may be prescribed.

The levels of illumination which are recommended for various tasks are based on researches in vision, on observations of results in actual installations, and on the adequacy of present equipment and methods to provide satisfactory illumination with safety and economy.

In average manufacturing areas it is desirable to provide levels of illumination of the order of 20 to 50 footcandles. This may be provided from a general lighting system which will provide an even distribution of light over the entire area.

For tasks which demand greater attention to detail and must be seen accurately and quickly it is desirable to provide illumination of the order of 100 to 200 footcandles. These higher levels of illumination in general may be most economically provided by the use of a reasonable amount of general illumination augmented by individual or supplementary lighting.

It should be remembered that it is essential to have good general lighting as a basis on which to build these higher levels of illumination. The general lighting should provide at least one-tenth as many footcandles as is provided from the supplementary lighting equipment. For example, with 15 footcandles of general lighting, 150 footcandles would be the maximum that should be provided by supplementary lighting.

In far the majority of instances, improving seeing demands higher levels of illumination. But this is just one factor that is controllable. Other elements such as quality, control, direction, and surroundings, enter into the problem and require an intelligent selection of reflecting and diffusing equipments and their proper location.

Probably the most apparent and at the same time the most vicious factor of quality is that of glare. Glaring lights are hazardous to eyesight and positively wasteful because they reduce visibility. The pupil of the eye functions to protect the retina from sudden exposure to extreme brightnesses. Everyone has experienced this reduction when driving at night against the beams of an oncoming automobile.

Glare is an undesirable and usually unnecessary by-product of poor lighting. When glaring light sources are in the line of vision the pupils of the eye narrow down automatically, thus restricting the opening for "seeing" light to enter. From 40 to 60 per cent of the useful light is often wasted, counteracting the effect of glare.

Similarly, reflected glare—that is, brightness reflected from shiny work surfaces, glass-topped desks, store counters, and the like—may prove even more annoying and interfere with vision to an even greater extent than direct glare. This calls for an intelligent analysis of the seeing task and dictates the choice of equipment and its location so as to insure both adequate diffusion and proper direction of the light on the work. The illumination of the surroundings, that is, reduction of severe contrast between the immediate visual field and the rest of the room, is of extraordinary importance in relieving eye muscles and obviating the necessity for frequent adaptation of the pupils of the eyes.

Let us now consider the economic side of good lighting. While statistics have been lacking regarding the relation of lighting to industrial accidents, a recent estimate by W. Dean Keefer of the National Safety Council indicated that faulty illumination is the direct cause of about 5 per cent of all industrial accidents and is a contributing cause of about 20 per cent. If by improved lighting the cause of the majority of these accidents is removed, a great service will be rendered to the workers of this country. The cost of this relighting is usually far less than the accident cost.

It is an accepted fact that improved lighting increases efficiency. Fast work, more accurate work, and improved inspection, result from better illumination. Tests show production increases all the way from 10 to 35 per cent with improved lighting.

Even where automatic machines are used excellent seeing conditions are of particular importance, for the machines must be attended and supervised. These machines produce material at a high rate of speed and any time lost in setting up, adjusting, supplying material or detecting faulty operation, will result in a large loss in production or spoilage.

Better illumination reduces the possibility of spoiling materials and ruining tools and machines.

Better lighting makes it possible for the foreman to see all his operators and machines quickly and easily. He can detect any faulty conditions which might be accident hazards or make for inefficient or difficult work.

Good lighting offers a satisfactory and economical way of advertising the fact that your plant is a desirable place in which to work. In the well lighted plant labor turnover is less.

Reduction of eyestrain means fewer headaches and minor ailments which are responsible for lost time and discontentment. Cheerful and comfortable surroundings have much to do with a worker's attitude toward his job and his employer. Since poor lighting may cause annoyance and an unfavorable reaction, it is quite likely that the cost of good lighting can be justified in many cases by the psychological benefits alone.

Twenty-four hour operation of industrial plants is rapidly becoming a necessity for lowering production costs. Increases in demands for products may soon force manufacturers to choose between adding more space and machinery for daytime operation or using the same plant and equipment continuously. In the majority of cases, a well lighted plant can make a change of this nature without alterations.

Metals Section

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C. E. Ralston, Pittsburgh Plate Glass Co., Pittsburgh, Pa.

* Deceased.

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J. A. VOSS, Republic Steel Corp., Youngstown, Ohio.

MONDAY AFTERNOON SESSION

October 14, 1935

The first session was called to order by Vice-Chairman H. W. Darr, Bethlehem Steel Company, Johnstown, Pa., who presided, welcoming the delegates, and calling attention to the excellent progress of the section during the past year.

Practical Operations Are Safe Operations

By FRANK A. MORRISON

Personnel Manager, Kelvinator Corporation, Detroit, Mich.

When we think of practical operations, as applied in industry today, we should make a comparison with the practical and safe operations in industries twenty years ago. We should, for a moment, pause and think of the hours that safety engineers put in with management, trying to convince them of the practical and efficient operations of safe machines. We should remember the effort and heartaches that have been necessary to progress, to the point that safety has reached in industry today. And while we are thinking of these things, we should not hesitate to give just credit to the National Safety Council and the various local industrial safety councils throughout the country.

When I look back a quarter of a century and consider the type of operations and the machines that were used in the automobile plants of that period as compared with the equipment of today, I can only take my bow to the safety organization and say, "Well done, my good and faithful servants."

I think of a little plant which, a few years ago had to increase production and found it necessary to put back in operation an old press that had been obsoleted months before. The operator objected to the press on the basis that it was not safe and not practical, but his objections were over-ruled. Only a few hours afterwards, the press repeated and the operator lost his right hand at the wrist. The operator, gentlemen, was my brother.

However, when we consider the effort that has been put behind the safety movement, and consider the cooperation that we have had from the big men in industry—from the Knudsens in General Motors, from the Kellers in Chrysler, from Fishers, and other big men in Detroit and throughout the country—we realize why it was possible to accomplish the progress of safety in the last decade.

Twenty-five years ago, we had no safety organizations in the plants; we had no safety committees; we had no cooperation. Today in a great many of the industries, the safety engineer's word is law when it comes to operating an unsafe machine. Cooperation of this kind has made it possible to accomplish the magnificent results that have been accomplished in our large industries.

Twenty or twenty-five years ago, industry fought the proposed compensation acts as they were proposed in the various states. Today, we are operating under compensation acts in all states with the exception of two—Arkansas and Mississippi. We have found it very difficult to operate in these two states under the so-called Manufacturers Liability Act, as it is impossible for the manufacturer to determine the amount of his liability, while in other states this liability can be determined immediately.

True, there are certain states that have gone beyond reasonable bounds in extending the act to cover occupational diseases and other socalled protective measures. These measures have worked hardships on employees as well as employers, to the extent that industries, in some instances, have left the state on account of the high compensation cost. In other cases they have adopted such rigid physical examinations that jobs have been limited to a certain class of employees only, and men, with defects, have found it impossible to secure employment because the act does not provide protection to the employer for defects the employee may have at the time of securing employment.

Consideration must soon be given by industries at large to rehabilitation of employees who are no longer physically qualified to do the type of work that they have been doing. This must apply to those who have grown old in industry as well as those injured in industry. This is one of the big problems facing the directors of industrial relations in industry today.

Too little thought is given in many plants to the minor injury which, if not attended to immediately, may lead to a serious injury to the employee at a later date, with the resultant serious cost to the employer. I am thinking particularly of the cut and scratch that the employee may receive and neglect.

I was interested the other day in reading an article sent out by the Safety Section of the Rock Island District of the U. S. Army Engineers. This article was headed, "The Story of the Little Nail" and read as follows:

"For Lack of Safety a Leg Was Lost: Aw, never mind turning over that board. That little nail don't amount to much; an' if it did go thru a guy's shoe, it wouldn't do nothin' but scratch him."

So spoke the careless superintendent.

Later in the day he stepped on this same little nail. To prove that his previous statement was right, he pulled out the nail and said, "Aw, that's nothin'. Just a scratch."

But the scratch persisted. The second day he limped painfully; the third day he went to the doctor; the fourth day he went to the hospital; and the tenth day they amputated his leg just above the knee.

"For Lack of a Leg a Position Was Lost: His leg was slow in healing; and compensation was not superintendent's salary. He received damages, but they came in a lump sum, and, having leisure and no training in handling more than a month's pay at a time, the money was soon dissipated. Because of his leg he no longer could hold a superintendent's position; and finally accepted a job as night watchman—terrified that even that might fail him.

"For Lack of a Position a Home Was Lost: His wife was a sunny, sweet tempered woman and his children were bright, happy and contented. But with the much lower standard of living, the wife became nervous, irritable and careless; and the home took on a slovenly, down-at-the-heels air. His children felt the effects of the changed home conditions, and spent more and more time elsewhere. Unable to keep up with old friends, they drifted down among questionable companions. They became sullen, impertinent and resented all discipline. The father found that home was no longer home to him for his family sneered at him as a failure.

"For Lack of a Home Life Was Lost: Home being no longer pleasant, he began hanging around the saloons, then drinking heavily and finally reporting on the job drunk. It became a common occurrence and he was discharged. Feeling abused and that his employer still owed him a living, he went back one night and attempted to rob the place. The new watchman discovered him; and, in the ensuing fight, the watchman was killed.

"For Lack of a Life a Soul Was Lost: He was quickly apprehended; and, having no money for lawyers and no honest defense if he had had, he was soon convicted.

"And like the ever-widening rings that spread out when a stone strikes the water, the consequences of that nail, carefully ignored, spread thru the lives of himself, his wife and his children; and its effects rippled on even unto the third and fourth generations."

This article pictures how effective a little injury may be, particularly to the dependents of the employee. Of course, this same thing can apply to any kind of injury.

If every employee in every industry could be made to realize the importance of safety to his job, and could be made to realize the seriousness of minor injuries when not properly attended to, accidents in industries would be cut down immeasurably. This is the job, in my opinion, that is facing the safety engineer of today. The big job that he had a few years ago of inaugurating safety methods in machinery has been to a great extent, accomplished. The machine that is built today is built by engineers who build in that machine every possible type of safety. The dies that are being manufactured today are designed with the utmost thought of safety by the designers. Therefore, our safety engineers have made their first great stride toward the Utopian goal in safety. They must now turn their attention to an educational campaign to organize and educate safety to every man at every job in every shop.

Safe Handling of Gas in the Steel Industry

By GEO. T. WILLIAMS

Supt., Blast Furnaces & Coke Plant, Indiana Harbor Works,
The Youngstown Sheet & Tube Company

This discussion will be limited to gas handling in the steel industry because in this industry almost every gas that is commercially used is found and in quantities from the smallest, to the individual furnace that consumes as much as a city of 100,000 people. The production of the gas and the piping and handling of it is a problem of sufficient magnitude without consideration of those gases such as butane, propane, hydrogen, acetylene, oxygen, etc., that are stored in steel bottles or tank cars. These gases are in use in steel production but not as a source of production fuel.

The hazards that are brought about by the use of gas come from the properties of the gas. Gases are combustible, and if the combustion is not controlled, men may be burned and property damaged. The combustion takes place rapidly, and if it is confined, the result is an explosion. Moreover, many gases are toxic when breathed.

With all of these possibilities for accidents it is surprising that so few accidents in the steel industry are caused by gas.

Accidents caused by gas, however, are serious except for the slight burns. Those caused by inhalation or explosions are very often fatal and sometimes catastrophic as, for example, the gas holder explosions at Pittsburgh and at Neunkirchen, Germany.

The following is a list of gases that are being regularly used as fuel in steel plants together with their approximate specific gravity and B.T.U. per cubic foot, which properties are of great importance in developing safe means of handling them. They are:

Gas	Specific Gravity	B.T.U. per Cu. Ft.
Coke Oven Gas	0.40	550
Blast Furnace Gas	1.00	80 to 100
Coal Producer Gas	1.00	160
Coke Producer Gas	.97	130
Water Gas	.97	300
Natural Gas	.65	1000
Oil Refinery Gas	.95	1,200 to 1,800

Any gas by itself is perfectly harmless and so is air. Air and gas in an explosive mixture are safe—unless there is some way of igniting them—then they become very dangerous.

Since we should assume that there is always some way to ignite the mixture, the first and fundamental safety rule in gas handling is to keep the gas and air away from one another until they get to the furnace burner. The operator should turn the air on *first* with dampers open, and then ignite the gas by holding a flame in front of the burner as the valve is opened.

While this method will provide the utmost in safety, there is no danger of explosion unless the gas and air are in a proportion within the explosive range of the gas and that range is different for every gas. Gas and air are regularly being mixed and pumped through pipes under controlled conditions, but it is gas of high B.T.U. per cubic foot and having narrow explosive ranges, such as, butane, propane and oil refinery gas.

The air requirement of a gas is ordinarily spoken of as the amount of air necessary for the complete combustion of the gas. It is an old "thumb rule" in the gas

industry that the air required for combustion is $\frac{\text{B.T.U.} - 100}{100}$. The rule applies fairly well to gases of high B.T.U. per cubic foot but not to gases of low B.T.U. such as blast furnace gas.

The explosive range of a gas is generally spoken of as the maximum and minimum mixtures of gas and air that will support combustion, *i. e.*, which will continue to burn when started. Not all mixtures of gas and air will burn. The percentages of gas and air that can be mixed together without combustion, is different for every gas and varies also for each gas according to temperature, turbulence, pressure and other conditions. There is an excellent discussion of these facts in Bulletin No. 279 of the U. S. Bureau of Mines. It is called "Limits of Inflammability of Gases and Vapors" by H. F. Coward and S. W. Jones. Quoting from that work and other sources we find the following approximate limits of inflammability at ordinary temperatures and pressures:

Approximate Limits of Flammability

	Avg. B.T.U. Per Cu. Ft.	—By Volume Per Cent— Lower Limit	Higher Limit
Blast Furnace Gas	90	35	74
Water Gas	300	6.9	69.5
Coke Oven Gas	550	5.3	31
Natural Gas	1000	4.8	13.5
Oil Refinery Gas	1500	3	9

The figures show the limits between which mixtures of gas in air are combustible. Between these limits mixtures of gas and air are something to be treated with respect.

Therein lies what is probably the greatest hazard in gas handling. There are times when we cannot avoid dangerous mixtures of gas and air as, for example, when a new line or piece of equipment is to be purged of air, or piping and equipment full of gas are opened to the air or completely purged of gas for repair. Then there are certain to be explosive mixtures locally, or throughout the equipment, and it is of first importance that those in charge of the work *know* all the conditions in and around the danger zones. To *know* does *not mean* to "assume" or "guess" or "take for granted." It means to be certain.

The choice of men to handle gas has much to do with success from the standpoint of safety and efficiency. Someone must *know*, in handling such a delicate substance. I prefer to have a discussion and mental drill before the work is begun and a military organization set up with one man as leader.

The Orsat apparatus for the analysis of gas is a great help. It definitely will determine the percentage of oxygen in any mixture, and with that knowledge the operator can tell just how dangerous any mixture is or if it is safe. These determinations take time and slow up the work but they furnish definite knowledge of conditions in the danger zone. But gases of the widest explosive range such as blast furnace gas are dangerous in any mixture. This is probably the most dangerous gas that is handled in industry and so industry has learned to use all possible precautions against the mixture of it with air.

As the B.T.U. per cubic foot of gas increases, the air requirement for combustion and explosion also increases until we come to natural gas and oil refinery gas. With these we are not so much worried by air in gas, as we are by a little gas in air. These gases diluted with a little air are not combustible, but a small amount leaking from packing glands in valves, or pumps, or from gaskets in flanges, if confined in a room, may provide the source of a disastrous explosion.

For preventing the mixing of air and gas when clearing equipment of either, several methods may be employed, some safe with one gas and not at all safe with another. Two safe methods of displacing air with gas in common use are by steam, which acts as a cushion or blanket between the air and gas, and by a mixture of carbon dioxide and nitrogen formed by the combustion of gas, cooled and forced into the piping. Either is costly, and while the generation of carbon dioxide and nitrogen is the safest, it is also the most expensive method. While the use of steam is less expensive, with large piping and long lines, the heat of the steam often expands the steel, with the danger of breaking the piping. There again we come

to a consideration of the gas being handled. If it is a gas of low B.T.U. and low air requirement, we *must* use steam or inert gases. Otherwise, we would be taking a chance. With the gases of high B.T.U. per cubic foot and high air requirement we may use the gas itself to displace air providing there are positive and sufficient pressures.

To purge a new twelve inch line, eight miles long, with a gas of 1500 B.T.U. per cubic foot, we have opened the gas line with a pressure of twenty pounds per square inch into one end of the line and removed the air at the other end as rapidly as possible. By analyzing for oxygen at the end of this line, the purging was found to be complete in about two hours. In another case of purging only 1200 feet of 42 inch piping with a gas holder in the system, we generated inert gases to force the air out of the system before admitting blast furnace gas of low B.T.U. per cubic foot, and that purging required thirty hours. Those who risk purging the piping and equipment of new by-product coke oven plants have invariably used the raw coal gas, heavy with tar and oil vapors to remove the air but accidents have happened and there is sufficient risk to justify operators in shutting down and starting up these systems to use a blanket of steam between the air and this 600 B.T.U. gas. When stopping the flow of blast furnace gas for short periods during repairs, it is the universal practice to fill all the piping and auxiliary equipment with steam.

At times it is necessary to hold a pipe line full of gas at zero or atmospheric pressure to break into that line to make a new connection. At the opening, air will be mixed with gas, and if the piping is fitted with flanges it is the safest practice to place a solid steel plate between flanges on each side of the opening. If the line is made up of bell and spigot leaded joints, the opening can be protected against a gas and air mixture with rubber bags made to fit tightly against the inside of the pipe when inflated. There is equipment available that will drill a hole into a pipe and tap a thread in the hole as it is drilled with the line in operation and under gas pressure. When the flow of gas is stopped, the rubber bags can be inserted through the holes and inflated until they fill the pipe tightly. They will also hold medium gas pressures in the line while a repair is made between them, but no such equipment should be depended upon when a man has to work between them, with his safety dependent entirely on them, as they may leak around irregularities of the inside surface of the pipe and they may rupture and collapse at the critical moment. Men should not be permitted to work in piping or equipment unless protected from the source of gas at least by a solid steel plate in the line. It is far better to have piping designed so that somewhere between the source of gas and the man, there is a valve that can be shut off, and a piece of the piping that can be removed so that the place where the man works is no longer a part of the gas system.

As for a gas valve it is a safe assumption that there never was such a device guaranteed to be perfectly tight and non-leaking. We discuss the advisability of locking valve wheels or handles to prevent unauthorized persons from opening them while workmen are dependent for their safety on the valve remaining closed and yet there is no guarantee that the valve itself will remain closed and non-leaking. When we need a device for closing or stopping the flow of gas through a pipe we should depend only on a solid steel plate across the pipe area or a section of the pipe entirely removed. For pipe of twenty-four inches and larger, there has been developed a valve that spreads flanges apart and moves a steel disc into the opening so as to stop the flow in the pipe and so that any leakage that may occur, takes place around the disc and to the atmosphere outside. All one has to do for safety is to put the operating control of this device in a remote place, or put a gas mask on the operator who must be close to the escaping gas.

Equipment connected to gas lines should be protected in the same manner. If a furnace is idle for a period of a week or longer, we should not depend upon the control valve to keep gas out of the furnace. There should be a solid blank between flanges or a section of pipe removed from the line to prevent the accumulation of gas in the furnace. If this precaution is taken, it will make no difference if a valve leaks, unless the leak happens to cause a gas accumulation in a closed room. At least it will make no difference to the man who is sent into the furnace to repair brick work, or the man who goes into the furnace with a light in his hand to make an inspection, or the man who undertakes to light the furnace before

its air system has purged any gaseous atmosphere out through the chimney. If I may repeat a simple law of thermodynamics here, I shall say that a chimney pulls gases to the outside atmosphere because the atmosphere inside the chimney is lighter than the atmosphere outside. The outside pressure pushes gas up the chimney through the furnace. The reason that chimney gases are lighter than the outside atmosphere is that the chimney gases are hotter. Their temperature is higher because the furnace delivers them at a higher temperature. Therefore, if the furnace is cold it does not deliver any warm gases, the temperature inside the stack is the same as the temperature outside the stack, the weight of the gas inside is the same as the gas outside and there is no flow. In fact the flow may be downward in the chimney because of the extra weight of moisture in the form of vapor inside the chimney, and so for the sake of safety, if we cannot clear the furnace atmosphere by any other means except its flues, dampers and chimney; we build a fire at the base of the chimney to create a "stack pull." Just because a damper is open to a flue and to a stack, is no reason that the furnace atmosphere will clear itself of gas. Possibly it will, due to winds at the top of the stack but possibly it will not and because it might not, we open all available doors and if there is any doubt we analyze the furnace atmosphere before we apply an ignition torch or open a gas valve. There is a responsibility in every plant that uses gas in furnaces to see to it that such precautions are taken by someone who knows. Usually it should be an operating foreman who has been taught these simple principles.

When we open a discussion on the toxicity of gases, we enter a field in which I am limited to experience and observation. Assume first that if an atmosphere is dangerously explosive or near to that condition, it is toxic. In mixtures of gas and air, small quantities of such gases as carbon monoxide, carbon dioxide, ethylene, acetylene, benzol, toluol, Xylol, carbon di sulphide, hydrogen sulphide, cyanogen, and others are known to have harmful effects on man. If man is prevented from contacting such dangers, we are practicing preventative safety and not the kind of safety that depends upon technical skill to get us out of the unfortunate situation into which we may have got by lack of foresight.

Once again the procedure to avoid the contact of men with dangerous gases varies with the gas. In most cases it can be said that steam will displace and volatilize the gas from any container. The amount of steaming depends upon the size of the line, tank, or vessel and it may be as little as one hour for a fifty gallon drum or as much as twelve hours for a tank car or forty-eight hours for a storage tank. The container must become hot enough and left long enough at that temperature to volatilize and remove the vapors. After that it must be cooled and aerated before men may enter and before men may enter there must be tests to make certain that life can exist in that atmosphere.

There are several mehods of testing such atmospheres, as the use of canaries in mines, or analytical chemical devices, but we prefer "waltzing mice." Obtainable at most pet shops, they spin aroud on one foot, burning up more energy per ounce of weight than anything one can imagine. Toxic gases slow them up, or completely overcome them.

If we suspect a dangerous atmosphere, three or four of these mice in a cage are put into the atmosphere and watched. If they do not seem to be affected, a man may enter on condition that he wears a safety belt and rope and there is at least *one other man* at the entrance *watching him, the mice, and the rope.* That man must realize that one of the mice may have more resistance to gases than the other, that all of the mice may have as much resistance to gas per ounce of weight as the man, that the mice might not feel the effects first. Analytical devices may accurately determine the toxic condition of any atmosphere at the moment, and in the spot where the sample is taken but they will not indicate changes which take place in an atmosphere as work progresses and air circulation is changed by the addition or removal of equipment which interferes with the air circulation, or changes which take place removing iron oxide scale behind which dangerous vapors have been trapped. Such devices have merit but are much better designed to determine explosive mixtures than to indicate toxic gases, for their usefulness is limited to the time and the place where the sample is taken.

Carbon monoxide gas probably presents the greatest toxic hazard in the steel industry. As it is breathed into the lungs and is absorbed by the blood, it destroys

the red corpuscles, or changes the ratio of red to white corpuscles or upsets some bodily balance or other that easily results in a fatality. In its pure state it is a colorless and odorless gas having a density of .966 which is about equal to air. Therefore, mixed with nitrogen which has about the same density we have a mixture of gases that presents a serious hazard because it does not separate readily from air. Also, it does not diffuse readily into air being of the same weight and density, and it is poisonous in small proportions.

Carbon monoxide is found in any product of combustion where there is insufficient oxygen for complete combustion. If the combustion is complete the product is carbon dioxide which has some toxic effects but is more smothering than poisonous. The monoxide gas is found in the steel industry particularly in water gas, coal or coke producer gas and in blast furnace gas and blast furnace gas causes more men to be overcome and affected than all others. In the high temperatures of the blast furnace carbon combines with nitrogen and hydrogen to form the deadly hydrogen cyanide or prussic acid gas. Most of it combines with other materials in the furnace and remains there, but slight traces of it in the gases along with the carbon monoxide seem to intensify the effects of the monoxide. Whether or not men are completely overcome, they suffer severe headaches and nausea from breathing it. Men may breathe it until they are overcome with no warning other than a dizziness, which generally comes too late to allow them to recognize the symptom and escape. We do not find that men build up any immunity to the gas on repeated exposure, but we do find that there are men who can absorb more gas than others. Blast furnace men call them "gas eaters" and it is quite probable that they have a blood building power or metabolism of some sort that permits them to resist the effects of carbon monoxide longer than others. There is no particular race of men that withstands the gas effects longer than others but they are very often the strongest men of a wiry build and with great vitality.

When it is known that there is danger of carbon monoxide in an atmosphere, men should not be permitted to go into it. There are gas masks that will effectively absorb this gas into a canister of chemicals, but men who have to do work while breathing through these devices object to them because the heat generated by the absorption of the gas in the chemical makes the mask uncomfortable and the work seem more difficult. Absorption masks are perfectly safe in unusual places that are gassy, but we find that men prefer the face masks into which fresh air is pumped. The operations around a blast furnace are confined to a relatively small area and we have equipped ours with a piping system in the gassy places around and above the mantle of the furnace where men may attach hose connections to their face masks and secure fresh air. For a source of fresh air, at a clear spot away from any gaseous atmosphere we have built a water pump that creates a supply of clean, washed air by the simple means of a stream of water flowing through a pipe. We do not depend upon any mechanical or electrical means for the generation of the air supply. Either might fail when a man was depending upon them but so long as the plan has water pressure, the man has fresh air. The sketch shows diagrammatically how such a device is built and how it works. Such generators of fresh air can be purchased except for the piping and would probably be more efficient than the one shown.

As for methods of rescue and resuscitation we diligently practice them and once a week at least two different crews in different places go through the drill of entering actual gaseous atmospheres of sulphur dioxide using oxygen helmets. Teams have instruction by experts of the United States Bureau of Mines, and competitions between them are arranged periodically.

We do not write out rules regarding gases because every situation is so involved technically that it cannot be described in generalities, but must be handled specifically by someone who is technically trained. There are, however, two rules which if they are violated come under the classification of unsafe practices. They are, first, that the mixing of gas and air must not be accidental and unknown. If it is to occur at all, it must be planned and if it is in dangerous proportions all precautions must be taken to keep all methods of ignition away from the mixture. The second is that when men are to enter an atmosphere suspected of containing gas or one that has contained gas, it must be assumed that it still contains gas in dangerous quantities. Men may enter such atmospheres only after tests have been made chemi-

cally or with small animals and then only with safety belts attached and at least one other man on guard outside the dangerous atmosphere.

Whatever the problem—the danger of asphyxiation of workmen, or explosion in a gas holder or the simple backfire of a gas burner—it can be solved if it is presented to one who knows the physical laws of gases in theory and in practice. To leave such problems to untrained persons is in our opinion one of the great unsafe practices in the handling of gases.

WEDNESDAY MORNING SESSION

October 16, 1935

Experience Facts in the Metal Industries

By CHARLES W. HANKO

Safety Director, Pittsburgh Steel Company, Monessen, Pennsylvania

The smelting, refining and fabricating of various metals involve so many ordinary and serious hazards that a periodic examination of our injury experience is an essential part of our safety work. Industries, such as those represented in the Metals section, have a long road to travel before they can equal less risky industries in safety. We are constantly confronted, therefore, with the questions "What progress are we making?" and "What is the present injury situation in our plants or industry?" and "Where and how can we individually and collectively achieve better results?"

Members of the Metals section, whether in the steel, foundry, copper or other non-ferrous metals industries, have been making consistent progress in reducing the frequency and severity of disabling injuries. Annual reports from our members to the National Safety Council show a reduction in frequency of about 60 per cent since 1926; all branches of the section made about the same improvement. We have made larger reductions in frequency than American industry as a whole and also excelled the gains made by such important industries as the machinery, meat packing, mining and food. The public utility industry is the only one to exceed our decrease in the frequency of disabling injuries since 1926 by a considerable margin.

Severity Rates Still High

I regret, however, that our reductions in the severity of injuries have not kept pace with the improvement in our frequency rates. Decreases in severity since 1926 varied from 24 per cent for the steel industry to 60 per cent for foundries, and considering our section as a whole, our improvement has not equalled the average for American industry. The experience of other industries with serious hazards has been similar to ours. The cement industry, for example, has reduced frequency 65 per cent since 1926 but the reduction in severity has been only 28 per cent, and in the chemical industry, a reduction of 58 per cent in frequency has been accompanied by an improvement of only 12 per cent in severity.

An examination of our experience with injuries of different types, fatalities, permanent partial disabilities, and temporary disabilities, throws some light on the failure of our severity rate to decrease more rapidly. In the steel industry, for example, the frequency of fatalities has dropped 34 per cent since 1926, permanent partial disabilities have decreased only 29 per cent, but temporary disabilities—the least serious of all injuries—have fallen 62 per cent. Furthermore, the reduction of 29 per cent in the frequency of permanent partial disabilities has resulted in a decrease of only 14 per cent in their severity and the large drop of 62 per cent in the frequency of temporary disabilities has resulted in an improvement of only 19 per cent in their severity. The situation disclosed by these figures can be found, also, in the petroleum, chemical, cement, and other industries whose operations involve more than average hazards. Safety engineers in such industries, therefore, can well afford to give serious thought to the question "Why have serious injuries decreased so slowly and what can be done to accelerate their elimination?"

The progress we have made in reducing injuries is reflected in our comparison with records in other industries. The average frequency rate for 30 major industries was 15.29 for 1934 and with the exception of our foundry division, rates in our section were about 50 per cent below the general average. Companies producing non-ferrous metals had the lowest rates in the section, averaging 10.30; this rate gave them a standing of ninth out of thirty important industries. The 1934 record of our steel industry was almost as good.

I regret that I cannot point to an equally good showing from the standpoint of severity. Of the various branches of the section, companies producing non-ferrous metals also had the lowest severity rates in 1934, averaging 1.46 against 2.20 for steel plants and 2.21 for foundries. The rates for foundries and steel plants are sharply higher than the average of 1.70 for industry as a whole.

We do not have sufficient information to determine definitely significant reasons for our comparatively high severity rates. Most of the members in the steel industry have been reporting their records by departments and this system has been helpful in determining where the worst hazards exist. A summary of departmental records for the last six years shows that open hearth furnaces, blast furnaces, and coke ovens have the highest severity rates, and therefore, safety effort should be concentrated on them. This has been done by safety engineers and the reductions in injury rates have exceeded the improvement made in other departments during the last five years. Transportation, general labor, and general mechanical departments have rates ranging from 3.68 to 2.98 for the last six years and are the next important sources for serious injuries in the steel industry. These six departments constitute a considerable proportion of the experience of the industry so that marked improvement in the reduction of severity rates will materially effect the general rate of the entire industry. I hope that all members of the Metals section will adopt departmental reporting because I believe it is of real help to know the locations in our plants which require the greatest study and where the most substantial progress can be made.

One-fourth Are Machinery Accidents

I want to emphasize, also, the importance of the proper design, inspection, guarding and operation of machinery because of all the various types of accidents occurring in our plants, those involving machinery constitute about 25 per cent of the total, and are our most important type of accident. While I cannot substantiate my opinion with actual figures, I am convinced from my experience that machinery accidents usually mean severe injuries and a high severity rate. The magnitude of our problem involving machinery hazards is shown by the fact that our percentage of accidents on such equipment is about twice the average for industry as a whole.

We have, also, another type of accident which is outstanding in our experience. "Handling Objects" accounts for almost an equal percentage of our total accidents. How many of your men know the proper way to lift, hold, and carry materials? There are numerous accidents resulting in crushed fingers when heavy objects are not properly set down. Accidents of this type and "machinery accidents" will assume added importance in the event that business continues to improve because new men and old men returning after long lay-offs are particularly susceptible to them.

There can be no let-up in safety work when production is rising. Our experience during the last two years proves the necessity for greater effort in such times. Injury rates in the various divisions of the section decreased quite steadily from the peak production year of 1929 to about 1932 but during the last two years, improved conditions have been accompanied by higher rates. Let us hold the gains we have made!

Converting Talk Into Results

By J. RUSSELL CRAIG

Safety Director, Pennsylvania Indemnity Corporations, Philadelphia

I am heartily in favor of my subject because I believe that less talking and more action is the way to bring results.

Let us assume that we are walking into a plant having an ideal accident prevention program. Most of the material and methods I shall mention are used by all companies to which we refer. We will study the methods in logical order to see the satisfactory results obtained.

We lay our foundations in the words of H. M. Croghan, director, Department of Safety, Sanitation and Claims of the Inland Steel Co., "No industry can succeed in accident prevention without 100 per cent cooperation through the entire organization." And as Robert L. Schmitt, secretary, Louisville Car Wheel and Railway Supply Co., says, "Aside from constant executive direction in endeavoring to keep the safety idea continuously before our workmen, we have for the most part followed standard old line safety practices. Our principal asset has been the good will of our workmen."

So we see that in accident prevention there are two main groups, as there are in all industrial relations: management and men.

To secure the president's interest and approval is your first step, and management can show its direct interest in various ways. To illustrate, the presidents of several organizations have given awards for safety records and presented them in person at employee mass meetings.

Our second step, given us by Dr. R. C. Engel of the Corrigan McKinney Steel Co., consists of a complete physical examination for each employee. Their employment department keeps a very complete record; when a certain department needs a man, it describes the kind of work to be done and the type of man desired: then the employment department, by referring to its records, can furnish the right man. This prevents the development of accident-prone men.

Both management and men must remember the great good which comes from a physical examination. It helps fit a man physically, mentally, and tempermentally for his job; many hidden defects have been found and possible injuries prevented by these examinations. If men are taught that after a physical examination they may be transferred to positions to which they are better suited, thus prolonging their employment which otherwise might be terminated due to physical breakdown or accident, they cooperate more readily. They realize that it is to their own interest to do so.

The president of the Corrigan McKinney Steel Co. has given Dr. Engel credit for building the foundation of their accident prevention record upon physical examinations. How well this fits in with our first step already mentioned.

The third step consists in having definite printed rules. The Carnegie Steel Company realized this for as John A. Oartel, chief of Safety Bureau, writes: "From the beginning of our safety work we have insisted strongly on compliance with safety rules. We try to be practical and our rules book is brief and to the point. . . *All rules have been developed as a result of experience.*" *To make this booklet more* effective the president of the company has written a personal message to each employee which is printed in the beginning.

The man passes the physical test, his employment application is approved and he is turned over to his foreman. The foreman, after giving him a welcome, presents him with a book of safety rules to read and sign: "I have read the safety rules contained in this book and understand them. I will not do anything that will break any of these rules. I will not take chances. I will endeavor to work safely at all times so that my department will not have accidents." There is a place for his signature, department and check number.

The fourth step is to make the supervisory force conscious of accident prevention. An example is shown in the Carnegie Steel Co.'s booklet with its message "To all department superintendents: Before men are asked to sign their safety books, foremen should be sure that they understand all the rules." A second method is outlined by H. M. Croghan, Inland Steel Co., "We have all new men report to the safety office for examination after they have been on the job a week to ten days. We ask them to tell us what instructions they were given regarding what to be careful of, who instructed them, and when? We also ask them questions about the printed rules. When we find any man who has not been properly instructed, we report the fact to the head of the department where the man works."

H. W. Darr, supervisor of safety, Bethlehem Steel Co., gives an excellent idea of how to meet the new employee. "In approaching the workman in a kind and considerate manner, always keep in mind that the other fellow is not supposed to know as much about the subject of accident prevention as yourself. Try to secure and maintain the good will of every man in the plant. I invite suggestions and give courteous consideration to all that are offered, keeping in mind at all times that men can be led by kindness to do ten times more than by trying to drive them. The day of cursing and nagging to obtain results has gone from the industrial world forever."

The fifth step is an organization for carrying on the safety program. Mr. Oartel sends us a complete lay-out, of which this is a resume:

1. General safety committee; the center of activities, composed of a representative from each of the nine plants and representatives from the city office directly or indirectly connected with safety work; about 15 in number; has an advisory committee consisting of the president of the company, the chief surgeon, the chief mechanical engineer, etc. Meetings are held monthly. The topics discussed are: (a) accidents or near accidents, and (b) designs for safeguards, etc.

2. Plant general safety committees; consisting of department superintendents or assistants, safety engineer or director. Topics discussed are: materials and information transmitted from the safety bureau of the company and subjects developed locally.

3. Department safety committees; the department superintendent or assistant is permanent chairman; the foremen and workmen belong to this committee.

4. Sub-committees, composed of department foremen and workmen. The duties consist of instructing new men, inspecting their own corner, and looking out for and reporting dangerous practices.

Our sixth step is stimulating the efforts of individuals to carry out the safety program. J. A. Voss, director of industrial relations, Republic Steel Corporation, gives the following guide: (A.) "Each superintendent prepares a letter known as a 'safety discussion.' From these letters a composite letter is compiled and printed; on the reverse being a discussion of the question. These sheets are then given to all department heads and all foremen in the plant. They provide a guide to work with in group meetings. This has been found unusually beneficial in convincing the foreman that his superintendent is really interested in accident prevention work. The success of the program depends on the fact that the district manager is 'after it' all the time."

(B.) "By unsafe practices reports, we mean that the foreman is to report the unsafe practices of his workers to his superintendent on a regular form. During 1934, there were 6,924 such reports filed. It is up to the foreman to correct the unsafe practices when they occur and to explain why the work should be done in a different manner. It must be done at once if we are to secure the full benefit of such work.

(C.) "We prepare short items (never over a page) which can be used by the foreman in his group meetings. These tell of accidents within the plant, the use and value of safety shoes, goggles, etc. They carry a local atmosphere and again guide the foreman in carrying his work to the men on the job. Some of these messages are news letter type, while others are in the form of a discussion card."

W. T. Filmer, supervisor of safety, Youngstown Sheet & Tube Co., has the following to say about every employee taking part in the safety program: "We devised at the beginning of 1934 what we call our 'Safety Observer System.' Every foreman appoints one man for every 20 men in his crew to act as a safety observer, to serve for two weeks. These men become special safety pupils of the foreman. He talks to them every day in a friendly manner about what safety should mean to them, and so completely saturates them with the spirit of safety that he should, at the end of the two weeks, be able to say, 'There is another man I won't have to worry about.' These observers keep their eyes open and, if unsafe practices are

being attempted, call the attention of the offender to the hazard involved. Such incidents are not to be reported to the foreman, as it is definitely understood this must be done in a helpful spirit without any possibility of the observer being considered a spy or snooper. He is only putting into practice the things he has been taught by the foreman, the primary purpose being to make him safety conscious. If the foreman is not satisfied with his progress he appoints him again in a month or two, and gives him another dose. During 1934 more than 6,000 men out of an organization of 7,800 served in this capacity."

The Carnegie Steel Co. has a safety leader system, a safety leader being appointed for every six men, who shall have supervision over their safety. He makes a daily report concerning near accidents or dangerous practices. He also makes recommendations with reference to the guarding of machinery or anything else *that may improve conditions.*

Management, of course, realizes that its foremen and supervisors need intensive training in safety and also how to teach it. The Republic Steel Corporation, to assist foremen and supervisors, issues a bulletin called "The Foreman's helper." It takes up such subject as:

1. Calling attention to records past and present urging cooperation.
2. Comments on infections.
3. General safety orders violated—a case study.
4. Matter on industrial relations, with such pertinent comments as, "The proper handling and fair treatment of employees by the foreman is essential."
5. A list of safety remainders.

E. F. Blank, director of safety and welfare, Jones and Laughlin Steel Corporation, has installed a Foremen's Safety Training Course with good results. The topics to be discussed are given out beforehand, so that each member of the group of 10 to 15 men is familiar with them. Leading questions are prepared. Typical examples of the topics are, "Handling of Burning and Welding Material," "Ladders, Stairs, and Scaffolds." One feature of this training system is the demonstrations which follow the discussion. Apparatus is set up and under carefully controlled conditions, the actual hazards talked about are made to happen. Thus several types of educational appeal are made at one time.

Of course, we all use the Foremen Training Course material and other information published by the National Safety Council.

Sometimes special problems arise such as wearing of goggles and safety shoes. I. A. Brinkman, safety director, Mackintosh-Hemphill Co., gives us a guide. "We tried to encourage our men to wear goggles where there was a hazard, but had no definite order covering it, or discipline for infractions; the same applied to safety shoes. After several accidents in 1931 that goggles and safety shoes would have prevented, I had a conference with the president and works manager. I finally won my point, with the result that all men working in the cleaning and shipping departments, or around roll lathes in the steel foundry, turning alloy iron in our iron foundry, roll or machine shops, handling metal or working near metal being poured, or working at the cupolas or furnaces, including foremen, are compelled to wear goggles at all times. It was also decided that every man working in our plants would have to wear safety shoes, and this included our superintendants and foremen.

"The discipline set up to govern these orders was as follows: a man was warned once for not being properly equipped; for the second offense he was given a week's layoff; for the third offense he was discharged. If a man received an injury which either goggles or safety shoes would have averted, his foreman would receive a week's layoff without his salary. This requirement was made effective February 1, 1932, and we have not had any eye or foot injury to date."

Most companies have stated that they have had good reductions in their accident rates. It is interesting to note some of the special results of using these methods.

The Carnegie Steel Co., with their safety leader system shows: "From November 1, 1925, to January 1, 1934, at Homestead Works:

Reports made	2,990,504
No. of safety recommendations in reports	21,614
No. of safety recommendations approved	18,037
No. of safety recommendations completed	15,421

Mackintosh-Hemphill Co., results in enforcing goggles and safety shoes rules, netted in savings in compensation:

Goggles	$34,315
Safety Shoes	15,600

The Youngstown Sheet and Tube Co., with the "Safety Observer System," shows the following results in 1934. With an increase at one plant of 42 per cent in man hours, accidents increased only 11 per cent. In another plant, hours increased 6 per cent, accidents were reduced 52 per cent.

An analysis of the experience of the Beloit Iron Works is most revealing:

	1929	1934
Cost of medical care and compensation	$1,045 per mo.	$83.50 per mo.
Frequency rate	45.12	7.91
Severity rate	6.51	0.14
Compensation cases	20	11
Insurance rating	Dr. 6.7%	Cr. 26.5%

Metals Section Safety Contest

The data on the Metals Section Safety Contest were presented by H. W. Darr, Acting Chairman, as follows:

One hundred ninety-four units were entered in the Contest this year, and 219,830 employees worked 425,051,091 man-hours. The average frequency rate was 8.354, which represents a decrease of 19 per cent from the rate of the 1934 contest. This year 104 units ended with a frequency rate below the average. Twelve per cent of these completing the contest finished with perfect records. In this contest 25 plaques and seven certificates were awarded.

The plaques were presented by W. F. Worth, works manager of twine mills, International Harvester Co., Chicago, and Vice-President for Finance of the National Safety Council, to the following:

Steel Mills Division, Group A—The Corrigan McKinney Steel Co., Cleveland, Ohio, 5,566,016 hours, 10 injuries.

Steel Mills Division, Groups B and C—Three tied for first place—The Youngstown Sheet & Tube Co., South Chicago, Ill., 929,672 hours, no injuries; Great Lakes Steel Corp., Hanna Furnace Division, Ecorse, Mich., 783,302 hours, no injuries; The Youngstown Sheet & Tube Co., Hubbard Furnaces, Youngstown, Ohio, 104,325 hours, no injuries.

Rolling, Finishing and Fabricating Division, Group A—Aluminum Co. of Canada, Ltd., Toronto, Ont., Canada, 1,236,706 hours, 2 injuries.

Rolling, Finishing and Fabricating Division, Group B—Eight tied for first—Revere Copper and Brass Inc., Baltimore Division, Baltimore, Md., 900,413 hours, no injuries; The Youngstown Sheet & Tube Co., Evanston, Ill., 536,856 hours, no injuries; Republic Steel Corp., Grand Crossing, Ill., 334,969 hours; no injuries; Lehigh Structural Steel Co., Allentown, Pa., 279,050 hours, no injuries; Steel & Tubes Inc., Brooklyn, N. Y., 251,847 hours, no injuries; Chapman Price Steel Co., Indianapolis, Ind., 225,116 hours, no injuries; Laclede Tube Co., Alton, Ill., 139,917 hours, no injuries; Republic Steel Corp., Unionville, Conn., 126,936 hours, no injuries.

Foundries Division—Four tied for first—Mackintosh-Hemphill Co., Midland, Pa., 339,385 hours, no injuries; The American Rolling Mill Co., Central Works, Middletown, Ohio, 181,809 hours, no injuries; Ideal Foundry & Machine Co., Youngstown, Ohio, 153,577 hours, no injuries; The American Rolling Mill Co., Sixth St. Foundry, Ashland, Ky., 104,022 hours, no injuries.

Heavy Machine Shops Division, Group A—United Shoe Machinery Corp., Beverly, Mass., 6,246,912 hours, 3 injuries.

Heavy Machine Shops Division, Group B—Five tied for first place—United States Rubber Products, Inc., Shoe Hardware Div., Waterbury, Conn., 808,123 hours, no injuries; C. Hager & Sons Hinge Manufacturing Co., St. Louis, Mo., 570,669 hours, no injuries; D & B Pump & Supply Co., Los Angeles, Cal., 180,587 hours,

no injuries; Noera Manufacturing Co., Waterbury, Conn., 163,485 hours, no injuries; Pittsburgh Steel Co., National Steel Fabric Div., Monessen, Pa., 125,390 hours, no injuries.

Light Machine Shops Division—Two tied for first—Benjamin Electric Manufacturing Co., Des Plaines, Ill., 807,091 hours, no injuries; Boston Gear Works, Inc., North Quincy, Mass., 634,820 hours, no injuries.

THURSDAY MORNING SESSION

October 17, 1935

Maintenance Kinks in the Metals Industry

By JOHN A. OARTEL

Chief of Safety Bureau, Carnegie Steel Company, Pittsburgh, Pa.

Forty-five safety kinks assembled by Mr. Oartel during the past year were presented as lantern slides. The first group included eighteen slides which had been reproduced from photographs, the originals of which had appeared in the pages of the NATIONAL SAFETY NEWS during the year.

A second group included 27 slides reproduced from pictures taken in the plants of the Carnegie Steel Company.

Other pictures came from the American Steel and Wire Company, Donora Works.

Your Hour

Led by T. H. McKENNEY

Supervisor of Labor and Safety, Illinois Steel Company, South Chicago, Ill.

Prior to the meeting questions were submitted in writing, several were selected for discussion, and it was arranged that the remaining questions be given publicity through the section News Letter. The questions discussed were as follows:

Question: Has anyone developed a printed set of safety rules for each department in the plant, rather than a large book for the entire plant? (a) If so, how does it work out? (b) Are they given to each man or posted?

Answer: Most plants have a general rule book. Few have departmental books. The concensus was that a general rule book is too much for each man to read and that a departmental rule book is worth while provided the supervisor of the department keeps the men interested. This is being done in some plants.

Question: Has anyone devised a system to make certain that every man returns goggles to his department when leaving the employ of the company, even though on a temporary lay-off?

Answer: Very few plants require workmen to make a deposit for safety equipment when it is given out. The opinion is that goggles are provided for the saving of eyes and that the less said about the cost, the better the results.

Question: What method is best for placing safety suggestions before department superintendents? (a) By letter; (b) On a form for that purpose; (c) In minutes of safety committee meetings?

Answer: Make a personal contact with the superintendent and then follow this up with a letter. Never use a form.

Question: In the promotion of a safety educational program, is it advisable to use as subject matter the description of recent accidents, or rather not to discuss accidents at all, but to confine the discussion to safety features generally?

Answer: Reports from the majority of plants show that they send the details of each accident to all department superintendents to use at their safety meetings. Some send out a definite safety question once each week to be discussed at the superintendent's meeting.

Question: Nearly every large steel company has a large safety organization known as a general safety committee which holds periodical meetings. Should the personnel of this committee consist of workmen, or foremen, or both? If both, which class should predominate?

Answer: Some companies have committees made up of workmen, of foremen, and a permanent committee of both. Others have all workmen, and still others have 60 per cent foremen and 40 per cent workmen.

Question: What is a good plan to maintain safety interest in a plant which only employs 50 men?

Answer: Let the superintendent do the job.

Question: Are there any members present using Fox grinders or similar high-speed grinding wheels equipped with dust-collecting systems?

Answer: Two replied in the affirmative: Wheeler Carpenter Steel Company, Reading, Pa.; and Kennington Steel Company, Kennington, Ill.

Question: What progress is being made in dust control in stainless steel grinding and polishing rooms?

Answer: No plant represented has a dust-collecting system. It was recommended that respirators be used having the U. S. Bureau of Mines approval.

Question: What methods do you use in your plant to impress employees that mental safety is more important than physical safety?

Answer: Continual education and making personal contacts with the men.

Question: We know that practically every industry has adopted safety shoes as standard. What, if any, are the common handicaps or objections to such shoes?

Answer: The main trouble with safety shoes is not with the shoe itself, but with those who fit the shoes.

Question: Do your track men who use sledges wear goggles, and if so, what kind?

Answer: Only one company reported the use of goggles in such work.

Safety Chips

"Safety Chips," a film strip presented by Clarence F. Otto, safety engineer, Employers Mutuals, Milwaukee, Wis., showed various types of operating conditions with attendant hazards and accident prevention measures, such as typical unguarded and guarded machines, types of guards, and safety kinks.

Many effective home-made pieces of safety equipment were illustrated.

Mr. Otto accompanied the film strip with an oral explanation.

ADJOURNMENT

Mining Section

Officers 1934-35

General Chairman—Wm. G. Metzger, Hudson Coal Co., Scranton, Pa.
Vice-Chairman in Charge of Membership—J. W. Alt, Calumet & Hecla Consolidated Copper Co., Calumet, Mich.
Vice-Chairman in Charge of Engineering—C. W. Gibbs, Harwick Coal and Coke Co., Pittsburgh, Pa.
Vice-Chairman in Charge of Health—A. J. M. Ross, Homestake Mining Co., Lead, S. D.
Secretary and News Letter Editor—Daniel Harrington, United States Bureau of Mines, Washington, D. C.
Entertainment Committee—R. N. Hosler, Coal Mine Section, Pennsylvania Compensation Rating & Inspection Bureau, Harrisburg, Pa.
Poster and Slide Committee Chairman—J. J. Forbes, United States Bureau of Mines, Pittsburgh, Pa.
Program Committee Chairman—J. T. Ryan, Mine Safety Appliance Co., Pittsburgh, Pa.
Publicity Committee Chairman—M. R. Budd, Explosives Engineer, Wilmington, Del.
Statistics Committee Chairman—W. W. Adams, United States Bureau of Mines, Washington, D. C.
Members at Large—
P. M. Arthur, American Zinc Co. of Tennessee, Mascot, Tenn.
W. H. Coltins, National Lead Co., St. Francois, Mo.
M. F. Fairlie, The Mining Corporation of Canada, Ltd., Toronto, Ont., Canada.
H. C. Henrie, Phelps Dodge Corp., Bisbee, Ariz.
Thomas E. Lightfoot, Koppers Coal Co., Pittsburgh, Pa.
Lee Long, Clinchfield Coal Corp., Dante, Va.
George Martinson, Pickands, Mather & Co., Hibbing, Minn.
D. D. Moffat, Utah Copper Co., Salt Lake City, Utah.
M. W. Moffat, Jeddo-Highland Coal Co., Jeddo, Pa.
L. T. Sicka, St. Joseph Lead Co., Bonne Terre, Mo.
Howard I. Young, American Zinc, Lead & Smelting Co., St. Louis, Mo.

Officers Elected for 1935-36

General Chairman—J. W. Alt, Calumet & Hecla Consolidated Copper Co., Calumet, Mich.
Vice-Chairman in Charge of Membership—C. W. Gibbs, Harwick Coal and Coke Co., Pittsburgh, Pa.
Vice-Chairman in Charge of Engineering—C. J. Barrett, U. S. Steel Corporation Subsidiaries, Duluth, Minn.
Vice-Chairman in Charge of Health—Lee Long, Clinchfield Coal Corp., Dante, Va.
Secretary—Daniel Harrington, United States Bureau of of Mines, Washington, D.C.

Entertainment Committee Chairman—Wm. G. Metzger, Hudson Coal Co., Scranton, Pa.

Program Committee Chairman—R. N. Hosler, Coal Mine Section, Pennsylvania Compensation Rating and Inspection Bureau, Harrisburg, Pa.

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Statistics Committee Chairman—W. W. Adams, United States Bureau of Mines, Washington, D. C.

Members at Large—
P. M. Arthur, American Zinc Co. of Tennessee, Mascot, Tenn.
John L. Boardman, Anaconda Copper Mining Co., Butte, Mont.
Angus D. Campbell, McIntyre Porcupine Mines, Ltd., Schumacher, Ont., Canada.
W. H. Comins, National Pigments and Chemical Co., Potosi, Mo.
Thomas E. Lightfoot, Koppers Coal Co., Pittsburgh, Pa.
George Martinson, Pickands Mather & Co., Cleveland, Ohio.
D. D. Moffat, Utah Copper Co., Salt Lake City, Utah.
V. O. Murray, The Union Pacific Coal Co., Rock Springs, Wyo.
R. B. Paul, New Jersey Zinc Co., New York, N. Y.
L. T. Sicka, St. Joseph Lead Co., Bonne Terre, Mo.

TUESDAY MORNING SESSION

October 15, 1935

The opening session was called to order by Vice-Chairman J. W. Ault, Calumet and Hecla Consolidated Copper Co., Calumet, Mich., who presented a resumé of the year's activities in the section, praising the work of committee chairmen.

Problems of the State Department of Mines and Minerals in Promoting Safety in Coal Mining

By JOHN F. DANIEL

Chief, Department of Mines and Minerals, University of Kentucky, Lexington, Ky.

Before a company can have a good safety record the safety idea must be sold to the head of the organization. When this is done it is much easier to put the idea across to the operating officials and other personnel. Many times a company will flounder around, attempting to get right with safety, when the head of the concern is not sufficiently interested to assist the operating staff and workmen to get well started. When this is the case, the person directly responsible at the top usually realizes he has passed up a good bet only after one or more lives have been lost.

When requested to recommend a safety program to a company, the Department of Mines and Minerals usually starts out by taking stock and sizing up the officials directly in charge, to determine if they are really interested in safety or whether they are just marking time. If the Department believes the leading officials are sincerely interested, then the size of the organization, the conditions both inside and outside the mine and the labor turnover are seriously taken into consideration. The accident record is closely scanned, particularly those types of accidents which most frequently occur. The kind of equipment is noted, and whether or not the entire personnel has been trained in First Aid to the injured.

The first recommendation the Department makes is that all employees be trained in First Aid to the injured. The second is that weekly meetings be held of the operating staff in order that all matters pertaining to safety procedure be thoroughly discussed and understood by those in charge. After this, meetings of employees are held, sometimes all together, either semi-monthly or monthly, and sometimes, in the case of a large company, in groups as to occupation. For instance, timbermen, slatemen, pumpers and miscellaneous members in one group; machinemen and coal loaders in another group; and trackmen, motormen, brakemen and wiremen in another group. This is done to emphasize the various types of accidents to those engaged where the accident occurs.

The equipment used and the various practices in effect play a large part in any safety program, and this sometimes necessitates overhauling of the ventilating apparatus, or the track, wiring and working tools.

Safe Mines Have Small Labor Turnover

We have usually found that the companies with the best safety records are those with the smallest labor turnover. Inexperienced workmen add considerably to the total of accidents both fatal and non-fatal. In fact, some companies have devised a model working place in which to instruct loaders and daymen, and in many other instances, companies maintain regular instructors who break in new employees.

There is no longer any argument over the comparison of cost between a good and a bad safety record. We find that our companies are falling in line to a very considerable extent and in few instances is there any opposition to sound safety recommendations made by any member of our inspection force.

Standardizing of safety practices and mine safety rules are quite an asset, although it must be remembered that the same conditions do not exist in any two mines, regardless of the fact that they may be located adjoining each other. When mine rules are put into effect they should be broad enough to cover any condition that might be encountered in the ordinary working of a mine, and if the company operates more than one mine, the rules should be broad enough to cover the entire group.

Many different types of accidents occur in and about a coal mine. A Department representative makes an investigation of all serious and fatal accidents, and the results of these investigations are published in a monthly bulletin in order that officials and workmen engaged in the industry may study how the accident occurred and especially how it could have been prevented. Sometimes we find the cause of the accident was carelessness on the part of the injured, sometimes faulty equipment, sometimes failure on the part of a trackman, timberman, motorman or brakeman. Sometimes the fault is a let down on safety by mine officials.

The Kentucky Department of Mines and Minerals has jurisdiction over some 2,000 coal mines and some 50,000 workmen. The safety setups vary, therefore, to a considerable extent. Naturally also the mine officials have ideas of their own as to what they think would be best in a safety setup. It is always good business to help them along with their ideas in this respect, for no one is as familiar with a local organization as the officials directly in charge and no one so acquainted with the conditions and practices in effect as the workmen themselves. We have found, also, by experience, that it is wise to encourage some mine officials to suggest their own setup, as they unquestionably take more interest in something which they themselves have, to a great extent, thought out.

It is not good policy to formulate rules that are not both sensible and practical and that cannot be carried out. In many companies safety suggestions by the employees are encouraged, the suggestions either being made to mine officials or a note being dropped in a safety questionnaire box, especially provided for that purpose.

The Department of Mines and Minerals, therefore, can have no definitely fixed policy in regard to a safety setup. It always is advisable to recommend a setup that will fit into the particular personnel and conditions with a minimum number of changes, so that the operating procedure may continue to run smoothly.

WEDNESDAY MORNING SESSION

October 16, 1935

Safety from an Executive Point of View

By P. C. THOMAS

Vice-President, Koppers Coal and Transportation Company, Pittsburgh, Pa.

Safety was once not a matter of great concern to management. It was more or less accepted that every occupation had its hazards and any man accepting employment must assume these risks. But the last twenty-five years have taught us that it is not necessary for men to be injured, maimed, or killed in the ordinary work incident to their earning a living. We have also learned that the executive who has accident reports appearing regularly on his desk is very likely to see red ink on his profit and loss statements. For accidents can, and often do, spell the difference between a profit and a loss.

The reason for this is, that accidents vitally affect the three major factors of management—quality, production, and cost. Quality cannot be maintained by careless workmen, or those who are prone to have accidents. If an employee is careless as to safety, he is very apt to be careless as to the quality of his work. Production is seriously interfered with when an accident occurs. We find this is particularly true in the mining industry. When a man is injured production practically ceases in the section in which he works, for it is necessary to have first-aid administered even though the injury be slight. If it is serious, or the man unable to travel, a locomotive must be used to haul him to the outside. With this disruption of the transportation system production is seriously curtailed. In the coal industry when a fatality occurs, the mine is usually shut down on the day of the funeral. When both quality and production are disturbed it naturally follows that costs will be affected.

An important item of cost is compensation insurance, whether 10 or 10,000 men are employed. Due to the liberalization of compensation laws in the various states, the rate of compensation insurance has steadily mounted. In addition to the cost of compensation for accidents alone, the matter of compensation for industrial diseases, which are akin to accidents, is being brought before State Legislatures each year and many states have now adopted compensation laws that provide benefits to men who have contracted industrial diseases in connection with their work. Any executive who fails to appreciate the fact that compensation costs are mounting and will continue to mount, is closing his eyes to the obvious. There is only one way to lower compensation costs, and that is, by means of a sane, comprehensive, and persistent safety program. Regardless of the method by which a compensation rate is computed, the fact remains that those concerns which have a low accident record have a low compensation rate.

What, then, should be the attitude of an executive in charge of property toward this important subject? Is it sufficient for him to issue instructions that a safety man be employed, have him set up such a safety program as he may see fit, and let it go at that? Unfortunately this procedure has been the cause of the failure of many safety projects.

The far-seeing executive will personally select the man who is to direct the safety work for his company: one who is not only thoroughly grounded in the basic principles of accident prevention; but one who will not hesitate to present to him the true picture of safety conditions in his plant, be they good or bad. He should place the man selected on his personal staff, so that communications from the safety department will carry the same weight as those from the heads of other departments. He should require periodic reports as to the number of accidents, their severity, and the compensation cost. In the case of fatalities, he should be immediately informed and over his own signature send such letters to his heads of departments as may serve

to impress upon them the seriousness of the accident itself, as well as means for preventing a recurrence.

It has been demonstrated again and again that when the head of a concern is not really interested in accident prevention, the knowledge of this attitude filters down along the line, and regardless of the efforts of the safety department they meet with little success. The other day I saw a poster which might be paraphrased to read "When Heads Believe in Safety, the Hands Will Believe in Safety Too." It is a peculiar thing that accident prevention will not travel upward. Foremen and gang leaders may try to make the men work safely, but if they receive no support from their general foremen or superintendents, the men soon get to know it. A superintendent may desire with all his heart to have a no-accident record and to keep his compensation cost at a minimum, but if he has a general manager or vice-president indifferent to his efforts he will soon become discouraged.

Obviously it is necessary to have workable safety rules. Failure to live up to these rules should call for discipline, but the man who is disciplined should not be made to feel that he is being punished, rather that his shortcoming is being brought to his attention so that he will remember, and not do the same thing over again. Discipline cannot succeed unless the person next in line above the man who applies the discipline is in sympathy with it. The worst possible thing that could happen is to have a foreman or sub-foreman apply discipline for a violation of safety requirements and then to have his immediate superior rescind that discipline because he was not in sympathy with the action of his subordinate.

In the coal mining industry executives have a full realization of their responsibility for accident prevention. It must be borne in mind that to promote safety in mining requires an expenditure of considerable money. Timbering costs may amount to a very high figure. When chances are taken these costs can be cut down, but it is poor policy to attempt to save by means of insufficient timbering. Likewise, the matter of rock dusting is an item of very considerable expense. On the other hand, there is now scarcely a single executive who would hesitate to rock dust his mines when needed, in order to make them safe against the terrible hazards of explosions.

Because I have spoken mostly of costs in connection with the obligations of an executive toward accident prevention, do not think for a minute that the humanitarian side of the picture is forgotten. A report of a fatality or other serious accident coming to his desk may bear a name that in itself is unfamiliar to him, but it in no way lessens the vividness of the picture of a bereaved home with perhaps fatherless children. The concern of the employee working in the farthermost parts of a coal mine and that of an executive directing the property are exactly the same; everyone loses when a man is hurt.

Discipline and Its Relation to Safety

By N. P. RHINEHART

Chief, West Virginia Department of Mines, Charleston, W. Va.

Our records show that men working in new places and under unfamiliar conditions account for more than 50 per cent of mining accidents. Unfortunately, experience alone does not always ensure safety on the job; but a long service record under familiar conditions (which in reality is training in discipline) does usually produce a good safety record.

There cannot be a formula for discipline as related to safety. But the three outstanding elements are leadership, confidence and force; and the greatest of these is leadership. When applied to the accident situation with care and diplomacy, discipline has a tendency to create organized effort which outlaws carelessness. If safety is left to mere luck, however, a gradual disregard for human suffering is the result.

It is well known that in the average mine worker familiarity breeds a contempt

of danger. How often, after an accident, do we say "If this or that had been done, this poor fellow would be alive today." The thing that was left undone too often was a wise application of discipline.

Discipline may in fact be considered to be a training school, where the education given to the employee will make him safety minded. The human element fails more times for lack of training or leadership than because of its own fundamental weaknesses. The discipline of safety education should therefore be well planned *and taught to new men immediately.*

In selecting new employees in the future, employers will, I am sure, give more attention to their willingness to accept discipline. Practical disciplinary measures administered with consideration and diplomacy help to create safe habits in employees who automatically in time build up outstanding safety records.

The term discipline should not be confused with the enforcement of petty safety rules and grudges. Safety rules should be few, short and simple. The employer who goes beyond reasonable discipline breaks down the whole safety structure of his organization. Matters in dispute should be settled promptly. The whole safety movement is doubtful as long as a single problem in discipline is allowed to continue without action. Discipline is the motive power for eliminating discords and creating good will.

When you decide to build safety by discipline, ask yourself: Are all of the management familiar with the work? Do all of the foremen have the quality of leadership? Are all of the foremen sincere and reliable? Do the foremen have the confidence of both employer and employee? Do the foremen accept discipline themselves? Have you convinced the employees that the rules are practical?

The enforcement or voluntary acceptance of practical rules among employees creates respect for the management, while on the other hand, the adoption of impractical rules breaks down discipline. Therefore, care should be taken in selecting superintendents to direct the program. The successful manager brings about safety by selling discipline to his employees. The conclusion is that practical, not petty, discipline can establish and continue accident prevention.

Discipline and Its Relation to Safety

By RALPH E. KIRK

Safety Engineer, The Philadelphia & Reading Coal & Iron Company, Pottsville, Pa.

The speaker said in part: The relation between safety and discipline seems as natural as that existing between fish and water. Ideal discipline comprises perfection in the issuance, transmittal, understanding and execution of all orders and instructions. The materialization of the ultimate or ideal in discipline would automatically relieve erstwhile harrassed executives of the major fraction of their habitual worry. Safety Engineers are specifically included in the category of "harrassed executives."

Those of you who have surveyed the records of casualty experience in the Anthracite Region have doubtless inferred that there must be room for improvement in the disciplinary standards there prevailing. This may be true. Nevertheless we feel that some explanation for the current standard of discipline and the recorded casualty experience can be found in the existence of the unique regional conditions hereinafter described.

American enterprise has repeatedly electrified the industrial world by the number and character of the sweeping changes it has *successfully planned* and executed. But in the Anthracite Industry there exists an unique condition of resistance to change that is rarely if ever paralleled in American industry. The effect of this deeply rooted antipathy to change in the existing order upon the improvement of disciplinary standards and its close associate, safety practices, is clear and unmistakable.

What character and degree of changes in the established order might be deemed necessary in the effort to improve disciplinary standards, with special reference to the evolution and support of safety practices? The answer is that all work along the lines of accident *prevention* falls in one or another of three main categories:

1. Discovery or recognition of hazards.
2. Elimination, or control, of hazards.
3. Elimination, or reduction, of exposure of persons to the hazards.

The *elimination or control* of existing hazards and the reduction of exposure of persons to existing hazards means accomplishing changes in the existing practices and conditions of employment.

Management must continue to rely upon the accomplishment of successful and successive changes in the existing order for improvement in results. In such a situation management must evolve strategy and tactics and organize the forces needed to gain its twin objectives of improvement in disciplinary standards and the enlistment of widespread support for safety measures.

The term "discipline" is not susceptible of universally acceptable definition. The concept of discipline as here used is that of a force directed and controlled by management for the purpose of co-ordinating the activities of individuals or units in a common effort planned by management.

In military service high tribute is paid to a unit when it is accurately described as being "well disciplined." Investigation of such a condition invariably reveals that the individual members of a well-disciplined command have been first of all, taught what to do; and secondly, they can be depended upon to do it regardless of the personal inclinations of any individual or group. Otherwise expressed, the first step in the establishment of discipline is provision for instruction and the second is provision of incentive. Regardless of the expediences and diversions that may be necessitated by reason of local conditions, the fundamental characteristics of any successful disciplinary system remain the same: instruction plus incentive.

Where the complete domination of management is unchallenged, orders and instructions concerning changes in the existing order are usually issued in more or less arbitrary form. Sufficient incentive for compliance on the part of the individual employee is provided by the tacitly understood condition that continuance of employment depends directly on a satisfactory degree of compliance with the order as issued.

On the other hand, when change in custom can be accomplished only by and with the consent of another directly and vitally interested party, instruction becomes of paramount importance as an activity of management. The quality of persuasiveness must be employed effectively. The wiles of the practical politican and the skill of the salesman must be substituted for the mandate of the monarch of all he surveys.

The systematic instruction hereinafter described may be loosely thought of as propaganda. It should be clearly understood that ballyhoo and high pressure methods are notoriously unsuccessful in advancement of overtures to the Anthracite worker. The average Anthracite worker is quite capable of subjecting the detailed terms of any proposition to keen scrutiny. Only propositions of genuine merit, moderately expressed and fairly intended, and which clearly provide for the effective safe-guarding of his self interest can hope to obtain either his formal approval or passive acceptance.

Although a proposal may be accepted in principle, management cannot then relax its careful attention to instruction and incentive. During the period when compliance is being expected, management may fail to obtain in practice the full advantage of the successfully negotiated change in the heretofore established custom due to lack of instruction concerning the nature and scope of the change. On the other hand the newly presented advantage may be indiscreetly pressed to such a point that the promised incentive fails to materialize completely. Subsequently charges of exploitation and bad faith may be justifiably and successfully raised.

Agencies of instruction are many in number, different in degree of effectiveness, and often strangely divergent in character. At one extreme is the straight line operating order issued by the proper management official admittedly clothed with incontrovertible authority to make such a pronouncement. At the other extreme is the personal appearance of a representative of management before the assembled workers or their authorized representatives for the purpose of presenting to them

conciliatory proposals formulated by management or of combatting antagonistic proposals which have been advanced by an influential part of the employees' organization.

Generally speaking, an overture of the management of an operation conducted ostensibly for profit must contain a definite appeal to the self interest of the person or persons to whom it is addressed if their voluntary support of such overture is to be reasonably expected.

Seldom is it practicable to offer specific incentive directly and definitely to the mass of workers contingent upon their mass support of propositions concerning improvement in disciplinary standards and safety measures. The comparatively inflexible character of the wage structure, the necessity for careful conservation of the privileges and prerogatives sanctioned by custom and agreement, the poverty of the employer and the psychology of both employer and employee combine to form a strongly negative attitude toward propositions of this kind.

Incentive appeal is usually confined to consideration of the benefit that is presumed will result indirectly from the acceptance of the proposed change. There is one basic principle concerning incentive that management must keep in mind. That principle is that a request for negotiation of a mutual agreement invariably carries the inference of the willingness to accept mutual obligation as well as the expectation of mutual *profit*.

Effective incentive appeal can be embodied in carefully balanced statements concerning the probable effect of a proposition upon maintenance or improvement in the earning power of the individual worker. Presumed reduction of the chance of injury implies increased assurance of maintenance of earning power, even though the forces aligned in opposition may be prone to uphold the fatalistic attitude concerning the inevitability of the occurrence of injury entirely in conformance with a pre-arranged plan. Presumed improvement in earning power is an even stronger incentive appeal.

A good measure of success has been obtained in many instances by a fair and careful presentation of the merits of a proposition to carefully selected individuals who possess actual or potential leadership. There is definite incentive toward favorable reaction induced by the subtle compliment thus paid by management in the recognition of the individuals so addressed. Such individuals ordinarily form the active and articulate minority who dominate the majority of the workers. If the active support of the dominant minority can be enlisted, at least passive acceptance by the great majority of the workers can be confidently anticipated.

There has been a clearly perceptible degree of lag in improvement in casualty experience in the Anthracite region in comparison with results reported from many other sectors. It is here contended that there is a direct and obvious relation between the casualty experience and the lag in advance of disciplinary standards occasioned by the comparatively inflexible conditions of employment based upon the regard for established custom. The strategy and tactics necessitated by the local conditions encountered offer striking contrast to the sweeping movements over wide fronts in pursuit of Safety objectives that have characterized action in other fields and other industries. The advance of disciplinary standards and safety practices in the Anthracite region is largely dependent upon the patience and skill displayed in the progressive capture of a number of individually small but collectively strong positions held by forces which are both well organized and inherently opposed to change. The resultant handicap thus imposed upon management is considerable, but not insuperable. The issue presented must eventually yield to the deft and patient application of the sound principles of management.

However the statement should be made in the interest of fairness that by no means is all of the lag noted in Anthracite casualty experience here alleged to be due to resistance to change in established customs and practices. Nonetheless, the resistance to changes has had a clear and unmistakable effect upon the adoption and enforcement of practices designed to bring about improvement in current casualty experience.

As a compensating offset to the relative tardiness with which progress has been made to date general conviction prevails that the results attained will prove in the long run to be more enduring in beneficent effect than the sensational results so frequently obtained elsewhere by free and practicably unlimited exercise of the abundantly possessed police powers. Otherwise expressed, voluntary support patiently acquired as the result of conversion is confidently expected to exert a more permanent influence than compulsory adherence to regulation obtained largely or solely on tacit reminder of present economic dependence.

Both men and management in the Anthracite region are alert and active. Both men and management sincerely deplore the aggregate casualty experience and sincerely desire to effect improvement. It is the responsibility of management to evolve acceptable ways and means to make the desire a reality. The responsibility has been definitely accepted. Regardless of handicaps, and the demand for patience and skill in overcoming them, progressive improvement in casualty experience, due to improved standards of discipline soundly based upon genuinely co-operative effort can be confidently expected from the Anthracite region in the not distant future.

Discipline and Its Relation to Safety in Metal Mining

By J. W. ALT

Safety Engineer, Calumet & Hecla Consolidated Copper Co., Calumet, Mich.

There is no question that discipline is very essential in the promotion of better safety; however it is less important than several other subjects that tend toward the prevention of accidents.

In the preliminary steps of organizing for better safety it is necessary, for the safety engineer to observe working conditions; to study accident reports and causes of accidents; to gradually outline a set of safe practices and to subdivide these as regards the different classifications of labor; to establish with the men and bosses his sincerity of purpose in performing a task that will be of benefit not only to the company but also to the men; to encourage the men and bosses to offer suggestions for the betterment of safety; to hold safety meetings of the bosses; to establish a good bulletin board system; to keep safety records of the individual employee and of each shift boss; and to keep the safety record of each shaft or each department.

After the safety department has carefully observed working conditions, studied accident reports and outlined a set of safe practices which have been fully discussed and approved by the bosses and department heads, the rules are then published in book form, and a copy is furnished to every employee with the understanding that he must be familiar with those pertaining to his particular work and that these rules must be strictly followed.

When the men have become familiar with these rules, discipline will be of vital importance. We have found that discipline has great effect not only on the man who has been disciplined but on the whole organization. News of this kind travels far and wide, not only is the case known in the shaft or department, but to a number of other shafts or departments. Proof of this is shown in the following instances.

In making a tour of inspection of one of the shafts, a safety engineer saw some sticks of powder on the ground near the powder container. This was reported to the shift boss who investigated and found the offender. He told the man that he could not work again until he had seen the head mining captain. The mining captain referred the man to the shaft captain, who said that he wouldn't take him back until he had squared himself with the shift boss. This man was kept off of the job for four days. The next day an inspection trip was made to a shaft at the opposite end of the property, where a good many employees already knew of this violation. This put a stop to violations of this kind.

On a tour of inspection a safety engineer came to a miner who had started a hole without using his goggles. This was reported to the boss who immediately sent the man to the surface and the same procedure was followed as in the case mentioned above. Since this case we have not had a serious eye injury.

One of our most common difficulties with workers is to secure the reporting of small cuts, scratches and other small injuries. Recently a miner in sledging a

piece of rock was struck on the back of the hand by a stone which caused a small cut. This happened on Tuesday and he continued to work without having reported to his boss. On Friday he went to the hospital with a badly infected arm and hand. He was kept in the hospital for about a week and was home for three weeks. When he returned to work he was reprimanded and given a lay-off of four days.

Discipline should apply not only to the men but to the bosses as well. In the early stages of our safety work several of the bosses were not putting forth their best efforts to remedy unsafe conditions. So we decided to inaugurate a point system which consisted of inspection reports to the shaft captain and head mining captain. These reports were posted where they could be read by the shift boss. Now a monthly, quarterly, and yearly record is kept of each shift boss' run. The boss having the fewest points for the month is given a small cash prize, but to obtain this he must not only have the least number of points but also go through the month without a lost-time accident. Bosses who were accumulating too many points against their run and who did not show the right attitude in correcting unsafe conditions were notified to appear before the head mining captain. Some of these bosses who were reprimanded later came through with fine safety records, while others have been demoted.

A mistake made by some bosses is to correct unsafe conditions themselves, rather than stop a man from work and make him correct the condition. When a boss goes on correcting unsafe conditions in this manner he only tends to make matters worse because the attention of the men is not called to poor practices. Some of the common mistakes we found in the early stages of safety development were as follows: Boss barring loose ground, bending or pulling protruding spikes or nails, picking up drills, or other material from the center of the track, putting stopper in chute, cleaning up under chute, replacing guard chain across the shaft, hanging up bell lever, and putting poor tools aside to be sent to surface. All of these things should have been corrected, but not by the shift boss. If the boss had given his men proper instructions and then the men were not carrying out these instructions, they should have been disciplined.

Discipline in the promotion of accident prevention is valuable but it should be a last resort. Isn't it better to do everything possible toward the safety education of the worker so that he will see that it is to his advantage to work carefully and avoid injury? A shift boss has only a limited amount of time. He cannot watch a man perform all his various tasks. If the man has been well instructed in the hazards of his job and has a proper regard for his own safety he will not need watching. The boss who tries to improve the safety of his territory and of his men will be a far happier boss than one who is always on the lookout for some violator of the safety rules whom he can discipline.

In our educational program we have issued to each employee a book of instructions and rules for the prevention of accidents. Three bulletin boards are located at prominent places. In these boards are displayed a news picture, a National Safety Council poster, and a home-made poster, with the number of days that the shaft has gone without a lost-time accident. In the home-made poster attention is called to some unsafe practice or hazard of our particular working conditions. We are fortunate in having a man in our safety organization who can draw these pictures and they arouse considerable comment. The shift bosses are held responsible for the knowledge their men have of the bulletin board, and to further stimulate interest we occasionally offer small prizes for the best answers to questions about the bulletin board, and to questions pertaining to safety and the general condition of the working place. If 75 per cent of the men under a shift boss do not know what is on the bulletin board, a point in the point system is recorded against the boss. It is surprising the amount of interest this creates.

A small loose leaf book for each shaft is kept with the accident record of each man, this record being brought up to date monthly. At various times each man's record is discussed with him. For outstanding records we make an award of the best type of hard boiled hat with a safety emblem attached.

We have also on several occasions put on a safety contest, using two large pictures. On these pictures are drawings of good and bad practices. The pictures are displayed at each change house for a period of three days, and the men are given the opportunity to write down what they consider good and bad practices.

These papers are graded by the safety department. A first, second, third, and several small prizes are awarded to the men in each shaft having the highest marks. A great deal of discussion always takes place at the time these pictures are displayed and we feel that the educational work derived from these contests is well worth while.

Captains and shift bosses are furnished with a copy of all regular accident reports which show the number of accidents for the month and year to date, with the frequency for each shaft, and also a comparison with last year's record for the same period. This report also shows the shaft's present, and best, records in days and shifts, together with the individual standing of each shift boss, the date of his last accident, the number of accidents he has had for the year to date, his present record in number of months, his best record in months, and his standing, which is determined by the date of his last accident together with the number of accidents that he had for the year.

An understanding exists with the men that when their shift goes through a year without a lost-time accident, their shift will be given a dinner. These dinners are very popular and have aroused enthusiasm for better safety. Following the dinner, the evening is spent in playing cards and other amusements including several boxing exhibitions.

We have found that through better leadership disciplinary measures automatically become unnecessary. Some of our shift bosses have found it unnecessary to discipline a single man. The experience of one outstanding man is quite interesting. This shift boss had a record of 15 consecutive months without a lost-time accident, and then he was transferred to another shaft where the accident frequency was considered high. During the first three months that he was at this shaft, four accidents occurred on his shift, but in the following 19 months not a single lost-time accident occurred. Again this shift boss was transferred to another shaft, and a few weeks after he had assumed his new duties a five day lost-time accident occurred; but after that one mishap, up to the present time, this boss has completed seven months without a lost-time accident.

THURSDAY MORNING SESSION

October 17, 1935

Are We Introducing New Hazards in Coal Mines Faster Than We are Eliminating Existing Hazards?

By DANIEL HARRINGTON

Chief, Health and Safety Branch, U. S. Bureau of Mines, Washington, D. C.

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Careful analysis of the main causes which enter into the killing and maiming of our coal miners—falls of roof and coal, haulage, explosions, electricity, machinery, explosives, shaft accidents, surface accidents, and miscellaneous accidents—shows that real progress in preventing fatalities has been made in only two classifications—explosions and the use of explosives. It also shows that slight progress has been made in the prevention of miscellaneous accidents and of accidents in and around shafts. However, essentially no progress has been made in reducing injuries from falls of roof and coal or from surface accidents, while there has been a definite increase in the rates for haulage accidents and those due to electricity.

Explosion disasters, including fires, have been identified luridly with coal mining, and for many years they were considered an inevitable part of operation. However, the main effort toward bringing about safety in coal mining has been directed to the prevention of these dreadful occurrences, apparently with a measurable amount of success in the past few years. Early in this century many of our most disastrous coal-mine explosions were caused by ignition of gas or dust or both by shooting off the solid during the working shift, using black blasting powder or dynamite, almost universal coal mine practice. In time, most of our coal was cut by machines (now 85 or more per cent of our bituminous coal is machine-cut) and the very much safer permissible explosives largely displaced black blasting powder and dynamite in blasting coal. Moreover, some mining states and many progressive mines did much if not all blasting when the working personnel were out of the mine. As a result of precautions taken, relatively few major coal mine disasters have been caused by blasting for the past 20 years.

Unfortunately, however, while the material lessening of solid shooting and of the use of black blasting powder and dynamite, along the extension of the firing of shots on the off shift, gradually decreased the occurrence of explosion fatalities from these causes, extension of undercutting and other methods of mining coal tended to speed up the loosening of coal; with it, the release of considerable quantities of gas and dust and explosions of gas or dust by open-light ignitions held the rate of occurrence of fatalities from explosions and fires at least as high as when solid blasting with dynamite and black blasting powder during the working shift were in effect.

The introduction of the electric cap lamp some twenty years ago into gasy mines largely eliminated the open light from the most dangerous mines, hence materially reduced the occurrence of explosions by open light ignition. Again there was relatively little relief from gas and dust explosions, because about as soon as the use of electric cap lamps reduced open-light ignitions, expanded use of electrical equipment in coal mines gave a new igniting agent in the form of the electric arc. Disasters continued to occur with unabated vigor, there being many very disastrous explosions in the years 1924-30, the period of maximum intensity of introduction of electrically operated mining machinery.

Many of the explosion disasters with excessively heavy loss of life in this period were caused by gas or dust ignitions by electric arcs. The firscal year 1928 had a particularly bad record in this respect, as 282 or 82.5 per cent of the 342 people killed in explosions in our coal mines were killed in explosions started by electric arcs. In fact, for the 5-year period from July 1, 1927 to June 30, 1932, out of 984 persons killed in explosions in our coal mines, 683 or 69.4 per cent were killed in explosions started by electric arcs. Fortunately, the number killed in explosions of electrical origin was but 11 (or 12.7 per cent) in the fiscal year 1932, the last year of the above mentioned five-year period. In the fiscal year 1933 there were but 25 persons killed in coal-mine explosions of electrical origin and but 21 in the fiscal year 1934, the last period for which final data are available. It now appears that at last we have (at least temporarily) practically conquered *all* of the main causes leading to coal-mine explosion ignitions. At any rate their destructiveness has been decreased, as there were but 7 fatalities from major coal-mine explosions and fire disasters in the one major disaster in the calendar year 1933, but 22 in the two major disasters in the calendar year 1934, and but 28 in the three major disasters in 1935 to August 1.

While the past three years have been relatively free of major disasters (and it is due to this fact chiefly that our coal-mine fatality rate has been kept low) there are good reasons to fear that the lull is but temporary. Our coal mines are now embarking on new methods which, if not carefully safeguarded, are likely to precipitate another series of disasters. The extension of mechanization has brought about a persistent demand for blasting coal during the working shift (frequently with little safeguarding), which is a definite recession from progress made in the past. Unquestionably much of the considerable reduction of fatalities from explosions due to blasting in the past 25 years has been due to the fact that much of the blasting has been done on the off shift and by shot fires. The Gresford disaster in Wales in September, 1934, with 263 deaths, as well as several other recent British coal-mine disasters, are suspected of having been caused by blasting with the shift in the mine, and British coal-mine blasting practice is now being subjected to severe scrutiny.

Another potential source of explosion disasters is the present tendency to utilize multiple shifts in coal mining; there is no question that there is a definite relaxation of discipline and supervision on night shifts because the higher mine officials necessarily work during the day shift.

Early in the present century coal was obtained chiefly by being blasted from the solid, using black blasting powder or dynamite with squibs or with so-called safety fuse, practically all blasting being done by the individual miner largely as he pleased. In those days sightless, armless, and legless ex-miners were by no means an unusual sight and fatalities were numerous. Later some mines took the blasting out of the hands of the individual miner and entrusted it to shot firers. This was of some aid in reducing individual explosives, accidents, especially when the shot firer worked on the night or other off shift, although many individual short firers were killed through foolhardiness, or negligence.

The introduction of cutting machines with resultant changes in explosives practice, especially the material decrease in the size of the explosive charges used, was a long step in decreasing blasting accidents. But the development of permissible explosives after the Bureau of Mines came into existence in 1910 and their displacement of black blasting powder and dynamite unquestionably was one of the most far-reaching advances in the present generation. The gradual introduction of electrical blasting methods in conjunction with the use of permissible explosives has also aided much. The mines of the anthracite region of Pennsylvania have had a much worse accident rate from the use of explosives than the bituminous industry.

During recent years there have been some disquieting tendencies in mine blasting practice. Among them is the introduction of black blasting powder in some consolidated form instead of its former granular shape but having many of the dangerous characteristics of ordinary black blasting powder. The exigencies of mechanized mining appear to demand blasting during the working shift, using some form of blasting device or even ordinary explosives. This is bound in time to result in disaster as it has been doing in British coal mines for several years.

In the early days of the present century coal-mine roof-fall accidents were in large part due to the violent blasting practice then in effect. Shooting off the solid with heavy charges of black powder or dynamite would severely shatter the roof as well as the adjacent coal, with shots in one place in a mine jarring down the loose material in another place upon hapless workers at almost any minute of the shift. With restriction of blasting to the off shift and using of shot firers this hazard was largely reduced.

With the advent of cutting machines, and later on permissible explosives, smaller charges of explosives were used, thus helping to protect the roof, but there were relaxations as to the time and other precautions of blasting, and with the increasing size and deeper cover of mines and seasonal or other rush demands for coal, mines or parts of mines were "gutted," squeezes, creeps, bumps, and other influences tending to keep mine roof in a broken tender condition also intervened, and with blasting allowed at all times in the day, the loose roof material was being more or less continuously shaken down on the workers.

Another serious trouble in connection with falls of roof is the fact that the man in charge of a coal mine usually feels that his personal reputation and future advancement depend upon getting out cheap coal, so the practice is to take the cream in the form of the "easy" coal (usually advancing rooms) and leave the "skim milk" (the pillars or the deficient coal) to the next fellow who follows in charge of the mine. The roof of many a mine has been ruined by this by no means unusual practice, and when the "other fellow" tries to extract long-standing pillars he usually finds the coal broken and friable and the roof treacherous in the extreme.

Very often the "other fellow" too takes the "easy" way by failing to pull the pillars systemmatically, seldom are they kept in line, timbering is not always kept in shape (in some cases not enough timber or not the right kind is supplied), supervision of the miner's attack on the pillars is frequently lax, and he is prone to take "easy" coal back from the face even when by doing so he may precipitate premature falls.

When the advent of mechanized loading numerous new conditions were introduced, many of them unfavorable to the prevention of roof-fall accidents. The highest rate of roof-fall accidents in the history of coal mining in the United States occurred in the period 1927-32, or about exactly coincident with the peak of the increase of mechanized loading in the United States. The worst roof-fall fatality rate in the history of coal mining in the United States was encountered in 1930, but fortunately

this has receded rather rapidly, the rate for 1933 being much lower than the average for the past 30 years.

The worst disappointment met by the coal mine safety worker in the past 30 years is the fact that in rate of occurrence of the major cause of coal-mine fatalities, falls of roof and coal, there has been essentially no progress nationally. For a generation around 50 per cent of all coal-mine fatalities have been caused by falls of roof or coal, and at least 99 per cent of the cases have been one-man accidents. If it were not for numerous instances in which mines with extremely bad roof conditions, have through intensive timbering and equally intensive supervision been able to operate with relative freedom from roof-fall accidents, one might be driven to the conclusion that nature had so arranged affairs that these accidents simply couldn't be avoided.

Early in the present century much of the coal-mine haulage was by mules and relatively small combination wood-iron band pit cars. Even then, haulage fatalities, while only about one-half as numerous as the fatalities from explosions, were far too frequent.

With the gradual speeding up of practically all phases of coal production, haulage accidents increased, reaching a high rate during the heavy production war period, a much higher rate during the period of lower production, 1921-1926, and a peak in the period of rapid expansion of mechanized loading, 1926-30, and receding slowly during 1931 to 1933, the last year for which comparable figures are available.

One feature which has intensified the risk is that frequently cars and locomotives have been increased without increasing the size track rails and ties. Also in more recent installations wider and higher locomotives have been placed in service without increasing the side or top clearance of the haulageways.

The much more extensive use of the trolley-locomotive system during the past two decades is unquestionably responsible for a considerable part of the higher haulage accident rate. The bare trolley wire has in many instances caused workers to be thrown under cars or between timbers and cars. In addition the trolley system has caused many deaths charged to electricity, and has initiated several mine explosions. While the trolley locomotive has several advantages from an operating standpoint, it certainly is ultrahazardous. Consideration should be given to the possibilities of the compressed air, the storage battery, or possibly in time the Diesel engine or some similar type of engine to displace the trolley locomotive.

Beginning about 1905 electrical appliances were introduced rather rapidly in coal mines, the fatality rate from this cause increasing to its present rate between 1910-15. Somewhat fewer than 100 persons are killed from this cause each year in the coal mines of the United States. The trolley-locomotive system, with its deadly bare wire, usually unprotected, accounts for nearly half of the contact electrical deaths in our coal mines. This is a hazard which should not be allowed to continue year after year.

In so far as major mine fire and explosion disasters are concerned, the electrical hazard seems to have been fairly well curbed—at least for a time—but it seems probable that most of the credit should go to rock-dusting and good luck rather than to precautions with electrical equipment. The hazard of death from contact with electricity, while apparently lessened slightly in 1934 and 1935, remains fundamentally with probably greater powers for destruction in the future than in the past unless our coal mining people become awake to the menace of the unguarded trolley wire and poorly guarded electrical equipment now so widely used.

Mining, especially coal mining, is an occupation little understood by persons not actively engaged in it, and not any too well understood by persons who have made it their life work. These generalizations are more definitely applicable to the United States than probably to any other country. The vast area of the United States, with the varying conditions under which mining is carried on in the different regions, many of them hundreds of miles apart, makes it almost impossible for any one person to have anything like an adequate knowledge of the industry as a whole.

Safety in mining has made less progress than in many other so-called hazardous industries. This is true of many other countries as well as of the United States.

Certainly, in this day no thinking person familiar with mining will accept the explanation that mining is an unsafe occupation because of its inherent hazards and must continue to be ultrahazardous. There are now available so many instances of long-time operation of individual mines without accident occurrence or with low

accident frequency and severity that we know now that proper procedure will reduce accident occurrence at least one-half or even three-quarters from recent performance.

That definite progress is being made in this direction is proved by numerous facts. In 1932 (the latest year for which data are available) 70 per cent of our bituminous coal came from mines that operated throughout the year without a fatality. There was but 53.6 per cent of this non-fatality production in 1931 and but 49.8 per cent in 1930. Also in 1932 all of the fatal accidents in bituminous mines came from properties producing less than one-third of the total output for that year.

The safety man in coal mining has for years been in the position of the mythological toiler whose job was to roll a huge ball up hill. Relaxation on his part would allow the ball to roll back and crush him. Scores of influences have intervened to block safety efforts: the alternating periods of feverish desire for maximum output, as during the war period and the opposite extreme of painful deflation of the years 1920-21 and 1930-33 have seriously handicapped efforts to prevent accidents. The "sprags" placed on safety endeavor by the numerous labor disturbances which have confronted coal mining in the past thirty or more years can't be overemphasized. The cutthroat competition which has prevailed for most of this generation has interposed almost insuperable bars to progress. The "economies" necessary to allow coal sales at cut prices are largely assessed on personnel, not only in wage cuts but also in retrenchments in safety.

Rapid and often ill-considered changes in mining methods, with the placing of ill-fitting equipment in mines without sufficient training of workers in the new methods has often blocked the efforts of those trying to make the mines less hazardous. Numerous other instances of similar nature might be cited.

However, nôtwithstanding the up-hill work of the past and some possible shadows which appear to be falling across the future, there is reason for hope. Many of our progressive mines have shown definitely that coal mining can be carried on with relative safety. The fellow who fails to "get on the band wagon" may be forced out of business. After all, safety pays, and ultimately unsafe mines will be found impossible to operate.

Accident Prevention Methods on the Colorado River Aqueduct Project

By T. W. OSGOOD

Chief Safety Engineer, The Metropolitan Water District of Southern California, Los Angeles

The measures practiced to safeguard the 10,000 workmen engaged in building the Colorado River Aqueduct will be better understood if some idea is had of the magnitude of the project. The main aqueduct extends over desert valleys and through barren mountains, a distance of 242 miles from the Parker Dam located on the Colorado River 150 miles down-stream from Boulder Dam, to a terminal reservoir near the eastern margin of the coastal plain. Parker Dam, being constructed by the United States Bureau of Reclamation, is of concrete arch design 800 feet long and with a maximum height of 315 feet from bed-rock.

The principal features involved in the construction of the project include the following:

1. The main aqueduct will embrace 91.94 miles of concrete lined tunnels 16 feet in diameter, 62.47 miles of concrete lined canals, 54.65 miles of cut and cover concrete conduit, 28.86 miles of inverted concrete siphons and pressure pipes, 1.19 miles of pump discharge lines, 0.91 miles of open cut into the first terminal storage reservoir, and 2.29 miles through intervening reservoirs, a total of 242.31 miles. The aqueduct is designed for a capacity of 1,605 cu. ft. per second, or approximately one billion gallons per day. Five pumping stations will be constructed, the electric power to drive these pumps being generated at Boulder Dam and delivered to points on the aqueduct by a 230-KV transmission line 237 miles long; incidental to this feature 148 miles of telephone lines will be constructed.

2. The distribution system embraces 16 miles of concrete lined tunnels 10 feet in diameter and 133 miles of pipe lines.

3. The Cajalco dam, at the junction of the main aqueduct and the distribution system, is of earth-filled type, maximum height 90 feet and length 7,500 feet.

Actual construction on the aqueduct was begun in February, 1933, and work is now under way on all phases of the main aqueduct and on the distribution system tunnels. Along the 386 miles of the project there are construction camps which are models of sanitation and comfort. Refrigerator trucks deliver food-stuffs to refrigerators at the camps; laundry service is available, and there is daily mail service. First-aid supplies are maintained at points accessible to the work; there are first-aid stations in charge of trained nurses at the various camps; and well equipped hospitals with surgical and medical staffs are located at strategic points. Construction work is being carried on 24 hours a day, in eight-hour shifts.

Safety on the aqueduct had its inception in the timely adoption by The Metropolitan Water District of Southern California, of this policy: "The application of every possible safety measure shall be practiced."

1. The Safety Division consists of a chief safety engineer, three assistant safety engineers, and a secretary. The safety engineer acts in a consulting capacity, studying the safety problems and advising the executives and supervisors of the hazards and of measures to correct them, cooperating with the supervisors in the conduct of their safety work, keeping the executives and supervisors informed on the accident trend, of the causes and consequences of accidents and of measures for preventing accidents.

2. The division engineers in charge of construction cooperate in the safety activities and are vested with authority to enforce safety measures.

3. Upon the construction supervisors is placed the responsibility directly to prevent accidents.

The accident prevention methods fall under the two general headings: "Timely elimination of hazards" and "The development of the safety spirit within the entire organization."

The elimination of hazards has been well served by generally good and, for the most part, new mechanical and electrical machinery, and other equipment; these have been kept in good repair, hazardous points are guarded so far as practical, and the men use goggles, respirators, hard-toe shoes and similar protective devices. All workmen and other persons, while in a tunnel, are required to wear protective hard hats.

On tunnel operations, wet drilling is employed, headings are barred down after each blast and timber or steel support is placed wherever necessitated by unstable rock or ground. Prior to September 1, 1935, 80 miles of main aqueduct tunnel had been bored and of this, 59 per cent was supported by timber and steel, and 14 per cent by gunite.

In the San Jacinto 13-mile tunnel excessive quantities of water were encountered, 7,500 g.p.m. at one heading, but the maximum flow at five other headings has been approximately 3,000 g.p.m. Measures to alleviate this hazard embrace the drilling of test-holes 35 feet ahead of the face; construction of suitable bulkheads; pressure grouting; placing tunnel support; installation of 30 inch water pipe lines and heavy duty pumping units. In the 7 mile Valverde tunnel the maximum inflow of water at any one of eight headings was 3,000 g.p.m. and some 30 foot sections produced a maximum of 900 g.p.m. Effective safeguarding measures also were taken in this tunnel.

Safety provisions appurtenant to tunnel haulage include:

1. Man-cars are provided for safe and comfortable transportation of workers, the most acceptable type being of steel enclosed construction, with seats installed lengthwise of the cars. Man-cars are pulled, not pushed, by the locomotives.

2. Electric battery and electric trolley locomotives are used exclusively for underground haulage.

3. Car couplers are divided about equally between the automatic type and the bar-and-pin and link-and-pin types. Automatic couplers facilitate haulage and from the safety angle are far superior to other types.

4. Other haulage safety features are good trackage with the switch frogs and guard-rails blocked with wooden wedges, lights at both ends of trains, block signals and rules for safe operation of trains.

Tunnel illumination is adequately provided by electric circuits; however, during preparations for blasting electric battery flood-lights only are permitted in the headings.

Ventilation in the tunnels is provided by blowers of suitable capacity and 20 or 22 inch pipe lines for conducting air from the surface to tunnel headings. After blasts have been fired, the powder smoke is exhausted by reversing the blowers. Every possible safeguard is thrown around the storage, transportation and use of explosives, the principal features being:

1. Fire-proof, bullet-proof and well ventilated magazines are provided for the separate storage of dynamite and blasting caps, and for making primers, and slitting dynamite cartridges. These magazines are located at least 100 feet apart and at safe distances from construction operations, buildings, highways and railroads.

2. Second class portable magazines for the separate storage of dynamite and primers in quantities not exceeding 100 pounds are constructed of two-inch planks. When placed in the tunnels, these magazines usually contain less than 100 pounds of explosives for use in blasting shallow block-holes.

3. The sign, "MAGAZINE—EXPLOSIVES—DANGEROUS" is posted conspicuously on magazines which are kept locked whenever unattended by an authorized person.

4. Explosives are transported from points on railroads in automobile trucks equipped with sides and tail-gates and with warning signs and red flags displayed at the front and rear. The safe operation of trucks is governed by appropriate rules.

5. Dynamite and primers are transported from magazines to tunnel headings in separate powder cars, or in two-compartment powder and primer cars.

6. Smoking and open flames are prohibited where explosives are stored or handled.

Electric detonation, employing 440 volt alternating current, is used exclusively for firing blasts at tunnel headings. The equipment embraces:

1. Blasting lines extend from blasting switch to heading and consist of No. 8 AWG single conductor rubber covered or waterproof, copper wire, installed on insulators on side of tunnel opposite all other electric circuits and pipe lines wherever possible; wires are spaced at least five inches and placed not less than eight feet above tunnel floor; splices are staggered and provided with insulation equal to that of the wire.

2. At the source of blasting current, a separate 2300-440 volt 5-KW minimum capacity transformer is provided exclusively for blasting. An externally operable fused switch of 60 ampere capacity, fused at not less than 35 amperes, is installed at the transformer. This transformer and switch are located on the same side of the tunnel, adjacent to each other and to the 2300 volt electric circuit.

3. The blasting switch is externally operable, double-pole, double-throw type of not less than 60 ampere capacity, normally held in the "off" position by a spring attached to the handle outside of switch box; in the "off" position the two wires of the circuit are short-circuited but not grounded; the line clips are equipped with arc quenchers; the switch box cover cannot be removed when the switch handle is locked in the "off" position, and the handle can be locked in the "off" position only; this switch is located opposite and on the other side of the tunnel from the transformer.

4. The transformer and switch, and the blasting switch are located not less than 1,000 feet or more than 3,000 feet from the tunnel face.

5. A two-conductor No. 8 AWG type "S" portable cord 20 feet long is provided to make connection between the switch at the source of blasting current, and the blasting switch; the cord and switches are equipped with locking type plugs and receptacles of not less than 60 ampere capacity and are not interchangeable with those at any other camp.

6. The safety switch is located not less than 500 feet from the tunnel face, of the same type and rating as the blasting switch, but not equipped with a spring. In the "off" position this switch provides a break in the blasting line, and the wires leading to the face are short-circuited but not grounded.

7. Lead wires are No. 16 AWG single conductor rubber covered copper wire, or No. 16 or 18 AWG single leading cotton covered annunciator wire.
8. Bus wires are not smaller than No. 16 AWG bare copper wire.

The track, pipe lines, and other similar electric conductors are bonded at intervals not exceeding 1,000 feet and are grounded. The tunnel blasting rules include the following:

1. Before explosives are delivered to the face, all electric circuits shall be removed at least 200 feet from the face and disconnected from the source of electric energy. These circuits shall remain at this location and shall not be energized until after loading operations are completed and the blast fired. During loading and connecting a round, the heading shall be illuminated by electric battery flood lights located approximately 100 feet from the face.
2. All switches in the blasting line, and the connecting cord, shall be kept locked in the "off" position except at time of firing.
3. Blasting keys shall be kept on the person of the shift boss, who shall do all shot-firing.
4. Electric blasting caps shall be tested with an approved galvanometer; this shall be done in the primer make-up magazine and the cap shall be placed in a shield during test.
5. Before connecting lead wires to the blasting line, the line shall be tested with an approved galvanometer, to make certain that the line is not energized.
6. Cap-wires shall be short-circuited until connected to the bus-wires; bus-wires shall be shorted until connected to the lead-wires; and the free ends of lead-wires shall be shorted up to the time they are connected to the blasting line.
7. Bus-wires and lead-wires shall be suspended on wooden supports and shall not contact any other object or the ground.
8. During loading and connecting a round, the number of men at the heading shall be kept at a minimum, all others shall retire to the blasting switch.
9. Electric blasting or preparations for electric blasting shall not be done during electric storms.
10. Wooden tamping sticks only shall be used, and sawed off after each use in loading a round.

Safety primers are used exclusively in blasting at tunnel headings and to a considerable extent on contract work. The safety primer consists of an electric blasting cap inserted and glued in a longitudinal hole bored through a wooden plug.

On the surface work, provisions for safe storage, handling and use of explosives, similar to those for tunnel work, are made operative wherever applicable; open cuts are sloped to safe angles of repose and loose rock and boulders are barred down; safe means is provided for transportation of men by trucks from camps to and from the work.

A good safety spirit exists throughout the entire organization; this spirit has been developed through the following mediums:

1. Safety committees, representative variously of the executives, supervisors, engineers and workmen, hold an average of 40 meetings each month at convenient points along the aqueduct. Ways and means for furthering safety are discussed and are put into operation.
2. Safety literature published by the National Safety Council, U. S. Bureau of Mines, U. S. Public Health Service, U. S. Bureau of Labor, California Industrial Accident Commission, American Institute of Makers of Explosives, compensation insurance companies and other recognized authorities, has been distributed among the construction forces. These organizations have rendered many other valuable services which have had a direct bearing on accident prevention.
3. Bulletin boards, located at the camps, are serviced with safety posters and bulletins at frequent intervals.
4. First-aid training has been conducted annually in aqueduct camps by the U. S. Bureau of Mines and additional training has been conducted by compensation insurance companies and by the Safety Division of The Metropolitan Water District. Inter-camp first-aid contests are held and prizes awarded.
5. A mine rescue station is maintained by The Metropolitan Water District under the supervision of its Safety Division and includes an enclosed truck, ten sets of McCaa oxygen-breathing apparatus and appurtenant mine rescue equipment. Six 5-man rescue squads trained by the U. S. Bureau of Mines are kept intact. This unit is available at any point on the aqueduct, but to date there has been no occasion for calling it into service.
6. Safety contests are a continuous feature and monthly and annual awards are made on the basis of lowest accident frequencies.
7. Copies of safety rules are distributed among supervisors and workmen.
8. Sanitary facilities are provided and appurtenant regulations are operative in the tunnels and on the surface.
9. Disciplinary measures have been applied for infractions of the safety and sanitary rules.
10. Records of accident frequency, severity, causes and costs are compiled and distributed within the organization.

The Hanna Coal Company of Ohio's System of Safeguarding the Health of Employees and Their Families in Mining Communities

By WILLIAM ROY, SR.

Safety Director, Hanna Coal Co. of Ohio, St. Clairsville, Ohio

The first step in creating our benefit association was to call a meeting of all the men at each mine. The proposition was put to them for vote and, after being accepted, steps were taken to conclude the arrangements. Committees were appointed to draft by-laws and discuss the question with local and state medical societies. The by-laws were presented to the men as a whole. When accepted, they were printed, distributed and put into effect.

The rules provide that all persons working for the Company, and their dependents, are beneficiaries.

Any person living with and dependent upon a member receives the same benefits as the member, except in case of death, which is based upon age or relationship to member.

The by-laws apply at all mines, yet each mine is a unit and not responsible to the other.

The by-laws cannot be changed, except upon the vote of all units.

A committee, consisting of six, controls the affairs of each unit. The safety director, one member appointed by the general manager, and four members elected by the entire membership comprise this committee. They have the power to appoint the chairman, vice-chairman, secretary, and treasurer, but only the committee has the right to vote.

This committee meets once each month and all bills contracted during the month must be passed on by this committee before they are paid.

The committee hires the doctor but the selection must be satisfactory to, and approved by, the general manager of the company.

In all other cases, the committee's vote is final, provided, however, it cannot violate the by-laws.

The necessary funds are raised by check-off, married men and single men paying a stipulated amount each month.

The company furnishes an emergency hospital at each mine. It contributes the safety director's time in checking all bills, securing agreements with surgeons, specialists, and hospitals, and looking after the general welfare of the membership. It also contributes to the association in case of death of a member or dependent.

The association doctors receive 45 per cent of the total amount of the check-off from their unit and, for this amount, attend to all medical cases, perform all minor operations, and furnish such medicine as is needed. The other 55 per cent stays in

the treasury to be used in special cases; such as, operations, hospitals, etc. also to pay death benefits.

All members must use the association doctor, except in case of emergency. They have, however, the right to select the hospital and surgeon, if such is necessary.

Cases existing at time of employment are not cared for, and liability ceases at time the member leaves employment of the company.

All other details are covered by the by-laws and a strict compliance with same covers a multitude of cases and works out in a successful way, as the following will show.

The association has been in effect a number of years, but I shall give you the income and volume of business transacted in 1934. During that year, we had approximately 2,500 members who, in addition to a large number of dependents, benefited by the arrangement.

The expense for medicine, in the following figures, was for special serums, antitoxins, or medicine used in hospitals, and does not include the medicine used by the association doctors in their regular practice.

In giving the number of hospital cases, it refers to only those that were sent to outside hospitals.

Many operations were performed in our own emergency hospitals and some special cases were treated at the office of specialists.

The death rate per thousand persons involved is only about 50 per cent of the rate in the State of Ohio.

INCOME FOR 1934		$56,201.09
EXPENSES:		
Hospital wards	$ 5,683.45	
Operating room	1,386.25	
Anesthetic	622.00	
Medicine	686.23	
X-rays	2,048.40	
Laboratory fees	401.76	
Dressings	155.23	
Death benefits	5,115.00	
Ambulance	239.00	
Specialist or surgeon	13,643.86	
Committee expense	58.36	
Miscellaneous	615.56	
Association doctors' salaries	23,147.78	$53,802.88

Association doctors treated their patients 41,242 times. There were 294 hospital cases and 45 deaths. There were 238 men, 245 women, and 395 children, who received special treatment or operations.

Any medical arrangement can be a success if all parties cooperate, and if it is conscientiously supervised and honestly administered.

ADJOURNMENT

Paper and Pulp Section

Officers 1934-35

General Chairman—*H. D. Banta, Hoberg Paper and Fibre Co., Green Bay, Wis.

Vice-Chairman in Charge of Membership—E. E. Grant, The Crystal Tissue Co., Middletown, Ohio.

Secretary and Program Committee Chairman—F. L. Irvin, St. Croix Paper Co., Woodland, Maine.

News Letter Editor—T. L. Christensen, Continental Paper & Bag Corp., Marinette, Wis.

Engineering Committee Chairman—J. H. Turner, Consolidated Paper Corp., Ltd., Montreal, P. Q., Canada.

Statistics Committee Chairman—A. E. Winslow, Hollingsworth & Whitney Co., Waterville, Maine.

Poster Committee Chairman—J. J. Hastings, Port Huron Sulphite & Paper Co., Port Huron, Mich.

Contest Committee Chairman—A. Scott Dowd, The Paper Industry, Chicago, Ill.

Health Committee Chairman—Dr. E. W. Paine, Hollingsworth & Whitney Co., Waterville, Maine.

Members at Large—

George J. Adams, International Paper Co., New York, N. Y.
W. J. Brennan, Maine Department of Labor and Industry, Augusta, Maine.
Kenneth L. Faist, The Champion Coated Paper Co., Hamilton, Ohio.
H. G. Gilson, Fitchburg, Mass.
W. A. Gleason, Hammermill Paper Co., Erie, Pa.
M. G. Hoyman, Kimberly-Clark Corp., Neenah, Wis.
W. J. Peacock, Northern Paper Mills, Green Bay, Wis.
J. J. Pleak, Consolidated Water Power and Paper Co., Wisconsin Rapids, Wis.
Samuel Pruyn, Fitch-Pruyn and Co., Inc., Glens Falls, N. Y.
F. H. Rosebush, Nekoosa-Edwards Paper Co., Port Edwards, Wis.

Officers Elected for 1935-36

General Chairman—E. E. Grant, The Crystal Tissue Co., Middletown, Ohio.

Vice-Chairman in Charge of Membership—F. L. Irvin, St. Croix Paper Co., Woodland, Maine.

Secretary and Program Committee Chairman—George J. Adams, International Paper Co., Glens Falls, N. Y.

* Deceased.

News Letter Editor and Publicity Committee Chairman—FRED W. BRAUN, Employers Mutuals, Wausau, Wis.

Contest Committee Chairman—A. SCOTT DOWD, The Paper Industry, Chicago, Ill.

Engineering Committee Chairman—J. H. TURNER, Consolidated Paper Corp., Ltd., Montreal, P. Q., Canada.

Health Committee Chairman—DR. E. W. PAINE, Hollingsworth & Whitney Co., Waterville, Maine.

Poster Committee Chairman—CLAYTON BRAATZ, Marathon Paper Mills, Rothschild, Wis.

Statistics Committee Chairman—A. E. WINSLOW, Hollingsworth & Whitney Co., Waterville, Maine.

Members at Large—

ERNEST AUGUSTUS, Mead Paper Corp., Chillicothe, Ohio.
W. J. BRENNAN, Maine Dept. of Labor and Industry, Augusta, Maine.
D. B. CHANT, Ontario Pulp & Paper Maker's Safety Assn., Toronto, Ont., Canada.
T. L. CHRISTENSEN, Continental Paper & Bag Corp., Marinette, Wis.
KENNETH L. FAIST, The Champion Paper and Fibre Company, Hamilton, Ohio.
W. A. GLEASON, Hammermill Paper Co., Erie, Pa.
J. J. HASTINGS, Port Huron Sulphite & Paper Co., Port Huron, Mich.
DON E. MCDOWELL, Kalamazoo, Vegetable Parchment Co., Kalamazoo, Mich.
ARTHUR MURRAY, Container Corp. of America, Chicago, Ill.
W. J. PEACOCK, Northern Paper Mills, Green Bay, Wis.
J. J. PLZAK, Consolidated Water Power & Paper Co., Wisconsin Rapids, Wis.
SAMUEL PRUYN, Finch-Pruyn and Co., Inc., Glens Falls, N. Y.
F. A. ROBINSON, Kimberly-Clark Corp., Neenah, Wis.
B. D. ROGERS, Bird & Son, inc, East Walpole, Mass.
F. H. ROSEBUSH, Nekoosa-Edwards Paper Co., Port Edwards, Wis.

MONDAY AFTERNOON SESSION

October 14, 1935

The opening session was called to order by Vice-Chairman E. E. Grant, the Crystal Tissue Company, Middletown, Ohio. The Committee on Resolutions presented the following resolution regarding the death during the year of General Chairman H. D. Banta. The resolution was adopted as follows:

Resolution

"In recognition of the long and untiring services of Mr. Herbert D. Banta in the field of safety education, the Paper and Pulp Section of the National Safety Council, at its annual meeting held in Louisville, Ky., October 15, 1935, wishes to express its sense of personal loss in the death of Mr. Banta, and its appreciation of his services as a member and officer of the Paper and Pulp Section.

"For many years Mr. Banta has been a tireless worker in behalf of the safety movement in preventing accidents and injuries to employees in industry, and the National Safety Council, particularly the Paper and Pulp Section, has suffered a distinct loss in Mr. Banta's death.

"Be it, therefore, resolved that this expression of appreciation be sent to the family of Mr. Banta, and to Mr. J. M. Conley, President of the Hoberg Paper and Fibre Company, with whom he was associated; also that it be spread upon the minutes of this meeting."

Chairman Grant then outlined briefly the progress made by the Paper and Pulp Section during the past year, mentioning the high grade work of the chairmen of various committees, and introduced the first speaker.

1935 Summary Report Paper and Pulp Section Accident Experience Exchange

By ARTHUR E. WINSLOW

Manager of Personnel, Hollingsworth & Whitney Co., Waterville, Me.

Out of 111 plants reporting 1,448 accidents in the Paper Industry Annual Safety Contest which ended this year only 36 reported to the statistics chairman of the section for the completion of this report. Of these 36 plants 18 were operated by 3 companies and of the 239 reports made, 138 or 58 per cent came from the plants of these three companies. This is very unsatisfactory. These data will yield their greatest value only when every plant reports every accident. Future statistics chairmen must contact the plants. If there are objections to giving the information requested, the forms must be altered. The delinquents should be shown the benefits of these studies.

Although it is unwise to draw conclusions based on data from so few accidents, in a few years an accumulative statement can be prepared which will be of unquestionable value. One difficulty which we must eliminate to improve future reports is the tendency of members to slight points of the questionnaire. If members of the section want this service, they must realize that each question is important.

Time lost as a result of the 239 accidents included in this study amounted to 24,243 days, including estimates given in a number of cases and not taking into consideration instances where the time lost was not indicated on the form. Of the 36 plants the number of accidents per plant ranged from 1 to 23, which is a decided improvement over last year's figures of 1 to 69 for 46 plants.

As the contest standing this year was determined by frequency only, no comparison of the days lost as reported in the contest and our exchange can be made. However, the average time lost per individual including charges for all types of disabilities was 100.2 days against 108.9 days last year, which is a reduction of 7.99 per cent. On the other hand if we exclude standard time charges the average per individual is 19.9 days which is an increase over last year of 12.4 per cent. In spite of this our frequency for the 1935 contest dropped to 16.444 or 16.2 per cent below that of the 1934 Contest.

Included in this year's study are 2 fatalities, 10 finger amputations, and one lost eye, compared with 4 fatalities, 7 finger amputations and the loss of one eye last year. This year we find 46.3 per cent of those injured reported as tour workers, 28.1 per cent day workers and 25.5 per cent not designated.

Of the 239 injured persons the reports show that 71.1 per cent were married, 22.2 per cent single, 2.9 per cent widowed, and 3.8 per cent not classified. These percentages compare with 72 per cent married, and 28 per cent single as reported last year. The study this year shows August the highest month with 29 accidents, while last year May showed the highest total with 44. This year, March with 16 accidents was the low month while last year, August, with two accidents, was the low month.

The contention that Monday should, under normal conditions, show the greatest number of accidents has proved itself in this year's tabulation, with Friday in second place. The largest total for one day last year showed 70 accidents against 47 this year. Probably the five day week operation prevalent under "Code" restrictions accounts for this but future reports may disprove this deduction.

Machines continue to figure in the greater part of our accidents but improvements are noted in departments such as Beaters, Finishing, Calenders and Construction. Pulp mills as distinguished from paper mills evidently had a more difficult year in 1935 than in 1934.

Accidents by departments were as follows (figures in parentheses are for 1934): Machines (paper, board, coating, roofing, etc.) 44, (66); repair and maintenance, 36, (39); beaters, 11 (27); pulp mill (all departments combined) 34, (24); general

yards (including janitors) 27, (21); finishing, 9, (19); wood room, 13, (19); wood yard, 17, (16); calendars and supercalenders, 1, (10); construction, 2, (8); coating operations, 5, (7); steam power, 6, (7); winders and rewinders, 6, (6); shipping, 11, (6); laboratory, 0, (3); acid making, 0, (1); electric power, 4, (1); receiving department, 1, (0); old and waste Pa. plant, 1, (0); box shop, 1, (0); container factory, 4, (0); converting department, 2, (0); stores department, 1, (0); office, 1, (0); printing department, 1, (0); miscellaneous, 1, (20).

Accidents according to type of work were as follows (figures in parentheses are for 1934):

Laborers, 53, (33); wood handlers, 16, (31); millwrights, 16, (26); machine tenders, 4, (17); back tenders, 7, (14); beater helpers, 4, (14); fourth hands, 9, (12); beater operators, 1, (9); third hands, 8, (8); rewinder operators, 5, (7); press cutter men, 0, (7); carpenters, 1, (6); truckers, 9, (6); pipe fitters, 4, (5); roll tenders, 6, (4); calender operators, 0, (6); calender helpers, 1, (4); rewinder helpers, 2, (4); firemen, 2, (5); coal handlers, 1, (0); cooks' helpers, 9, (0); oilers, 4, (0); broker handlers, 4, (0); machinists, 4, (0); foremen and inspectors, 6, (0); screen men, 2, (0); painters, 3, (0); wood preparers, 6, (0); grinder men, 10, (0); finishers, 3, (0); coating machine men, 3, (0); shredder operators 5, (0); welders, 1, (0); masons, 1, (0); blow pit men, 1, (0); wet machine men, 1, (0); power operators, 1, (0); laboratory and sample boys, 0, (4); rotary furnace operators and recovery men, 2 (0); cutter operators, 2, (0); counters (female), 1, (0); watchmen, 1, (0); truck drivers, 2, (0); leaders and shippers, 4, (0); sawyers, 1, (0); electricians, 3, (0); construction men, 1, (0); miscellaneous, 9, (78).

A total of 101 different machines, tools or appliances were involved in the 239 accidents. Outstanding are the 24 accidents charged to pulp wood, better than 10 per cent of the total. Accidents according to machines and tools were as follows (figures in parentheses are for 1934):

Calenders and supercalenders, 6, (16); cores, collars, shafting and pipe, 7, (16); winders and rewinders, 9, (13); roll-pulp, baled paper and waste, 7, (11) handbooks, picaroons, poles, 6, (11); pulpwood, 24, (11); hand trucks, 12, (8); electric trucks and auto trucks, 2, (8); conveyors, 6, (7); belts and pulleys, 2, (6); wet floors, 3, (6); paper machine dryers, 3, (5); tables, benches, chairs and other objects, 2, (5); four wheel wagons, 3, (5); tanks, 1, (5); valves, 1, (4); steam, water and air hose, 4, (4); I-beams and iron or steel bars, 5, (4); ladders, staging and poles, 9, (4); hammers and hatchets, 1, (4); boards and heavy timbers, 7, (4); coils of loose wire, 2, (3); wrenches, 2, (3); paper machine reels, 5, (3); paper machine felts and felt rolls, 1, (3); knives, 0, (4); cutter-presses, 0, (3); broke boxes 2, (3); heaters, 1, (3); doctor blades, 1, (3); miscellaneous, 110, (115).

This year fractures and amputations accounted for 74, the greatest number of injuries in any classification and about 30 per cent of the total. Bruises, contusions and abrasions came second with 62 or about 26 per cent. This is the reverse of last year's report. Lacerations and cuts came third with 29 accidents, and sprains and strains were fourth with 26.

The "nature of injury" totals for the accidents were as follows (figures in parentheses are for 1934):

Bruises, contusions and abrasions, 62, (91); fractured bones and amputations, 74, (69); sprains and strains, 26, (47); cuts, scratches and lacerations, 29, (41); crushing injuries, 4, (14); burns and scalds, 18, (16); puncture wounds, 7, (10); eye injuries, 3, (7); dislocations, 2, (1); hernia, 1, (0); fatal injuries 2, (4); chemical burns, 3 (5); electric burns, 1, (2); infections, 3, (0); ivy poisoning, 1, (1); miscellaneous, 3, (0); concussions, 0, (2); heat prostration, 0, (2); frost bite, 0, (1).

Again this year as last, hands, fingers, feet and toes were the parts of the body most frequently injured, with the eyes, back and spine, arm, knee and lower leg coming in the order named.

Falls of materials and objects led as the most popular cause of injury followed closely by falls of persons. Handling of material and objects was third. Fourth place went to being caught or jammed between objects or materials and caught in revolving rolls was fifth. Sixth place went to burns and scalds this year.

Of the 43 cases listed under miscellaneous with 11,970 days lost, two alone accounted for 10,500 days and two others 354 days, all standard time charges, leaving 39 cases accounting for 1,121 days.

The "Cause" Table.

Types of Acc. or Causes of Injury	1935 No. Cases	1935 Days Lost	1934 No. Cases	1934 Days Lost
Falling or slipping material and objects	51	7,168*	66	7,375*
Falls (from heights or level)	31	1,033	47	1,368
Hand tools	1	Not Given	28	377
Lifting, pulling, pushing, prying	7	134	27	199
Caught in revolving rolls	16	1,240*	24	6,932*
Handling material and objects	20	384	19	410
Caught in gears, belts, etc.	5	133	19	7,501
Caught under or run over by	3	51	10	52
Struck by flying objects	6	728*	10	85
Caught or jammed between objects or materials	19	645*	7	72
Splashing liquids	0	0	6	38
Stepping in holes or on objects	8	61	6	42
Striking and bumping against things	7	105	4	77
Burns and scalds	15	184	7	7,914*
(1) Hot water and liquids	6	119	3	1,854
(2) Hot pipes and materials	5	29	1	54
(3) Contact with flames	1	3	0	0
(4) Electric, livewires	2	13	2	6,003*
(5) Acid, caustics, chemicals	1	20	1	3
Explosion, explosive action	4	46	6	83
Foreign bodies, in eyes	2	42	2	7
Clothing caught in machinery	2	319	2	65
Miscellaneous	43	11,970*	10	187
Total	239	24,243	300	32,674

* Indicates standard time charges are included.

These accidents when listed according to departments show that Wood Yards led the departments in falling material accidents with 13; General Yard Work came next with 8; Wood Room 6; Pulp Mill 6; and Machine Room 5.

Falling material seems to hit laborers more often than any other type of worker. Out of the 51 accidents attributed to this cause, laborers accounted for 17, wood handlers and preparers 10, grinder men 4, and a miscellany of classifications 1 and 2 each.

TUESDAY MORNING SESSION

October 15, 1935

Accident Prevention in the Paper and Pulp Industry in Ontario

By D. B. CHANT

Secretary-Engineer, Ontario Pulp & Paper Makers' Safety Association, Toronto, Ontario

In order to describe our organization and its functioning I must digress for a moment to refer to the Workmen's Compensation Act of Ontario which I think is one of the soundest and best pieces of legislation of its kind to be found anywhere.

The act became law in 1915 to provide recompense for accidents to workmen in their employment, to get rid of litigation, and to secure promptness and certainty

of payment to the workman or his dependents without unduly burdening the employer. It extends its protection of the workman to all accidents arising out of and in the course of his employment instead of merely those caused by the negligence of the employer, as was the case prior to 1915, and it places the adjudication of claims in the hands of the Compensation board set up by the act, instead of the courts.

Under this Act all industries except a few such as farming and domestic service, are covered under one of two schedules. With the difference between these schedules we need not here be concerned. The chief point is that under Schedule 1 (which includes the greater part of industry and of course, the pulp and paper industry) the collective liability idea is applied to groups of employers. There are 24 classes each consisting of an industry or a collection of allied or similar industries and each class in turn is separated into a number of rate groups. Beng one of the large industries ours enjoys an exclusive grouping as Class 2 and this class is rated by groups as follows: pulp mills and board mills, combined pulp and paper mills, converting paper mills, corrugated paper box makers, miscellaneous converting and allied plants, pulp-wood logging operations—restricted to bona-fide logging of pulp or paper companies on their own lands.

Each employer is required to pay into the class accident fund each year an assessment based upon his total payroll and all the cost of accidents occurring in the industry including both compensation and medical aid expenses is defrayed by the board from this "class" fund. Permanent disability pensions, or pensions to widows or other dependents of injured workmen, are capitalized promptly and the required sum transferred out of the accident fund into a pensions fund which of course is kept invested and earning interest. Administrative expense is spread on a pro-rata basis as a total assessment paid each year and there are other minor provisions such as the disaster reserve fund, which need not be discussed here. The collective liability feature of the act is the basis for our scheme of organization.

Since the whole cost of each accident in our industry comes out of the class accident fund to which all in the class contribute assessments, it naturally follows, in theory at least, that an accident happening anywhere in our plants or woods operations is a matter of concern to everybody because it must inevitably be reflected in the rates of assessment applying to all in the class. And, conversely, a good accident experience anywhere benefits everybody in the industry. This commonality of interest throughout the length and breadth of our industry is the key-note of our accident prevention organization, which was incorporated in 1915 and is known as the Ontario Pulp and Paper Makers' Safety Association.

We are incorporated under the authority of the Compensation Act which provides in one section for the setting up of such associations for accident prevention and further provides that, if the Compensation board is satisfied that such an association when formed is sufficiently representative of the industry, it may approve such rules and regulations as the association may adopt and when so approved they become binding upon all employers coming under that particular class. Our association received such recognition upon its formation in 1915 and continues to represent the pulp and paper industry before the board. Every employer whose business is from time to time assessed under Class 2 becomes automatically a member firm of our Association and remains a member so long as his business remains in Class 2. Membership fees or dues are collected by the Board as a part of the payroll assessments and thus are truly proportionate to the payrolls of the various members and the funds so collected are paid over to us as required throughout each year by the Board which exercises reasonable control of our expenditures and audits our accounts annually.

Our Association is governed by a board of directors consisting of sixteen men elected at an annual general meeting of members and they are almost invariably senior executives of member firms. Careful attention is given each year to the preparation of the slate of directors for election, so that the body may represent the various branches of the industry and the geographical districts. Our present board represents about 90 per cent of the total payroll in our industry. They meet each month and really *direct* the affairs of our association.

To sum up we fully cover our industry; enjoy the confidence of the Workmen's Compensation board; are free from the annoyance of canvassing firms for membership or dues; have close contact through our board of directors with nearly the entire group of plants and operations; and are in a position to receive and give the fullest

sort of co-operation in trying to control accidents and accident costs in the industry.

Our charter defines our aims and purposes as being "To promote and carry on the work of prevention of accidents in pulp and paper mills and in any other industries which may for the time being and from time to time be assessable by the Workmen's Compensation Board in the same insurance group as pulp and paper mills, and generally to represent employers and employees engaged in such industries in connection with the administration of the Workmen's Compensation Act." We interpret this to entitle us to concern ourselves not only with safety but also with reducing the cost of accidents without, of course, in any way abandoning our neutral position as representing both the employing group and the employed.

Stated differently, while we consider accident cost reduction to be one of our major purposes we emphatically do not include what might be called "compensation chiselling" among the reasonable and proper means to that end. We want to see every injured workman receive full justice within the provisions of the act, and will do all in our power to see that he will get exactly that. But, we do not believe it to be in the best interests of either employers or employees to permit the excellent compensation law we have in Ontario to be abused by grafters or malingerers and will certainly do our utmost to uncover fraudulent claims, correct abuses, and bring an end to unfair practices by whomsoever committed.

Our service to member firms and their employees includes the following:

1. Collecting, recording, and tabulating of accident data covering every member firm's experience and each accident involving any expenditure of money from the class accident fund.
2. Distribution to all member firms, at regular intervals, of comparative statistical information on accident frequency, severity and cost so that each can see how its own experience compares with that of the class as a whole and the particular rate-group in which it is placed for assessment purposes.
3. Making periodical inspections of plans for the purpose of aiding in the recognition and removal of physical and mechanical hazards.
4. Assisting to organize and carry on accident prevention work in plants and woods operations.
5. Advising, and aiding in every reasonable way, the managements of member firms to reduce their accident costs and thus to save money through lower assessment rates.
6. Participating in safety rallies and meetings of employees, where desired, to assist the management to stimulate interest in accident prevention.
7. Conducting annual competitions among member firms in accident prevention to arouse and maintain interest.
8. Encouraging the training of as many as possible of the workers in the industry in first aid and awarding trophies and prizes.
9. Investigation of the circumstances of serious or fatal accidents and circulating of information thereon among members so that similar occurrences may be avoided in the future.
10. Advising and assisting in all matters having to do with assessment rates or compensation matters in general.
11. Arranging of meetings of geographical groups of plants and woods operations from time to time for the discussion of matters of all kinds affecting accident frequency, severity, or cost, and to encourage the various firms to improve their safety programs.
12. Acting as a clearing house for information having any sort of bearing on accident prevention or cost reduction, and rendering any other service in line with our aims and objects and the interests of member firms and their employees.

It would, of course, be foolish for me to claim that we perform all of these functions to the utmost possible extent and I make no such pretense. We want to do these things and we try to do them, but I freely admit that there is still room after twenty years for improvement.

"Keeping track" of the accidents which have occurred and tabulating their nature, cause, degree of seriousness, and cost for compensation and treatment does not in itself prevent other accidents from happening. The issuance of reports and bul-

letins showing accident experience must come "after the fact" of the accidents. Accident cost statements can only show the amount already spent. But we have found that such data in the hands of our directors and the managers of member firms does stimulate interest in the prevention of future accidents.

No manager relishes having his plant, or woods operation, near the bottom of a list showing comparative accident frequency, severity, or cost. He is likely to determine then and there to do something about it, and that determination will usually result in an improvement in his record.

Accident prevention is definitely a management function. A bad accident record is evidence that the management is not doing its job and almost all of our effort is expended in trying to arouse recognition of that fact and to arouse it without antagonizing the management. Accidents can be controlled in any plant, if the man in charge really wants them controlled and sets about doing so. Accordingly, I have consciously aimed our activities at the "man in charge." We do not say: "Give us a chance to prevent accidents in your plant, Mr. Manager." We do say "Mr. Manager, there's no reason why your record should be worse than that of Plant B, or Plant C. *You* can make it as good as theirs or better. And, *Mr. Manager*, we are here and ready to help. But it's your job and we can't do it for you. How about it?"

That is our theory of operation but, of course, it is not quite so simple as it sounds. This imaginary statement doesn't take that exact form. It usually is conveyed in reports and cost statements sent mostly without comment—but showing clearly just where his plant stands. We concentrate on those plants whose experience is worse than *average*.

We have been placing a great deal of emphasis on accident costs while continuing to tabulate frequency and severity figures. And I am not going to offer any apology to anybody for so doing. "Cost rate" is a perfectly good measure. If you have accidents, you'll have costs. You may be fortunate for a while and have nothing but minor accidents but time will take care of this and if you keep on having accidents your cost rate will soon reflect your frequency pretty accurately. And if you have no accidents, you'll have no accident cost.

I am willing to admit that the majority of plant managers are readily actuated by humanitarian motives. But, modern industry is organized on a competitive basis and market conditions require the plant manager to scrutinize his production cost sheet closely and constantly. The emphasis is heavy on costs. Then why try to deal with industrial accidents in terms entirely foreign to the cost sheet?

If a manager sets out to prevent accidents in his plant and succeeds, I do not care whether he was actuated by love or by economic reasons. The results are the same. We'll record the improved frequency rate, but we'll put most of our emphasis on the lower cost rate. And, if you think that plant managers and presidents do not look our cost statements over with more than a casual eye—just try misplacing a decimal point!

During the past couple of years we have been trying to find out more about the causes of accidents. Our research has some weaknesses, but is of enough real value to justify us in continuing it. Briefly, we set up a list of causes grouped under main headings and ask each member firm to classify its cases accordingly. We combine these separate classifications and state the result in terms of percentages of total number of cases and total cost due to each cause. The man who does the *classifying in each plant is the director of safety.*

Until recently most of us in thinking about accidents in pulp and paper mills had visions of vast buildings filled with heavy, fast-moving machinery—belts, gears, pulleys and shafting; heavy rolls in pairs or stacks with exposed in-running nips to catch the unwary; reels of paper and rewinders; slippery floors over which men hurried. Maybe we still see these things. But our study of causes is teaching us that the mechanical hazard is not nearly so important as we may have believed. For example, from the combined experience of the two years 1933 and 1934 we find that in Ontario mills only 7.3 per cent of our accidents and 12.4 per cent of our cost arose from what we call "faulty mechanical conditions" while 51.2 per cent of all cases and 52.4 per cent of the total cost were considered due to "human hazards" such as inattention, lack of care, horse-play, errors of judgment, unsafe clothing and acts of fellow workmen, and a further 4.8 per cent arose from the physical or mental

condition of the victims. If you add to these last two groups a further 5.3 per cent of cases and 12.5 per cent of cost to cover cases due to "disregard of instructions" you have 61.3 per cent of all our accidents and 68.8 per cent of our total cost represented by accidents caused by the workmen themselves. Even if these figures were wide of the truth, which I do not admit, it is still evident that our problem calls for intelligent and alert supervision, better training, and increased "safety consciousness" rather than for more guarding of mechanical hazards.

This becomes further evident from the 1934 figures covering a different sort of analysis which shows that "machinery in motion" is involved in only 12.3 per cent of our cases in the mills. Truly, pulp and paper mill accident prevention is sorely in need of better "mental guarding." It is our job to help management to arouse and keep up a wholesome interest in safety, to equip mills with the *best* safety devices—"careful men."

In woods operations mechanical causes play an even smaller part in accidents. The chief hazard is the "man with the axe" who, to judge by results in recent years, is not as cunning and dexterous with this weapon as he formerly was. There are a number of reasons for this, but the fact remains that "axe cuts" including "axe amputations" made up 29 per cent of all disabling injuries in our woods operations last year, while injuries resulting from the use or misuse of other types of hand tools such as "hooks," peavies, saws and pike-poles accounted for an additional 8.7 per cent, to produce a total of 37.7 per cent of all cases, classified as "involving hand-tools." As might be expected—the next largest group of cases (31.7 per cent) involved timber and covered injuries caused by falling trees, rolling or sliding logs, spilled or upset loads, and strains due to carrying, dragging, or lifting logs. Hazards arising out of uneven footing, complicated by deep snow and ice, and heavy underbrush produced 12.3 per cent of all cases, while frost-bite produced 3 per cent of the disabling injuries.

Cases involving equipment, other than hand-tools and including horses, as well as sleighs, tractors, winches, chains, ropes, cables, engines, plows, and boats, represent only 5.5 per cent of the total while infection of minor abrasions and scratches make up another 3.3 per cent.

From all of this it will be apparent to you that in the woods, as in the mills, the problem of accident prevention is one of teaching and encouraging men to work safely; correcting unsafe practices; discouraging the taking of unnecessary chances, and increasing the vigilance and accident consciousnesa of supervisors. Mechanical guarding will scarcely scratch the surface. And the difficulty of controlling working habits in the woods is much greater than in the mills because of the seasonal nature of the work and the peculiar psychology of your lumber-jack. Then, too, supervision is less close in the woods and the problem is further complicated by the fact that many of the men understand little English and are unable to read in any language.

When I tell you that accident frequency in the woods is approximately 4½ times what it is in the mills and that woods accident costs are more than three times the mill cost, you will be prepared to hear that we consider the accident problem in woods operations our major difficulty and one to which we are giving a heavy proportion of our time and energy.

We did not begin soon enough, but general determination is showing promise of improvement. As an indication of progress I may say that woods accident frequency *in* 1934 was 8 per cent lower than in the preceding year and the total cost per $100 of payroll was also down by 9 per cent. Both rates are yet much too high to be regarded with anything like satisfaction.

Now, let me give you a few figures to indicate the progress made over a period of years in controlling accidents in mills. I have here a chart giving key figures over the 9-year period 1926 to 1934 and another one depicting the same data, graphically. You will observe that, almost without exception, the lines on the graphic chart curve in the desired direction.

Cost figures over a period of 11 years—1923-1933—show steady improvement. The average assessment rate for all plants was $1.58 per $100 of payroll assessable, while the cost of all accidents came to $1.45 made up as follows: compensation to the injured worker, or his dependents, $1.15; and cost of treating the injuries, 30 cents. This leaves eight cents and you may be interested in knowing what became

of this surplus. On the average, for our whole class, each dollar of assessment collected was distributed as follows:

Cost of Compensation	70	Cents
Cost of Medical Aid	20	"
Cost of our Association	3.79	"
Administrative Expense	4.95	"
Surplus created	6.75	"
	105.49	"
Interest earned on Class Funds	5.49	"
Assessment dollar	100.00	"

The total sum collected by the Workmen's Compensation board as assessments was $2,885,688.09 and interest earned amounted to $158,475.95. The class began this eleven-year period with a deficit of $61,433 and came out of it with a surplus of $129,835.

Assessment rates tell the same story in a different way. Here is the picture they show—

	Average Rate 1923-1933	1934-1935 Rate
Pulp Mills & Board Mills	$1.69	$1.25
Pulp and Paper Mills	1.60	1.25
Conversion Paper Mills	1.18	.60
Waste Dealers and Allied Plants	1.08	.60
Paper Box Manufacturers	1.41	.90
All Plants	$1.58	$1.11 approx.

Decreases in assessment rates in 1934 from those in effect the previous year spelled a net saving of about $23,000 in total assessment for our member firms and we confidently expect the 1935 rates will carry this saving forward for another year. We will have no difficulty in justifying our existence as an association for accident prevention, so long as we can point to monetary savings year by year larger than our budget.

To sum up our story as an association we base our whole scheme of operation on the commonality of interest and responsibility which was written into our compensation act by its framers: ours is an adventure in co-operative service to an industry; we enjoy the support and confidence of the leading figures in that industry and have a strong group of those figures on our directorate; we believe that accident prevention is a management function and proceed on that basis: we are convinced that accidents can be controlled and we are working for lower and lower accident frequency and less and less accident cost. A little has been accomplished. Much remains to be done.

I am strongly of the belief that our future results will be such as to make what we consider a reasonably good showing to-day look very bad indeed.

Safeguarding Paper Making Machines

By M. W. DUNDORE

Production Manager, Beloit Iron Works, Beloit, Wis.

The conventional type reciprocating stuff pump, whether single, duplex or triplex is best mounted on its own independent foundation (to eliminate possible transfer of vibration forces) and guarded from falling objects by an overhead screen. If belted drive, the belt guard should conform to the state code. If direct motor driven, the nip or meshing between motor pinion and gear should likewise be adequately guarded as well as all other gear contacts.

Regardless of type of drive, means should be provided for disconnecting power and for locking and latching the starting device in the off position. It is necessary to get near the top to oil moving parts and therefore a permanent platform should be built.

Baseplates should be of ample design, straight and level to facilitate erection and to maintain alignment of the operating unit. They are not a substitute for a foundation and should not be considered as such. A unit out of alignment due to a poor foundation is a continual operating hazard because of constant manipulation required on the part of the crew to keep the sheet flowing true. A "spalling" foundation and poor job of "grouting" causes baseplates to absorb shocks for which they are not intended with a possibility of cracking and breaking thus disrupting the alignment of the original installation.

The footboards on the *head vat* or stuff box should be guard-railed, toe boarded and the walk itself beveled both ways from the center to shed water to both sides of machine providing certain footing for the operator.

On the *Fourdrinier* we advocate the use of portable aluminum ladders with cast aluminum threads and aluminum railing. We recommend the use of a portable and light weight wire carriage wherever a removable or cantilever fourdrinier is installed, and on a non-removabl fourdrinier a breast roll truck to eliminate heavy lifting.

A notable advance was the removable fourdrinier designed and built to relieve the operators from the task of removing and replacing stationary units. The shake unit can be enclosed and V-belt driven with forced lubrication. Shake connections of formica boards eliminate sliding parts and lubrication and are a big improvement over a unit which is totally mechanized.

Table rolls made of aluminum lend themselves to ease in handling and suction boxes of light non-corrosive alloys with galvanized angle iron troughs are much more readily handled in and out of machines than the old type heavy non-ferrous cast boxes.

Savealls should at all times be stiff, light weight, non-corrosive and amply designed so as to carry away *all* waters. Nothing is more hazardous to a hurrying employee than a wet floor. Ample gutters and drains should be provided along both sides of the machine so that water used in "washing-down" is carried away and does not accumulate over the floor. For safety in operation you should find structural steel main frames to withstand deflection, cast steel table rails especially when combined with a shake, dynamically balanced rolls, and cast steel shake connections, all of which provide a structurally safe unit. The suction box oscillating equipment can be so designed that oiling is reduced to a minimum and free from elements that may pinch an unsuspecting operator or oiler. All gears should be totally enclosed and cases designed so little oiling or greasing is required. Table roll bearings and saddles should be so designed that operators can make necessary adjustments while machine is in operation free from danger of wire cuts and "barked" fingers and knuckles.

In cylinder mould building recourse has recently been made to the use of corrosion resistive mould rods so as to decrease handling of these cumbersome units in and out of the machine. One customer recently specified removable fronts on cylinder vats so that moulds can be readily removed and with least exposure to operators.

The suction couch roll should be free from all protruding screws, made with a cantilever journal of adequate proportions to insure freedom from necessity of handling and removal during wire change, mounted on heavy duty bearings arranged to readily permit safe lubrication from front or back side of machine with roll in operation. We advocate blowing the paper off the couch onto the press felt with air.

The press section should be equipped with self drain footboards access to which can be made with portable aluminum ladders light enough to encourage operators to use them in place of precarious toe holds on framework or loose-footed wood ladders.

A Sheehan carrier can be supplied and installed today that will carry the sheet through a reverse press, smoothing and size press as well as Sheehan Ropes to carry on from last press to first dryer. This is a big step in accident prevention on a press. Weight levers and rods are being rapidly replaced with pneumatic and hydraulic lift and pressure devices which eliminate the ever present press weighting hazards. Water removal on presses can be accomplished through hollow leg castings with vacuum tight joints eliminating external ductors and piping, keeping unit clean in appearance. Roll bearings can be designed to permit easy removal of rolls by

means of overhead crane or trolleys, removable frame pieces of light weight where necessary to permit this. Frictionless bearings designed against water and dirt eliminate a great deal of this former handling hazard. Bearings should be designed for a long running oil supply so as to reduce the frequency of oiler hazards. In a number of installations it is good practice to combine brackets, legs and pads directly onto frames and as an integral part of the frames thus obviating these additional bolts, nuts and washers ordinarily used to bolt these parts onto separate frames. Crystallization and corrosion of bolts is an ever present hazard and hard to detect, therefore the fewer the joints the lesser the hazard. Press frames should be designed where possible with flush and smooth exteriors to eliminate toe holds. Felts cut through or slashed on sides beyond trim present a flapping auxiliary, and is an ever present hazard with its possibility of entanglement with other items of operating equipment.

The broke can readily be removed by means of a broke doctor and conveyor reducing the possibility of cutting hands on doctor blade. Doctors of the quick release type assist in safe operation by keeping equipment clean and clear of both broke, dirt and operators. Today the nip hazards on presses are being eliminated through the installation of suction presses which reduce the number of presses needed. Where builders have installed suction drum rolls, checking of the sheet, blowing and splitting at subsequent press points are practically eliminated thus reducing contacts between operator and machine. From some machines under certain conditions it has been found possible to entirely eliminate the top felt, reducing still further operating hazards.

Installation of rubber covered suction presses in the primary press position of cylinder machines has made possible the elimination of wringer rolls, helpers and plain primary press rolls. Each nip point is a hazard and the elimination through design of the multiplicity of plain presses found on older machines means elimination of accident possibilities. This also means elimination of the corresponding weights and weight lever arrangements. Roll arms and housings should be made of high strength irons and steels to preclude possibility of breakage to felt carrying equipment. Hinge pins can be made of non-ferrous metals in many cases to reduce hazard of steel crystallization and corrosion which ofttimes occurs and is not readily detected. Felt roll and press roll saddles can be made angular so as to reduce lifting height and allow better accessibility. Pressure devices on rolls should include calibrated springs with visible gauges so as to preclude overloading as well as inform operator as to what he is doing on both sides of machine.

Dryers. For access to high points along stack or Yankee dryer sections we advocate permanent steel ladders with reinforced wood rungs. The former for safety in strength and placement, the latter to prevent scorched fingers and lost grips. Sheehan carriers for threading paper around dryers greatly assist operators freeing them from carrying paper through by hand. Flush frames where possible. Totally enclosed chain drives for high speed paper machines with chains running in bath of oil in channels and troughs designed as part of the frames eliminate gearing hazards and stimulate clean operation. Approaches to mezzanine floors around paper machines principally Yankee dryer installations sould be of the permanent type, steel or wood construction. Frictionless bearings with *continuous* and *filtered* oil supply eliminate the frequent oiler hazard of crawling through gears and piping. Pressure rolls operating against Yankee dryers maintaining contact through hydraulic lifts with remote control eliminate weights and manual manipulation. Enclosed chain and sprocket drive are supercceding gear and pinion drive on Yankee dryers. Yankee dryers, designed and tested for high pressures and high speeds, should be mounted on frictionless and self-aligning bearings with heavily bolted and balanced construction. Dryers operating under high pressures should be treated with the same respect as boilers. Doctors can be provided to clean the dryers and eliminate hand scraping and reaching between dryers when in operation. Doctors should be well balanced so that they can readily be thrown into operating position with proper pressure and as quickly released when necessary.

Dryers should be balanced at all times to keep draw perfect and insure operators freedom from continuous manipulation. Placing balance weights on exterior heads of dryers should be done under supervision of a skilled mechanic or the builder who knows the need of beveling ends of weights, proper riveting and keeping

weight flush with ends of dryer. On new dryers the necessary weights should be on inside of heads secured with non-corrosive studs thoroughly riveted On old dryers Sheehan feed equipment can be readily added which will work freely in carrying through sheet thus safeguarding operators. Dynamic and static balancing of felt rolls to eliminate vibration should be always considered. Felt rolls and brackets which *carry wrap* of *felt* should be handled differently from rolls merely used as carry or guide rolls. The former should be sturdily built to carry the necessary strain and should be used *only for that purpose.*

Hollow leg frames provide a more accessible air supply where needed, keep dryer section free of ductors. Contact between basement and machine room in dryer section should be by means of an interlocking control so that machine room operator cannot turn over dryer section with some one working on basement felt dryers and equipment. This device should be tested frequently. Round stretcher weights can be readily guarded by means of a piece of pipe, securely fastened with an inside diameter larger than outside diameter of the weights. Dryers should be designed with man holes which will permit ready entrance and egress in time of trouble or maintenance. All steam and hot-water pipes within 7 feet of the floor or platform in this department should be covered or adequately guarded against contact. Drying cylinders partially filled with water, at starting time are a potential hazard when the steam is turned into them. Oscillating doctors with back of structural steel once mounted require no further handling as blades are readily inserted from one end. Oscillation through formica boards on suspended doctors eliminate oiling or greasing.

Calenders. Electric lifts can be provided for all stacks with totally enclosed gears in head, frictionless bearings and doctors for all rolls as part of safety in operation. Super-calender frames can be made open in front to ease removal of rolls by means of overhead crane or trolleys allowing free accessibility and quick handling with practically no danger to crew. Striped guards can be provided at nips which are very conspicuous. Rails, ladders, non-slip footboards, and toeboards should be incorporated in and around all stacks. Crowding of rolls should be continuously watched to eliminate breakage of parts of equipment and possible injury to operators. Calender frames should at all times be heavy in construction and the coupling for bottom roll free of any protruding parts which can disable a passing operator.

The danger, when scraping accumulations of materials off rolls, can be eliminated through use of scraper made in two pieces,—handle and blade. If blade is caught it pulls out of the handle and passes through roll. The handle being curved guards the hands and also prevents its being pulled through rolls. A feeder belt can be provided for starting paper where the sheet goes over the top calender roll. Easily accessible motor controls should be available for operators from several points of vantage. Roll bearings can be so designed as to expose very little of roll necks preventing operators from pinching hands when feeding through. Pressure and release devices on super calenders should have gauges visible from floor and both sides of stack so that operators can tell at a glance what they are doing thus avoiding operation by "feel" or "hunch."

Reel. Enclosed gears, dynamic and static balancing of rolls and drum should be a part of every reel with plenty of room between units comprising reel. Totally enclosed bearings, with ample oil reservoirs, and safe clutches should be an integral part of every spool. Water cooled unwinding stand drums should be hydraulically tested and dynamically balanced for speed and safety in operation. Reel spools should not be dropped on floor as this will invariably destroy their balance and cause bent journals. Due to the high peripheral speeds at which reel spools operate the builders treat this equipment with a great deal more respect than most operators who use them. Some mills provide a space (safety stop) of at least 8 inches between the reels to eliminate the nip hazard. This can be accomplished by making a frame to which is attached a lever with an eight inch (8") diameter wheel at its end. This wheel is placed between reels and is forced to revolve by contact with either reel surfaces.

Winder builders have realized that being the fastest piece of mechanism on the paper machine especial attention is required in the design. All rolls entering into a winder should be dynamically balanced for accelerating speeds and should be

designed with ample safety factor. Frames should be heavy and free from vibration during operation.

It is possible to guard drums from in front although one type of guard will not suit or fit into all kinds of operating needs. Unloading and automatic dumping devices are possible. Winder shafts can be mechanically ejected from rolls and mechanically replaced. Where belt straps are used for hoisting rolls the steel loops on the ends of the strap should be interlocked before placing on load hook, so that no loop will snap out of the hook when hoisted. Core collars with projecting set screws are a hazard. Conveying devices can be built to mechanically remove counter rolls. For advancing the sheet tape feed belts can be provided.

Slitters should be guarded above and below and on the approach. The former by means of individual guards and the latter by guard board or bar.

Paper Cutters are and have been the cause of many injuries. Care should be exercised when installing new knives to see that they do not protrude too far. Also, carriers should be provided for transporting knives. All gears should be fully guarded. Approved footboards and steps should be built onto reinforced frames to withstand vibration. Dynamically balanced revolving bars and rolls and welded construction of bed bars are now on modern cutters. An electrical safety control with two or more push buttons in series is now available. All push-buttons must be continuously depressed before knife can be operated. Each cutter bar should be equipped with a non-repeating device. All feed or draw rolls can be striped to show in-running nip and revolving bars can be guarded with removable screens or boards.

Drives. Fully enclosed compensating drives to press rolls running in baths of oil are now available. Fully enclosed Spiral and Hypoid Gear units in one piece castings, cool-running, self-lubricating and practically noiseless in operation and at all times accessible for inspection without need of taking apart, as well as self-contained mechanical and magnetic clutches with no exposed parts are also available. Pulleys should be guarded with welded steel covers; they should be balanced and checked with indicators for out of round at time of manufacture; should run true; be reinforced with inside rim; of ample hubs and extra heavy arms. Where excess speeds are needed we recommend welded steel pulleys Enclosed frictionless pillow blocks with reserve oil reservoirs are used thus eliminating inspection at points where there may be revolving shafting. Fully enclosed couplings with ample factor of safety and no exposed parts are recommended. Play safe with lineshaft pulleys, let your builder in on the problem of speeding-up. There is a limit at which pulleys will disintegrate. Don't simply speed-up on a "hunch" that it will work. Pressure lubrication, in copper or flexible tubing, so that oiler does not have to resort to unsafe practices for proper lubrication, should be part of every installation. Mechanical clutches can be so designed and installed as to present a smooth exterior either in idling or running position. Motor operated belt shifter, remotely controlled, keeps the operator away from fast moving belts, etc. All pulleys should be fully enclosed wherever contact is possible.

Passageways between sections should always be enclosed with materials which will afford adequate protection to operators, oilers, and others.

Modern machines can be equipped with an interlocking safety signal system to prevent operators from being injured through unexpected starting at another point.

Modern news presses are now equipped with from five to fourteen push button stations, each having both a Safe and a Run button. If an operator wishes to work among the presses or dryers he presses the Safe button at his station. This renders his section inoperative from all other stations and sections of machine.

Paper, if subjected to friction or pressure becomes charged electrically. This happens most readily when the paper is dry and when the relative humidity of the surrounding atmosphere is low. On a paper-making machine conditions are extremely favorable for the generation of static electricity through frictional forces and pressure acting on the paper as it passes over the dryers and through the calender stacks. This accumulation is sufficient to produce charges of high voltage. It is a common occurrence to obtain sparks from the paper when being reeled unless precautions are taken to discharge the static electricity by grounding the sheet or calenders through chain or pipe. Proper air conditioning of the machine room may

be a permanent cure for this troublesome phenomea. There should be plenty of room between machines, and between machine and wall, for the operating personnel and auxiliary equipment. Walkway across the top of machines should be safely constructed and securely fastened.

WEDNESDAY MORNING SESSION

October 16, 1935

Massing Man-Power Back of Safety

By W. J. PEACOCK

Head of the Department of Personnel, Northern Paper Mills, Green Bay, Wis.

The Northern Paper Mills, under the leadership of its mill manager, worked up in one year a most interesting safety organization of employees. Ninety employees serve on five departmental committees and one general committee in this plant of 600 people. The mill manager is the responsible head, the safety man serving as secretary. The departmental committee meets once a month with the superintendent in his office. The general committee meets with the mill manager, or, at his option, alone. This committee is responsible for a personal, uninfluenced investigation of every accident, and, while an investigation is also made by the department men, the decisions of the general committee are thorough and favor nothing but the facts.

For example, the workmen's committee, in one instance, was required to cover an accident to a brother-in-law of a high plant official. The other case had to do with a favorite member of the committee in person. The first man was found negligent, having broken a clear-cut rule of his department; the other man became the object lesson around which a new safe-practice rule was formulated. The committee added: "It is bad practice to wear gloves while placing rollers under seven-ton loads!"

The question whether an injured man's name should be posted following an accident was decided by the workmen's committee in the affirmative, on the ground that while the injured man undergoes suffering the whole plant goes through an experience. "This is our accident as well as the man's."

The rules that grow out of accidents, "written in blood," have been strikingly efficient, having much the weight of test cases in law. The way these employee representatives get after the man who neglects his goggles, or show up such ancient habits as "feeling the rolls," or raise the question as to a safe height for a yard-load of pulp wood, or puzzle over the human-interest situation of the man growing too old for the routine hazards of his job, is a revelation of the effectiveness of an intelligent program upon mill mind.

The practical effectiveness of this man-power program during its first year of operation is readily apparent. Working men, even those of 10 or 14 years' experience with safety committees, could not see anything else until material hazards were first of all conquered. The combined committees brought in an astonishing total of over 500 items during the year. This was especially significant in view of the fact that only 35 items in the same year were suggested for correction by the insurance inspector.

It was deemed essential by the Northern management, first of all, that all bona-fide recommendations of the workmen's general committee should be carried out. At the close of the first year interesting typewritten books of guarding suggestions, one in the hand of each member of the committee as well as on the desk of every superintendent and foreman, showed a total of over 400 such items completed, at a cost running into thousands of dollars.

Another interesting development, and one for which the plant has been particularly grateful, has been the improvement in plant state of mind. Knowing that their own fellow workmen will go the limit in finding the cause of every accident,

even the careless ones, and notably "repeaters," all workers have begun to watch their step as never before. It has become commonplace for the entire personnel to go three months or more without a lost-time accident and certain crews, including several known to be involved in hazards, are now aiming at the goal of a completely safe year.

"Psychology of Safety from the Management's Viewpoint"

By J. M. CONWAY

President of Hoberg Paper & Fibre Co., Green Bay, Wis.

The speaker said in part: Accident prevention in industry can be treated or considered under three distinct heads.

1. "Mechanical Safety" or the development and application of safeguards.
2. "Physical Safety" or the development of personnel.
3. "Mental Safety" or the development of a state of mind in management and personnel which promoted the Safety idea unit it became firmly fixed in both the conscious and subconscious minds of every individual employed in industry.

I believe the last classification is the most important, and that the degree of appreciation of its importance measures the degree of success attained in the Safety movement to date.

For many years we have been placing safety appliances in our plants and have been hiring men and women who were physically fit and adaptable to the tasks assigned. But, it was not until we were successful in fixing in the minds of every individual in our industries the value of a correct mental attitude, that our accident lists appreciably decreased.

The movement of accident prevention has risen from an almost hopeless theme of a group of idealists, to a place where it has many friends. Unlike many other great American movements, it has found favor with both sides of every faction and every group.

Study the accident records of today and you will find that most of them are more involved than were those of the past. Prevention of these accidents is going to require far more than application of safeguards and a list of "don'ts." It is going to require concentrated thought on the part of executives and new zeal on the part of plant foremen.

Every employee must be taught to think in terms of accident prevention. He must be taught that there is only one way to acomplish a task, and that is the "safe way." No mere order from the executive is going to do the work. Success will come through leadership and unabated effort.

To lead, the executive must have developed a "Safety Psychology." He must think and act in terms of safety. He must plan his year's industrial campaign with safety as a distinct part of that campaign. He must then transmit this "Safety Psychology" to his foremen, and they in turn must give it to the men and women under them. If the entire plant organization, from executive to janitor, thinks in terms of safety, then we will have it.

An executive without "Profit Psychology" would be an executive more or less foreordained to failure. I contend that "Safety Psychology" is not only as important as is "Profit Psychology," but that it is one and the same thing and that the plant with accidents cut to a minimum has a greater opportunity to profit than has one in which the accident hazard is large. A safe plant is usually an efficient plant—and an efficient plant is usually a profitable one.

The keen executive has appreciated this fact, and to a large degree it has brought about concentration upon means to eliminate accidents. Thus we must mark "Safety Psychology" as one of the attributes of a real executive and stockholders and directors of every enterprise should demand that the man who directs their industry have it in a pronounced degree.

The automobile of today is causing more death and injury than could have been laid at the door of industry at any time in its history. Has industry any responsibility in this situation, that is daily growing more serious? I believe that it has. In fact, I believe that traffic slaughter can be reduced only if industry and other agencies adopt this responsibility and handle it just as accident prevention has been handled by the industrialist and his employees.

Much has been said of late about wealth, its taxation and its redistribution. All talk along this line has referred to money and property, but the real wealth of America cannot be redistributed because it has been conferred upon men and women by their Creator in the form of bodies and minds that function in the degree that the Creator meant them to function. We cannot redistribute mental capacity or physical perfection. The individual either has it or it is missing upon his arrival with us.

We can, however, give each individual an opportunity to live under healthful conditions and to develop the mental capacity given him by the Creator. These are our obligations as citizens and we are meeting them. As men and women in industry we have the added duty of safeguarding the bodies and mentalities of our fellow workers against accident, and I am proud to say that we are performing this duty well.

If we are failing in any way, it is because we have not as yet found all of the tools required for a perfect job. We have safeguarded our plants to the Nth degree. We have used our best intelligence in selecting the best man or woman for the tasks to be done, and we have developed "Safety Psychology" to a point where plant officials and employees look upon an accident as a direct reflection upon themselves.

But, I am sure all of us can go much further in developing "Mental Safety"; in fact, if we are to go farther in acident prevention, we must do so.

In closing let me pay a tribute to the paper mill industry for its wonderful record along the line of accident prevention. In my observation no other group of men in industry has done more to set up real safety organizations, nor is there any industry where managers and employees are more harmoniously organized in promoting accident prevention.

WEDNESDAY LUNCHEON SESSION

October 16, 1935

Data on the 1934-35 Paper Industry Safety Contest

By A. SCOTT DOWD

Asso. Editor, The Paper Industry Magazine, Chicago

The record and final report of your 1934-35 Contest has been placed in your hands. As a whole, the results are worthy of praise. Forty-two thousand three hundred and seventy-eight employees with an exposure of 86,967,184 man-hours is the greatest number that have ever been engaged in this section's contest. The 110 units which completed the contest marks an increase over the number of participants in the previous year and is the greatest number of contestants since the banner year of 1931-32.

To simplify the contest frequency has been made the sole factor, as it is in all sectional contests of the Council.

It is a joyful fact that the average frequency rate in this contest has been reduced more than three whole points over that of the previous year, and that there are four additional perfect scores, a total of ten. (Note: there is an error in the report summary which includes two perfect scores of mills that did not qualify under the minimum requirement of our rules.) The average frequency rate for the past nine contests is 20, which is the lowest over-all average that has been thus far attained.

Comparing the records of each group in this contest with those of the last, we find that considerable progress has been made.

While Group A has not had a perfect score since the six-months contest of 1929, there were eight more contestants in the group than last year, and the average

frequency rate of 14.969 was a reduction of 27½ per cent. This was the greatest improvement made by any group.

Group B contained four more contestants this year, and its average frequency rate of 17.294 was an improvement of 7½ per cent. One perfect score in this group marks the third consecutive time that the St. Croix Paper Company has made this record.

Group C had practically the same record as the year before, with one additional contestant and a slight reduction in frequency to the average rate of 22.226. There were no perfect scores in this group, which is the second consecutive year that this has happened. Previous to the 1933-34 contest, this group recorded two or more perfect scores each year.

Group D had five more contestants than in the previous year, and an improvement of 1 per cent in frequency was made for an average rate of 19.935. Five perfect scores distinguished the group, an increase of two over the 1933-34 contest. The outstanding achievement in the group was made by the Riley mill of the International Paper Company, which has been operating without a lost-time accident since March 17, 1926, an unbroken record of one and one-quarter million man-hours.

The Re-Manufacturing Group, Division Two, recorded four perfect scores, an increase of two over the year before. A reduction in frequency of 21 per cent was made for a rate of 11.477.

A comparison of *Division One* as a whole in 1934-35 with the year before is as follows: 1933-34 contest, frequency 20.041; 1934-35 contest, frequency 16.903; approximate reduction, 15½ per cent. *Division Two:* 1933-34 contest, frequency 14.573; 1934-35 contest, frequency 11.477; approximate reduction, 21 per cent.

In the present contest the rules of the former have been retained with the exception of one revision of Rule 3, which now contains the paragraph: "All operations outside the mill yard proper, such as logging, lumbering, reforestation, marine and railroad transportation SHALL BE EXCLUDED."

There are 124 mill units entered in the 1935-36 Contest, and for the first two months, 53 of these mills maintained perfect records. May each one of you be inspired to maintain or approach nearer that state of happiness and prosperity that is to be found in a no-accident experience.

Paper and Pulp Section Safety Contest

In this contest 12 plaques and six certificates were awarded, the plaques being presented by C. B. Auel, manager, employees' service department, Westinghouse Electric and Manufacturing Co., East Pittsburgh, Pa., and Past President of the National Safety Council, to the following:

Division I, Group A—Hollingsworth & Whitney Co., Algonquin & Taconnet Mill, Waterville, Maine, 2,449,350 hours, 11 injuries.

Group B—St. Croix Paper Co., Woodland, Maine, 785,793 hours, no injuries.

Group C—International Paper Co., Little Island, N. Tonowanda, N. Y., 548,504 hours, 1 injury.

Group D—Five plants tied for first place—Bird & Son, inc., Phillipsdale, R. I., 216,581 hours, no injuries; United States Envelope Co., Morgan Paper Co. Div., Lititz, Pa., 184,863 hours, no injuries; International Paper Co., Livermore Mill, Chisholm, Maine, 158,610 hours, no injuries; Spaulding Fibre Co. Inc., New Mill Plant, Milton, N. H., 125,879 hours, no injuries; International Paper Co., Riley Mill, Riley, Maine, 116,298 hours, no injuries.

Division II—Four tied for first place—Container Corporation of America, Natick, Mass., 166,846 hours, no injuries; Texas Corrugated Box Co., Dallas, Texas, 141,340 hours, no injuries; Southern Container Company, Houston, Texas, 129,016 hours, no injuries; United States Gypsum Co., Genoa, Ohio, 82,084 hours, no injuries.

The Paper Industry Trophy

On behalf of Mr. Edward B. Fritz, publisher of The Paper Industry Magazine, Mr. A. Scott Dowd presented Mr. Fritz's major trophy to the St. Croix Paper Company, Woodland, Me. This was the third consecutive time that St. Croix had taken this prize. The record performance began September 23, 1931, and up to the close of the contest on June 30, 1935, had totalled 2,991,418 consecutive safe man-hours.

THURSDAY MORNING SESSION

October 17, 1935

Paper Mill Maintenance and Repair

By CLYDE FARRELL

Superintendent of Maintenance, Meade Corporation, Chillicothe, Ohio

Maintenance men compose one of the hardest groups to handle in the paper mill. They must constantly transport tools from shop to job, and from job back to shop. Consider, too, the great variations in the jobs. A mechanic may work three or four weeks, each day on a different job.

Maintenance is an overhead charge, a burden charge. In most modern mills the plan is to budget department heads with so much money for maintaining the plant and equipment. The budget depends not only on maintenance men to keep costs reasonable but also on the ability of the operating groups to produce the required number of tons of paper. Quite often production drops off due to causes over which we have no control. This hurts the reputation of the maintenance department.

What can we do to obtain efficiency? Maintenance supervisors should originate and rigidly enforce a definite policy of service. Maintenance competes with every outside service, the service shop, machine shop, etc. The justification for the Maintenance department is that it is able to produce service at a cheaper price than those on the outside. These outside service men depend for their existence upon their ability to attract and retain customers by providing quality workmanship at a reasonable price. They extend to the customer the consideration which the retail merchant gives to his customer.

Our customers are the foremen and operating heads in the mill. We should extend the same courtesy and consideration to them as do the outside service men. First of importance in the mill is the operating group. We are a service group only.

To the maintenance man, results come from development, organization, and records. Development should be both moral and educational. The maintenance group is difficult to supervise. They work in out-of-the-way places. There are no witnesses. Very often a maintenance man is called upon to go out on his own initiative and be responsible for a job. Will he work or will he kill time? Will he put careful thought into the job? Who knows whether, when he sees a particular defect, he will notify the superintendent? Who can say when he is off by himself whether he will wear goggles and have his ladder equipped with non-slip pads?

Long ago I found out that every man has inborn loyalty to someone or some thing. And every man has his own kind of pride. Some have pride in appearance; others in workmanship. Very early, when I was in charge of the electrical department, I recognized the existence of these two traits, and I resolved to take advantage of them. I set my men up with a superiority complex. I made them believe they were very intelligent. They set up a record they had to defend. On a construction job, the electrician would as soon lose his right arm as let someone get ahead of him. Working on the element of pride, I suggested to those boys that

they could buy uniforms. They did. Of course, that was in better days. When I was transferred to the maintenance department, I took care to leave a good foreman there.

I want to say a few words about organization. Organization is a proper distribution of authority, responsibility, and effort to achieve the highest efficiency.

Many men do not comprehend these factors. There is nothing sadder in industry than a foreman or supervisor who, through fear of his job or egotism, fails to distribute properly these three elements.

There is nothing so conducive to growth as to inspire your workers with praise. There is nothing which cramps efficiency more than to put them in a particular groove, and keep them there.

We had better discuss records. There are two kinds—informatory and supervisory. The informatory tells what we have done in the past, are doing in the present, and will do in the future. These are vital to a maintenance man. Supervisory records help us to prevent rather than repair trouble. Yesterday a speaker said he had never had a motor burn out. Well, we try every way to prevent it. In order to do this, we employ the tickler system. We determine by experience how often it is necessary to inspect or test equipment. We put that down on cards (there is a card for each machine). We may inspect them whether is seems necessary or not. We mark down the date and the man who did it. This is a safety measure. There are regular inspections of elevators, cranes, and locomotives.

Discussion

Mr. E. E. Grant: I disagree with Mr. Farrell that maintenance men should be second to production men. We give maintenance men first consideration. I do not believe that maintenance should be named a general burden or overhead expense. Maintenance is actual cost.

Q. Mr. D. S. Garber: Do you make a certain man responsible on every job?

A. Mr. C. Farrell: Yes. The major part of the jobs are done by teams. In case there is a larger job, we put a key man in charge. It is up to the helper to get along with the man he is working with. He must subordinate himself. If he has any worthwhile ideas, we listen to him. On the job, however, one man must have the say-so.

Q. Mr. W. A. Gleason: What do you do in regard to clean-up?

A. Mr. Farrell: We had some trouble in overcoming sloppy habits. Now we call men and foreman back if waste is found. I impress upon them the honor of the Maintenance department, and their pride makes them take care.

Q. Mr. A. Murray: Are minor jobs ever done by any but the Maintenance department?

A. Mr. Farrell: Yes, but it isn't best. I approached the general manager on this, and although he realized the danger of letting machinists put dressing on belts, etc., he hasn't done anything to stop it. We do not like to have machinists do this work, but it's bad business to tell an operator how to take care of his own machine. The ideal condition would be for the operating department to have nothing to do with this. There is a great deal of danger when they do.

Q. Mr. J. Williams: Isn't it a hazardous operation to apply stick dressing? I think it is a safer operation to apply it from a can. We have found the liquid superior to the stick. The stick lumps and doesn't condition the belt like the liquid.

A. Mr. Farrell: We have tried every make of belt dressing. The difficulty in the past was that the men disliked the liquid dressing. It is safer, but they won't have it. If they take a knife and cut the paper from around the dressing as they use it, a lot of the danger is removed.

A. Mr. Fischer: We use both in our factory. Three or four years ago we killed a man using stick dressing. We tried the liquid as a safety measure, but there were objections. We took a vote and the vote was equal; consequently we use both. We appoint a certain man to apply the dressing he chooses, and instruct him in its use.

Safety Exchange Round Table

Led by J. J. PLZAK

Safety Dir., Consolidated Water Power and Paper Co., Wisconsin Rapids, Wis.

Q. Mr. Plzak: What are the hazards and how can they be eliminated when welding and cutting in tanks and other small and unventilated places?

A. Mr. J. J. Banash: First let me suggest that you write the American Welding Society, 33 West Thirty-ninth Street, New York City, for their booklet on the question. Is the work done inside or outside? If it is outside and the tank is small, clean it out and keep it filled with water while working. Of course, the hazard is fire. Lots of plants have equipment for making carbon dioxide for use in case of fire. After the tank has been steamed out it should be tested for flammable gas. If you do not have apparatus for testing for combustible components, get a good chemist. A makeshift way for testing is to get a football bladder or a toy balloon and asperate part of whichever gas you use. Take it to a flame away from the tank and let gas slowly escape from the balloon into the flame. If the air just pushes the flame away, then, of course, it is safe. If it fires, you have flammable gas in the tank. Remember that H_2S when weakened will explode; when it is concentrated it will not.

Q. Mr. Plzak: What, if any, are the hazards in connection with working in clay dust without using a mask?

A. Mr. Pierce: To have a respiratory hazard you must have dust in air and men have to breathe it.

Q. What conditions set up this hazard?

A. Mr. Pierce: The manner of unloading material has much to do with the hazard. Some places it is wheeled in and other places it is dumped in. I haven't found that there is any particular danger. Therefore, why force them to wear masks since they are so uncomfortable? The dust is usually raised by air currents and not by the operation. In some industries they keep things wet to keep down the dust as much as possible. It is generally supposed that the danger is proportional to the amount of free silica in material. The material has a lot to do with the amount of irritation. Dust was injected into rabbit's lungs and there seemed to be little effect from anything other than silica The dust might cause irritation on the upper respiratory tract.

A. Mr. D. Hunter: A man unloading clay came in and said the clay was getting him. Our doctor said there was nothing about clay that affected a man's throat.

A. Mr. Pierce: It is said that Russian men are found to be in better health after being exposed to certain dusts. Seems to give them better teeth, bones, etc. Free silica is the harmful dust.

Q. Mr. A. A. Robinson: Have you had any compensation cases in relation to *fibrosis?*

A. Mr. Pierce: Never heard of any unless there was free silica. Paper men do not use this type of clay.

A. Mr. Grant: There is a bill now before the Ohio legislature making any dust case compensable.

A. Mr. Pierce: Other states are attempting to write this in.

A. Mr. Grant: When you get back home, find out about legislation in your state. Try to temper the legislature.

Q. Mr. A. Braatz: Did you ever have any trouble when grinding rubber?

A. Mr. Pierce: Organic dusts are not so bad unless they carry bacteria. There is nothing particularly dangerous in rubber itself. To be on the safe side, have an analysis made.

Q. Mr. Robinson: In recording lost time accidents, I would suggest that attention be paid to analysis of cause, showing to what degree the human factor was responsible.

A. Mr. G. Grieve: This is a broad subject. When a safety engineer attacks the accident problem in a plant, one of his first steps is to set up a complete accident record system in order to obtain information and measure results in promoting activities in his program. The analysis of accident causes requires a very complete

investigation of each accident if the conclusions are to be accurate. In arriving at the causes the safety engineer looks for information establishing (1) an unsafe condition and (2) an unsafe act on the part of the injured employee or a fellow workman. An unsafe condition is frequently beyond the power of a workman to correct and is considered a physical or mechanical cause. For example, defective equipment, lack of or improper guarding, hazardous work or arrangement, poor ventilation and illumination. Whether such a cause can or cannot be ascribed to an accident, the personal question arises: What unsafe act did the man commit and why? Has he a physical or mental defect? Has he been properly trained? Is it ignorance about his work, or did he disobey instructions? Did he take a chance or show other evidences of a wrong attitude?

A good principle to follow in the selection of a mechanical cause or personal cause when the investigation points to more than one of either type, is to record the one most easily removed and the removal of which would have helped most to prevent the accident. For example, a new employee was given explicit instructions about the operation of a certain type of machine and was watched at frequent intervals to make sure he understood. In the event of the machine jamming he was told to push the "stop" button, clear the defective piece and proceed. Later, a jam occurred and the new man pushed the "start" instead of the "stop" button, and in attempting to clear the machine (still in running position) lost a finger. Investigation showed the two buttons to be close together, of the same color and unmarked by "start" or "stop." These circumstances show two mechanical conditions, (1) defective material resulting in the jam, and (2) the unsafe arrangement and type of the "stop" button. Of these causes the inadequacy of the safety device is selected as the most important because it is most easily corrected and its correction will do most to prevent a similar injury. Though the employee failed to push the correct button as instructed, the personal cause is chosen as "lack of training or experience." It is important that the same person select the causes in order to insure uniformity in comparisons over periods. Opinions about the important causes may differ, but if one man decides all cases the selections are apt to be consistent.

Q. What system do you find best in your plant to control proper use of hand tools?

A. E. J. Smith, Western Electric Co.: One of the big things we do is our departmental inspection. We have an inspection that is unique. We list the departments on cards (one to a card) and the names of the foreman on other cards. They are shuffled separately and three cards from each are drawn. The three foremen indicated are appointed to the three departments drawn. Each foreman does not know beforehand what department he is going to inspect and no department knows when it is going to be inspected. The inspectors make out regular reports and these are kept by a committee for one month. If any department is in bad shape, tools out of place, etc., it has an opportunity to correct this before the next inspection.

Q. Mr. A. Augustus: Are all tools that are inspected furnished by the company or are they owned by persons?

A. Mr. Smith: We do not care who owns the tools. Some men like their own better, but each tool and piece of equipment is inspected regardless of who it belongs to.

Q. Mr. Augustus: If you find a tool broken, do you recondition it?

A. Mr. Smith: No. We throw it away.

A. Mr. Ferrell: We replace tools without asking management.

Q. Mr. Augustus: Has anyone given any thought to using the magic eye for a safety measure?

A. Mr. Plzak: Is has been used for detecting broken paper. It has been applied to freight elevators, but not so much for general safety work.

Q. Mr. E. W. Patton: In our shop we have difficulty in getting men to wear goggles. They say they can't see well enough.

A. Mr. Augustus: Have you tried full view goggles?

A. Mr. Plzak: Have their eyes examined. You can have prescription lenses put in goggles.

Q. Mr. Patton: The superintendent sided with the men when approached. What should I do in that case?

A. Mr. Plzak: Look up the law in Kansas. Look up the cost of an eye. Give these figures to the superintendent. That should have some effect.

A. Mr. G. Griffin: If the hazard is from the front, they can wear open goggles.

Q. Mr. Plzak: What will you do with men who are working in places where there is steam and have to wear goggles?

A. Mr. Augustus: You can wear open goggles. There are, too, simple methods to prevent fogging.

A. Mr. Grant: You can approach your men in this way. Ask a goggle salesman to come into the plant and give a demonstration on the high percentage of vision with these glasses. That should have effect.

Q. Mr. Hunter: Can you tell of an efficient rewinder?

A. Mr. Plzak: A guard that has been developed by Mr. Ferrell will be sketched and incorporated in the paper on Nip Hazards. Write to Mr. Fred Braun, Employers Mutual, Wausau, Wis.

A. Mr. Murray: Why not safety education instead since there is more exposure than can be safely guarded by the rails and various guards?

Q. Mr. Williams: One of our great problems is strained backs. No one has offered a logical solution to determine whether strained back was caused in plant or out of plant. Does anyone have any information on this?

A. Mr. Grant: The compensation laws hold us responsible for strains and one industrial authority recently stated that men have not had lumbago or rheumatism since the compensation laws were passed.

A. Mr. Plzak: We give a physical examination. Anything that might cause trouble with the back is corrected. We find out as much as we can what they do after they leave work. The social securities act will demand this.

A. Mr. Augustus: I received a lengthy tract on how to determine whether injury is real or false. I will be glad to send it.

Q. What protective measure can be taken against defective equipment containing chlorine gas?

A. Mr. Grant: In our plant we have had leaky tanks. We furnish the men with gas masks at three points of vantage so that we can approach from the safe side or opposite direction to which the wind blows. We then turn the fire hose on the leak.

Mr. Gleason: In Washington there is a guard on a guillotine cutter that is a series of wooden pegs. These pegs drop out ahead of the knife to keep longest finger from the cutter. In that way it is impossible to get through.

Mr. R. B. Hohn: We use the Seybold. The man has to use both hands. This prevents accidents.

Mr. Gleason: You can buy one that does not have two-hand control. However, the minute the operator removes his hand the engine stops. The helper never touches anything.

Mr. Blank: We attached an 8 foot by 9 inch board in front of the machine to hold narrow paper instead of their using hands.

Mr. G. T. Adams: We have a Thrustor control device. Frank Irvin at St. Croix Paper Co. has G. E. Thrustor Two-Button Control.

Q. Mr. Plzak: How many have found an effective elevator guard?

A. Mr. Augustus: Automatic gates.

A. Mr. Plzak: I have perfected an automatic gate. It does three things: 1. When elevator is standing at landing, gates will be down. 2. Elevator will not start when loading or unloading. 3. Elevator is closed on all four sides to keep man from being thrown off or having freight thrown against him.

ADJOURNMENT.

Petroleum Section

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Vice Chairman—R. B. Roaper, Humble Oil and Refining Co., Houston, Texas.
Chairman Atlantic Division—W. B. Murphy, The Atlantic Refining Co., Philadelphia, Pa.
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D. J. Wallace, Sinclair-Prairie Oil & Gas Co., Tulsa, Okla.
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Statistics Committee Chairman—J. W. MYERS, Standard Oil Co., (N.J.) New York, N. Y.

Past General Chairmen—

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R. S. BONSIB, Standard Oil Co. (N.J.), New York, N. Y.
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R. E. DONOVAN, Standard Oil Co. of California, San Francisco, Calif.
C. L. HIGHTOWER, United Gas Co., Houston, Texas.
G. O. LOCKWOOD, The Empire Companies, Bartlesville, Okla.
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E. J. SENNE, Socony-Vacuum Oil Co., Inc., New York, N. Y.
C. W. SMITH, Standard Oil Co. (Ind.), Chicago, Ill.
D. J. WALLACE, Sinclair Prairie Oil Co., Tulsa, Okla.

Secretary—H. N. BLAKESLEE, American Petroleum Institute, Dallas, Texas.

TUESDAY MORNING SESSION

October 15, 1935

The first session was called to order by General Chairman G. O. Lockwood, The Empire Companies, Bartlesville, Okla., who introduced Mr. William F. Gardner, manager, Standard Oil Company of Kentucky, Louisville. The latter welcomed the delegates. Chairman Lockwood then spoke briefly on "What We have Been Doing," sketching the progress of the section during the past year and calling attention to the meritorious work of standing committees.

A Statistical Review and Forecast

By J. W. MYERS

Secretary, Annuities and Benefits Committee, Standard Oil Company (New Jersey), New York City

Fortunately for our industry, while there was some increase in the number of occupational deaths in 1934, this is believed to have been due primarily to an increase in industrial activity, and the total number of occupational deaths remains approximately 16,000. There has also been little change in public non-motor vehicle deaths, the total remaining approximately 17,000. There was, however, an increase of 10,000 deaths largely ascribable to motor vehicle accidents on the highway and the petroleum industry should be concerned with the increase in non-occupational deaths.

The good-will of the public is a vital matter in the sale of our products. Motor vehicle deaths in relation to population are increasing faster than in relation to gasoline consumption and car registration. If this alarming trend cannot be corrected, eventually public opinion may be aroused to the point that restrictions may be imposed on the use of motor vehicles, which will be to the detriment of our industry. It is also obvious that, as large employers and operators of large fleets of motor vehicles, we are directly concerned with the costs of automobile insurance, as well as group life and disability insurance for our personnel. If all of the cost factors of non-occupational deaths and injuries as they affect our industry could be ascertained and compared with occupational injuries and deaths, I firmly believe that the costs of the occupational accidents would be found relatively small compared with the costs of non-occupational accidents as they affect not only our employees but the lives and property of the public and damage to company motor vehicle equipment. These are reasons why you safety men should not lightly regard the recently inaugurated campaign to reduce non-occupational accidents, the campaign which has been given the title "After the Whistle Blows."

Industrial Disabling Injuries (Including Deaths)

During 1934, the industrial members of the National Safety Council and associated organizations reported a frequency rate for disabling injuries of 15.29 per 1,000,000 man-hours worked and a severity rate of 1.70 per 1,000 hours worked, as compared with a frequency rate of 14.56 and a severity rate of 1.59 in 1933. Thus, the general trend in frequency and severity has been upward.

In our industry for 1934 the frequency rate was 14.31 and the severity rate 1.69. Both were therefore slightly below the average for all industries. In 1934, our industry stood fifteenth as to frequency and eighteenth as to severity, whereas in 1933 we stood thirteenth as to frequency and in twenty-second place as to severity. It is apparent, therefore, that we lost some ground last year in frequency and gained substantial ground in severity. From the standpoint of costs, it would appear that a net reduction was effected, since the saving effected by the decline in the severity rate probably more than offset the increase in costs resulting from the larger number of temporary disabilities. This opinion is based largely on the fact that the frequency and severity rates for fatalities and permanent total disabilities declined 19 per cent and 21 per cent, respectively, in 1934 as compared with the preceding year, whereas the frequency and severity rates for temporary disabilities only increased 12 per cent and 18 per cent, respectively.

I am unable to offer any facts which would explain the increase in our frequency rate and the fact that we lowered our relative standing among the industries. The increase in employment occurred, roughly, at the same time in all industries, and it may be assumed that the effect of the N. R. A. Codes was not substantially different in our industry from other industries. In fact, it is likely that the upturn in many other industries in so far as number of employees is concerned has been more marked than in the petroleum industry.

Trend of Disabling Injuries in Petroleum Industry

I have referred to the puzzling increase during 1934 in frequency and decrease in severity in the petroleum industry and the equally puzzling variations in frequency and severity in the other industries. The situation becomes even more puzzling when we study the preliminary returns of the 1935 contest in our industry as compared with the contest for 1934. These returns have been made available through the American Petroleum Institute. Unfortunately, the contest tells us nothing about severity, but, so far as frequency is concerned, we have a gratifying surprise in that the frequency rate for all divisions except Marine (which section has a contest of its own) is reported as 11.80 for the 1935 contest compared with 12.69 for the 1934 contest—a decline of 7 per cent. All five of our divisions improved their frequency rate in this year's contest, the improvement ranging from 3 per cent for the Pipe Line Division to 17 per cent for the Manufacturing Division. These results suggest that we may have been successful this

year in checking the upward trend in frequency of disabling injuries which has characterized our experience since 1932.

It is possible that the fact that our contest covers only the first six months of the year may check our efforts during the last half of the year. Our frequency rate in each of our contests for the eight years since we have participated in this activity has been lower than the frequency rate for the entire year as reported by all of our members to the National Safety Council. However, it does not necessarily follow that the absence of a contest in the last half of the year is the cause of the difference in the frequency rates cited above, for the reason that the hours of exposure covered by the contest have totalled, on the average, only approximately 38 per cent of the totals for which returns have been made in the annual reports. It is likely that the concerns which enter our contest have, on the average, a lower rate than all the members which file their annual returns.

Statistical Problems Affecting the Industry

Three problems of a statistical nature have arisen during the past year which have a relation to accident prevention work. They are as follows:

(a) The Definition of Disabling Injury

In 1933 the National Safety Council abandoned the term "lost-time accident" and substituted the term "disabling injury" and broadened the definition. It is now required that an injury must be counted as disabling, even though the employee does not lose time, if he is unable, by reason of the accident, to return to a regularly constituted job and to perform the same with normal efficiency. There has been at work for some time a national committee which is reviewing the entire subject of accident statistics. This committee is the "American Standards Association Committee on Standardization of Methods for Recording and Compiling Industrial Accident Statistics." I am a member of this committee as a representative of the American Petroleum Institute. The early meeting of the Committee revealed a wide divergence of opinion as to what statistical definition should be used for the purpose of recording accidents. Among the definitions discussed were the following:

(1) The old definition of a lost-time accident.
(2) The present definition of the National Safety Council.
(3) A definition which requires the counting of all injuries where the employee does not return to his regular duties.
(4) A definition requiring the tabulation of all accidents which require medical treatment.

Those interested from a social standpoint in ascertaining the true facts regarding accidents, such as government officials, assert that we should strive for the ideal of recording all accidents which cause injuries. But safety men dislike to see the definition enlarged in such a manner as to cause an apparent increase in their accident rates. They also contend that to greatly enlarge the definition and so increase the number of recorded accidents would have a discouraging effect on management, the foremen and the rank and file of employees, particularly if it made it impossible to achieve any substantial so-called accident-free periods of operation. An effort is being made to obtain a favorable decision on the part of all the organizations concerned on a compromise definition which would require the counting of all disabling injuries where the employee, at the beginning of the next calendar day following the day of injury, is unable "to perform his ordinary duties or some other duties in a regularly established job, that is, one not set up only to prevent the case from being counted as a disabling injury."

In the A. P. I. there is also a division of opinion on this subject. There is considerable sentiment in favor of adopting a definition which requires the counting of all accidents where the injury prevents the employee from returning to his regular duties on the calendar day following the date of injury. It is my opinion that as occupational injuries are reduced we should aim to broaden our definition in order that accident prevention activities may be more definitely focused on classes of injuries which are now given comparatively little attention, but we must move cautiously so that we as an industry may not be out of step with other industries.

The Committee on Standardization of Accident Statistics has reached one other conclusion: that in determining days of disability, certified calendar days shall be used.

(b) Hernias

There is considerable sentiment in our industry that non-traumatic hernias should be excluded from our statistics. This idea is advanced on the theory that non-traumatic hernias are the result of congenital disease and, therefore, not properly chargeable against industry. It has accordingly been suggested that all hernias be excluded which do not conform to the restricted definition of compensable hernias as embodied in some of the compensation laws, and the definition in the compensation law of New Jersey has been suggested as a possible basis. In my opinion, this would be a mistake. We can hardly expect management to have respect for our accident reports if it becomes known that we are excluding some cases for which industry is paying compensation. Of the forty-seven compensation laws, only twenty-four states have restricted definitions for compensable hernias.

(c) A Suggested Accident Index

There has been discussion during the past year concerning the adoption of an accident index which might reflect the results of our accident prevention work better than either the frequency rate or the severity rate alone. It has been proposed that the severity rate, which is expressed in terms of thousand hours worked, be multiplied by ten and added to the frequency rate, which is computed in terms of million hours worked. In multiplying the severity rate by ten you automatically convert the severity rate to the number of days lost per 100 hours worked. Thus, the accident index is obtained by giving the frequency rate 10,000 times the influence of the severity rate. There seems to be no sound logical reasoning for any such combination of rates. Historically, the severity rate has been expressed in terms of thousand hours worked instead of million hours worked in order to produce a severity rate which would ordinarily be more than 1.00. Probably it was never considered that from the standpoint of accident prevention results the frequency rate is 1,000 times as important as the severity rate. I doubt whether the addition of the two rates on any basis really means anything statistically since it is an effort to express two different ideas as a single idea. After all, the important service of statistics is to compare our results from year to year, both within our individual companies and as between companies and between industries, and it is my judgment that the frequency and severity rates as now compiled, shown separately, perform this function better than any single index. Each rate reveals significant facts which are lost sight of if a single index were substituted.

The Health Hazards of the Petroleum Industry

By W. J. McCONNELL, M.D.

Assistant Medical Director, Metropolitan Life Insurance Company, New York

The health hazards of the petroleum industry vary so in extent and severity depending upon the composition of the oil obtained from different regions, that only by analyzing the particular product in question and observing the many diverse processes through which it passes can potential hazards be disclosed.

Any discussion of these health hazards would be incomplete without mention of certain health problems met with in new oil fields. A new field usually attracts transients and drifters and in a short time a community exists with very little sanitation and facilities for preventing the spread of disease. People live in tents and shacks. The older fields, on the other hand, have been quick to insure the health of workers, and some have become model villages and cities.

The vapors of petroleum may be irritating to the skin and respiratory tract. When hydrogen sulphide is present in petroleum a deadly hazard exists. Fortunately, this gas is confined to a few fields and very probably is due to contamination of the oil with sulphur deposits in the earth. All field workers are subjected to these hazards, but not to the same extent as workers engaged in oil transportation, at pump stations, and in refineries. Production men are subjected to the weather and variations in temperature. Injury from physical strain is not an infrequent occurrence.

The worker in the small refinery perhaps is exposed to greater hazards than the worker in the large refinery, because in the former his duties are more general.

To divide petroleum into its fractional products the crude oil is subjected to such processes as distillation, refining, cracking, washing, chemical treatment, decanting, filtration, decoloration, treatment with absorbent earths, drying, mixing and compounding. Important products are gasoline, kerosenes, naphtha, fuel oils, lubricating oils, gas oils, paraffin and various waxes, asphalt and coke.

It will be appreciated how difficult it is to speak of potential health hazards in an industry which conducts such a variety of operations usually separate one from the other. Also that the volatility and toxicity of the products increase with increase in temperature. A hazard in one type of refining plant may not exist in another. Furthermore, the toxicity of the products varies with the sources and often is due to impurities. In speaking of any health hazard in the industry one must qualify his statement by saying the hazard in question may exist if a certain substance is encountered or if a certain impurity is present.

Skin affections resulting from direct contact with petroleum and its products are common among workers in every division of the industry. Schwartz[1] of the United States Public Health Service, has recently examined 4,500 workers employed in eight different oil refineries and reviewed the examination records of 11,000 others for skin affections. He found 488 cases of skin dermatoses, 25 of which were distinctly not of industrial origin. He states that the chief skin hazards in oil refining seem to be burns from fires or from acids and alkalies. Oil acne and papillomata, as well as an excessive amount of epithelioma, resulted from oil and paraffin. He found 12 cases of skin cancer among those examined. Prosser White classifies skin affections caused by oil and its products, according to the substance encountered, as follows:

1. Benzine of mineral oil, gasoline or naphtha, causing superficial dermatitis, dry scaly skin, eczema, pimples and pustules.
2. Burning oils or oils for lighting, causing papular and pustulous eczema, folliculitis with or without acne and abscess.
3. Residues, causing erythema, senile keratosis, warts, ulcers and skin cancer.

Many other observers have found and reported similar skin lesions among workers of refineries. All agree that cleanliness is an important factor in preventing the high incidence of these affections. Schwartz believes that the pigmented papillomata occurring among the men could in a large measure be prevented by the compulsory wearing of gloves and compelling the men to wash their hands with soap and water at noon before eating their lunch and immediately after they stop work for the day. Oil acne and wax warts, he suggests, can also be prevented by compelling the men to take shower baths, using plenty of soap, immediately after stopping work for the day, and changing to clean clothes.

Hydrogen sulphide, when present, is not only the principal cause of corrosion of expensive equipment, but also is a serious health hazard. The gas is heavier than air and is soluble in water and oil. It is characterized by an offensive odor, although in high concentrations, the sense of smell is quickly deadened so it cannot always be relied on as a warning sign. Death may result from exposure to concentrations of 0.06 to 0.08 per cent or more. The gas causes a respiratory paralysis that is followed by heart failure and death.

Sub-acute poisoning can be produced by long exposures to concentrations as low as 0.005 per cent. The gas is irritating to the eyes and mucous membranes. Conjunctivitis, pharyngitis, and bronchitis may result from low concentrations. A chronic form of poisoning, characterized by digestive disturbances, headache, lassitude, cold sweats, and local irritation to the eyes and the respiratory tract, is generally believed to result from prolonged exposures to low concentrations.

Complete protection against the inhalation of hydrogen sulphide is essential. The degree of protection afforded by the use of canister-type gas masks, the hose mask, and self-contained oxygen breathing apparatus against this gas, as well as against petroleum vapors is reviewed in detail in a report[2] by the Bureau of Mines to the American Petroleum Institute. Additional protective measures consist of properly designing equipment to eliminate places of exposure and instructing workmen to avoid exposure to the gas by insisting that they use respiratory protective equipment when working in contaminated places, and by training them in methods of emergency

[1] Schwartz, Louis, M. D., Dermatitis in the Oil Refining Industry; American Journal of Public Health, September, 1934, Vol. 24, No. 9.

[2] United States Bureau of Mines, 1925, Bulletin No. 231.

treatment. Adequate protection against petroleum vapors, which have anesthetic effects also is afforded by wearing breathing equipment.

Inhalation of volatile hydrocarbon products of petroleum produces affections of a general nature, depending upon the origin, degree of purity of the product, and the percentage of hydrocarbons boiling at high or low temperatures. Exposure to the vapors in small workrooms, tanks, vats, boilers, and locations where there is an insufficient supply of oxygen may cause loss of consciousness and even death unless the victims are very rapidly removed into the open air. Inhalation of small quantities of the vapors gives rise to headache, dizziness, and intoxication, resembling that of a drunken man. Inhalation of moderate quantities of the volatile hydrocarbons, even when sufficient oxygen is present, for long periods of time, causes buzzing in the ears, heaviness in the head, marked intoxication and sometimes loss of consciousness and amnesia. In some cases, according to Koelsch,[3] there is a state of excitement progressing to a maniacal condition with delirium, hallucinations, muscular tremor, clonic spasms, sometimes neuritis, paraesthesia, difficult deglutition and speech, shooting pains in the neck and chest, fall in the body temperature especially in the peripheral parts, with cyanosis and sensation of cold, and diminution in the respiratory rate and pulse.

By means of experiments carried out on prisoners of a penitentiary at Bucharest, Felix[4] found that in most of the cases 5 to 15 grams of the volatile oils inhaled for seven to twelve minutes caused dizziness, nausea, vomiting, and sleepiness, as well as congestion of the conjunctiva and a sensation of burning in the chest. Anesthesia and sleep were produced by inhaling 20 to 40 grams for eight to twelve minutes, with individual variations from a marked susceptibility to a considerable resistance.

The inhalation of 45 milligrams of light benzine vapor causes the death of such animals as dogs and cats at the end of two hours, but 60 milligrams per litre of air, or exceptionally even 80 milligrams, could, in some cases, be borne for twenty minutes without any inconvenience. Haggard found in his experimental work on the effect of gasoline fumes on dogs that the first disturbances occur with a concentration of 85 volumes per 10,000 volumes of air. When the concentration reached 156, the animal was not able to keep upright; with 102 volumes per 10,000 muscular spasms are caused, and with 162, epileptiform convulsions occur. Another animal lost consciousness with a concentration of 238 volumes per 10,000 volumes of air, and death occurred after two minutes with 243 volumes.

The effect on the blood of exposure to the distillates, benzine, naphtha, and gasoline, remains a controversial subject. Some investigators have found that solvents marketed under the name of gasoline or benzine actually contain enough coal tar benzol to give rise to symptoms typical of benzol poisoning.

Sulphur dioxide is encountered in refining processes, but does not cause, as a rule, acute poisoning, because the gas is so irritating to the eyes and mucous membranes in small concentrations that it serves as a warning signal to leave before any poisonous effects are experienced.

Carbon monoxide, although a considerable hazard of the past when workers were sent into the storage tanks to clean them out, is now rare since the introduction of steam cleaning.

Other gases and vapors, which are encountered in refining plants, are chlorine, ammonia, and chemicals used in fighting fires. Acids and alkalies are used in large quantities and may cause injuries from burns. Chlorinated hydrocarbon solvents are employed in motor oils to produce a better quality oil and every precautions should be taken to avoid exposure to these highly toxic solvents.

Another serious health hazard that must be guarded against is tetra-ethyl lead which is added to gasoline for the purpose of increasing its efficiency. Absorption of this fluid may be by way of the unbroken skin through contact or by way of the respiratory tract through inhalation. Tri-ethyl lead, a decomposition product of tetra-ethyl lead, may be inhaled as finely divided dust by those engaged in cleaning the interiors of gasoline tanks. Extensive exposure may result in lead absorption and acute intoxication. Recently, Dr. Stearns, of the Boston Psychopathic Hospital, reported a case of encephalitis due to tetra-ethyl or tri-ethyl lead in a man who was engaged in cleaning gasoline storage tanks, although it is reported that the man

[3] International Labour Office—Occupation and Health Brochure No. 20, p. 7.

[4] International Labour Office—Occupation and Health Brochure No. 317, p. 4.

wore an asbestos unit and a gas mask connected with a pipe line to an oxygen supply. Repeated exposure to small amounts may result in chronic lead poisoning. So much has been written regarding the dangers of ethyl fluid and the safe method of handling the product that a review of the subject is unnecessary here. The hazard is minimized where proper mixing equipment and adequate storage are provided. As a further precaution all those engaged in handling the product should be periodically examined for signs and symptoms of lead absorption.

Another operation which may prove hazardous is that of sandblasting to clean storage tanks, drums, etc., to remove rust and prevent corrosion. This operation generates considerable dust of a high silica content which when inhaled over a period of years causes a fibrosis of the lungs and predisposes the individual to tuberculosis. Effective protection against the inhalation of the dust is afforded the operator by providing him with an efficient positive pressure helmet.

Certain groups of workers are exposed to heat, variations in temperatures, dampness and to ultra-violet and infra-red rays incident to welding, cutting and lead melting operations. The latter hazards are not confined to the petroleum industry, but are common to many industries where such work is performed.

Despite these and perhaps other possibilities of health hazards in the petroleum industry, statistical data on the frequency and distribution of diseases and affections peculiar to the industry are very limited. The more acute poisonings are perhaps reported as accidents rather than occupational diseases, and chronic diseases or secondary complications may not be of sufficient severity to attract attention. The affections most frequently associated with the industry are skin eruptions, diseases of the eyes, and gastro-intestinal disorders.

Occupational mortality and sickness statistics often have brought to light adverse health conditions in industries. Unfortunately such statistics are very limited for oil workers. The most instructive data of this character available are contained in the joint mortality experience of twelve large life insurance companies on policies issued in their Ordinary departments during the years 1915-1926.*

The method of analysis employed in this investigation was to compare the actual number of deaths which occurred in a given occupation with the number of deaths which might have been expected on the basis of death rates by ages prevailing among persons insured during the same period who had no serious medical impairment, and who were engaged in non-hazardous occupations. Three classes of oil workers were studied: oil and gas field rig builders and handlers of explosives; other oil and gas field operatives, and workers in petroleum refineries. The table which follows shows for each class the number of years of life exposed to risk, the actual number of deaths, the number which might have been expected, and the ratio of actual to expected deaths.

MORTALITY OF OIL WORKERS.*

Class	Exposed to Risk	Actual Deaths	Expected Deaths	Ratio of Actual to Expected Deaths
Oil and Gas Field Rig Builders and Handlers of Explosives	2,799	30	9.8	306
Other Oil and Gas Field Operatives	51,358	238	187.3	127
Workers in Petroleum Refineries	16,652	73	61.1	119

The small class of rig builders and handlers of explosives had 30 deaths where but 10 might have been expected. Among the other oil and gas field workers there were 238 deaths where 187 might have been expected giving a ratio of actual to expected deaths of 12 per cent. Refinery workers had 73 actual as compared with 61 deaths expected—an excess of 19 per cent. Except for the class of rig builders and handlers of explosives, these ratios cannot be said to be very high for occupational classes containing large numbers of wage earners.

Accidents caused many more deaths than might have been expected. In fact, the excessive number of deaths from this cause was sufficient to account for the

*Joint Occupation Study—1926 compiled and published by The Actuarial Society of America and the Association of Life Insurance Medical Directors. New York City, July, 1929.

entire extra-mortality of both oil refinery workers and of the oil field workers (exclusive of the rig builders and workers handling explosives). A very large part of the excess mortality of the rig builders and handlers of explosives also was chargeable to accidents. Analysis of the mortality of each class by diseases produced inconclusive results because of the small number of deaths included. There were a few more deaths than expected from influenza among oil and gas field workers and a few more than expected from pneumonia among refinery workers.

The chief reason for the low incidence of occupational affections among petroleum workers may be credited to the progressiveness of the industry. Measures are inforced for the prevention of exposure to toxic gases and vapors and any exposure that does occur is usually the result of accidents and irregularities in the operation. Mechanical safeguards to lessen the hazards have been installed. The general practice is to confine the gases in a closed system at all times. Vents specially designed to remove the toxic gases to places where they can be safely discharged are in general use. Careful plant inspections are made and the workmen are instructed to avoid breathing the gases and to keep out of places where gases may collect. Tanks that must be entered are steam cleaned and ventilated and men are provided with protective equipment. Men are instructed in rescue methods and first aid. Protective and rescue devices are well maintained and available at all times.

Vocational Training As a Factor in Accident Prevention

By GEORGE H. FERN

State Director Vocational Education, Austin, Texas

Many methods used in accident prevention have been well developed and are securing a certain degree of success. Devices such as shop talks on accidents, posters showing the dire results of accidents and of unsafe practices, descriptive pamphlets, and competitive contests between departments have all proved feasible and desirable. But these factors of the safety campaign are really supplemental to a fundamental program that has for its purpose the systematic training of workmen in habits of safety on the particular job on which each serves.

It is well enough to advise a person regarding the dangers in driving a motor car through traffic. It is quite another matter to insist upon the observance of every rule and regulation of safety promotion from the start when breaking in a new driver. But even this would not avail unless the supervision of the learner was carried to the point where he was required to practice unswervingly every precaution which he had been shown how to observe. This is merely saying that a driver needs to be trained until safe habits become virtually automatic and this is equally true of the wage earning jobs in industry.

All of us are bundles of the special habits acquired through training. This is true also of every workman on the job. If you want to establish any habit of skill, you must require that the worker practice that habit correctly from the start. He must have careful supervision and drill in correct performance without deviation, until the practice has become firmly set. When this has been done, he knows only the correct way of doing the thing and, therefore, acts in no other way.

Too many foremen break in a new worker by first teaching him to do the job and later trying to teach him how to work safely on the job. The time to set safety habits is while he is in the learning process. This means the absolute requirement that the worker observe every safety precaution and perform every operation precisely as he has been taught without any deviation. You cannot fix a habit by having a person practice it one day and not practice it the next. Even after the worker has learned the safety precautions he needs to be inspected at intervals to see that he is practicing them. Only in this way can a foreman be sure that he can rely upon the worker to take care of himself.

It is a fundamental of business that production takes place in proportion as workers learn to take care of themselves without close supervision. This not only reduces waste of materials, equipment, tools and power, but it enables the foreman to attend to other duties. If this is true, then the cost of thorough safety training of the new worker is a cost-reducing policy.

Here let me point out that vocational schools train youth in the fundamental habits of skill. Every effort is made to train these youths not only in the skill of their occupation, but in what might well be termed "skill in accident prevention on the job." Such youths are going into industry with these habits well established. They prove valuable workmen from the safety standpoint.

For the great body of workers, however, the foreman is the real vocational teacher. He is continually breaking in new workers on specific jobs. He needs to have impressed upon him the importance of training these men in safe habits and his responsibility and opportunity to do this during the learning period.

When a foreman breaks in a new worker, he is like any other teacher. He can, however, do a more thorough job than any other teacher, because he can "tell, show, do and check." Before the job is started, he tells what is to be done and why, and also shows what is to be done and why. The next step is to have the worker do the job himself. If he does not do it correctly, the foreman spots his trouble, tells, or shows, him again, and has the worker try again. Then he lets him practice for a while, and then he checks to see how he is getting along.

All of this means that any systematic training in safe habits requires the following things by any person responsible for a group of people trained on the job:

1. He must analyze each job to determine the skill and understanding necessary to perform it correctly.
2. He should spot the danger points, call attention to them, and require the worker to practice from the beginning the safety precautions and motions necessary.
3. He should weave these safety habits into the total habits which the worker must acquire and teach them as a part of the complete job problem.
4. He should set as his standard, the proper performance of the job mechanically, and the proper performance of the job from the safety standpoint.
5. He should not consider the worker properly trained until he is sure that he has developed the requisite skill in operation of job processes and necessary safety habits.

We are entering upon an era when there is an economic contest between the efficiency of plants. Employers will select employees more carefully, induct them into their jobs more carefully, train them more carefully, and conserve them more carefully. This means that the foreman will be selected for his ability to train workers. As foremen become better instructors of men, they will become better teachers of safety on the job.

It is not my purpose to say what agency should provide a program of vocational training. It is rather to point out the necessity for such training and describe a program offered under the control and supervision of public school authorities which affords the workers this opportunity.

Each state, through a State Department of Vocational Education, in cooperation with local school systems, carries on a state-wide program of vocational education, supported by funds from the Federal Government, state government and local sources. In 1917 Congress enacted the Smith-Hughes Law appropriating money to the various states to stimulate vocational education in the fields of agriculture, trade and industries, and home economics. Vocational education, as conceived by sponsors of this law, includes education and training of less than college grade in any field which assists people, young or old, to get a job, to keep a job, to improve on a job, to get a better job, and to believe in that job. It prepares those of school age for advantageous entrance into skilled trades and occupations. It enables those who have left school for employment to receive further training which will fit them to do better work and command higher wages.

Each State Department of Vocational Education has a division responsible for the establishment, maintenance and supervision of classes in trades and industrial education. The Federal act provides that money appropriated should be expended for the salaries of teachers on the condition that for each dollar of Federal money the state or local community, or both, shall spend an equal amount. The act also provides money for state administration and supervision of the program, as well as a teacher training program. The instruction of any class depends largely upon the instructor. The instructors possess wide experience in the trade and industrial field. The program also provides for foremanship training, including the problems of foremanship

conferences and of better foremanship. A foremanship conference is an excellent step in the development of an educational program for any industry. It assists members of the group to acquire the habit of intelligently thinking through problems which require decisions and to plan the execution of such decisions. This is accomplished by analyzing topics or cases. The members of the group participate in discussion of the points involved and profit by the experiences of other members. In almost every foreman conference the discovery is made that certain inefficiencies are caused by inadequately trained workers. In addition to the benefit derived by each foreman, a training program for workers usually results.

Early in 1933 oil companies in the Mid-Continent area took advantage of the state vocational program by having conference leaders conduct a number of conferences on better foremanship among their supervisory forces. Conferences were conducted for the Lone Star Gas Company, Magnolia, Empire, Texas Pacific Coal and Oil, and others. The conference leaders were frequently asked for information on how workers could obtain instruction which would give them a better understanding of their jobs and a better understanding of the industry. The safety engineers and conference leaders realized that a real opportunity for industrial training existed.

Accordingly representatives of the State Vocational Education Departments of Texas, Oklahoma and Kansas met with several safety engineers and H. N. Blakesley, of the American Petroleum Institute, in Dallas, Texas, on April 2, 1933. During this conference conclusions were reached that:

a. A course explanatory and descriptive of the industry should be produced;
b. Specific courses, applicable to the various kinds of work in the industry, should be produced;
c. An agency or vehicle within the industry should be found to assist in carrying on this work.

The group realized that a well-organized program was necessary and that procedure would be facilitated if a correlating agency could be established. The central committee on district activities, production division, American Petroleum Institute, has been investigating trade extension courses with the view of developing training work for oil field workers. Members of the committee became much interested in a vocational training program described by officials of the State Departments of Vocational Education of Oklahoma and Texas.

The committee soon announced a plan of cooperation for establishing training courses in Institute Chapter areas by assisting the vocational representatives in reaching those who might be interested and by giving this program active support. The vocational representatives appeared at meetings of various chapters, presented their training plans, organized classes and selected instructors; and in a short time some 3,000 oil field workers were studying such subjects as: elementary science, gas engines, oil field mathematics, and blue print reading. Subject outlines were prepared and instructors obtained their own reference work and taught the courses as best they could.

At the annual meeting of the American Petroleum Institute, the central committee on district activities decided to appoint a topical committee on vocational training to act as a steering committee for the oil field vocational training program. The function of this committee has been:

a. Prepare an outline of production-department subjects on which texts could be prepared;
b. Assign these subjects to the state vocational representatives for development and the writing of texts, to eliminate duplication of efforts;
c. Select practical operating men to assist the state vocational representatives in the preparation of texts so that the texts have practical application to production activities;
d. Review and validate text material before it is published;
e. Assist the Federal and state representatives in a general advisory capacity.

The vocational training program for oil field workers is organized into unit courses, divided into three groups: first, basic courses such as mathematics and science; second, general courses such as internal combustion engines and steam power; and third, special courses such as rig building, pulling wells and methods of lifting oil.

About 40 subjects or unit courses are available. A number of textbooks are

available to students at cost. Instructors' manuals are furnished for each text. The texts so far produced have been written by representatives of the State Departments of Vocational Education in Oklahoma and Texas, in cooperation with men engaged in the oil industry. The topical committee on vocational training appoints specific groups to assist in the preparation of the text material before it is presented to the topical committee for final validation and approval. Many of the texts written for field employees are usable in other departments of the industry.

Each of the courses offered for the petroleum industry series has been organized on a short unit basis. Courses usually vary from 12 to 60 clock hours. Classes are organized whenever a group of ten or more men express a desire to receive vocational training in a particular subject. Classes are conducted at any time when members of the group are free to attend. Classes usually meet twice a week for a period of two hours at any place where facilities are available for instruction. Class organization is completed through the local superintendent of schools, who, with a representative of the State Department of Trade and Industrial Education, selects a qualified instructor and arranges for a meeting place. Instructors are paid an hourly wage. In some cases a small registration fee is charged each student for each course. In Texas this registration fee cannot exceed $2.00. In many cases the registration fee is refunded by the employing company if the men attend a specified percentage of the classes. Persons selected to teach courses in the petroleum series must have had practical experience in the petroleum industry in the subject to be taught.

Upon satisfactory completion of any one of the unit courses, a man is granted a certificate by the State Department of Industrial Education. Satisfactory completion of a course means, in addition to satisfactory class-room work, an attendance of at least 80 per cent of the class meetings. After completing a specified number of unit courses, a man is granted a diploma.

During the past year the vocational training program for the petroleum industry in Texas included 5,000 men enrolled in 250 separate classes, taught by 225 teachers. This represented programs in 57 cities, with men from 153 different oil companies.

WEDNESDAY MORNING SESSION

October 16, 1935

Science Reduces the Hazards in the Petroleum Industry

By J. H. DUNN

Production Engineer, Lone Star Gas Company, Dallas, Texas

We are told that Colonel E. L. Drake and his men laboriously completed, in the year 1859 near Titusville, Philadelphia, the world's first oil well at a depth of approximately 70 feet. In the 76 years that have followed, a vast amount of knowledge concerning the exploration for and production of oil and gas has been acquired by the industry. The fact that today the petroleum industry is prepared to drill wells, in the normal conduct of its business, to depths greater than 10,000 feet is indicative of the progress that has been made.

While the history of the development of the petroleum industry is quite romantic, progress has been made after hazards have taught us costly lessons.

In addition to the hazards common in the handling of heavy machinery and in working around moving equipment, the dangers in the petroleum industry may be infinitely greater, dependent upon the ability of the equipment in use to withstand pressures and to confine safely the highly flammable and expansive substance. Many disasters have been caused by the lack of pressure control. Many failures in equipment resulting in explosions and fires, have taught us to appreciate the meaning of the word pressure.

Pressure control becomes increasingly important as we drill to greater depths. It has been the fairly recent experience to encounter reservoir pressures as high as 3,000 pounds, or even 3,500 pounds per square inch. To illustrate a pressure of

3,000 pounds per square inch, let us compare its force with a force necessary to raise a weight. The Great Pyramid of Egypt has a square base covering more than thirteen acres and contains in excess of 90 million cubic feet of stone. A pressure of 3,000 pounds per square inch is sufficient to raise the Great Pyramid with sixteen more such structures piled one on top of the other.

The statement that the hazards in the petroleum industry have been materially reduced is true because of modern equipment and methods of pressure control.

As long as oil and gas was obtained at lesser depths and lower pressures, the general practice was to bring the wells in flowing wide open, exposing lives and property to the dangers of atomized oil and liberated gas as well as the hazards of the destructive power of pressure dissipation. The practice seemed to be accepted as a necessary gamble.

Modern methods have made it practical to complete wells and bring them into production under absolute control without even splattering the derrick. This has been made possible by a series of scientific developments. The modern core barrel permits the coring of earth formations at any depth and bringing them to the surface with the strata in their exact relative sub-surface positions. This development, together with the sand tester, which samples the production during drilling, have made it unnecessary to open a well to determine whether prospects of production are good or bad.

These operations are carried on while pressure control is maintained by the circulation of a hole full of mud of composition and weight sufficient to hold down safely the pressure expected. In addition, a positive control is maintained by a blow-out preventer, which may be put into almost instantaneous action if other methods of control fail. The blow-out preventer permits the emergency closing in of the casing while the drill pipe or tubing is in the hole. This apparatus has eliminated the excuse for disastrous blow outs which in the past have resulted in numerous wild wells.

Some of the greatest hazards in the industry have been the result of wild wells and cratered wells. The "Wild Mary" Sudik well, located near the business section of Oklahoma City, was brought under control on April 6, 1930, after flowing wild for eleven days at the rate of 100,000,000 cubic feet of gas and 25,000 barrels of oil per day. On April 2, 1931, in the Big Lake Field of Texas, another giant well broke loose and for four days flowed wild at the rate of 173,000,000 cubic feet of gas and 24,000 barrels of oil per day. Among the earliest and most disastrous wild wells in the East Texas field was one south of Gladewater which caught fire in 1931, and fatally burned nine men. Three lives were lost some months later in another well fire near Overton, Texas.

Now it is unnecessary to permit a well to flow wide open during completion operations. It is standard practice to allow them to flow on a restricted basis during that part of the completion operations commonly referred to as washing the well in. This process is started only after the flow string or tubing has been set and adequate pressure and flow control equipment has been installed on the top of the well. The equipment is collectively known as the "control head."

After installation of the control head, flow lines, separator, storage tanks and other equipment, the process of washing the well in is started. I have already mentioned that the pressure is held down during drilling operations by the circulation of heavy drilling mud in the hole. At the desired time water is injected into the flow stream of mud to make it lighter in weight. As the water replaces the mud the tendency is for the pressure in the producing formation to raise the fluid and start the flow of oil and gas. After the flow has removed the mud and water a valve is switched and the initial production flows, under complete control, into the storage tanks. The completion of a gas well follows the same procedure; except that it is closed in until arrangements are made for utilization of its production. In the case of either well, if the flow does not start of its own accord after washing in, the well may be assisted by lifting or swabbing inside the tubing. This operation is likewise conducted under pressure with special equipment.

Hazards also have been eliminated in the operation of high pressure wells. In installing or removing tubing, it used to be common practice to permit wells to flow wide open with continuous hazards to workmen. Today wells may be tubed or the tubing removed without the escape of any appreciable quantity of gas or

oil. This operation is accomplished by equipment designed to raise or lower the tubing, joint by joint, through a stuffing box arrangement.

It is now the exception rather than the rule for a gas well to be blown to the air at regular intervals. This practice was once considered necessary to keep wells clean and in condition to produce gas. It was also required by state regulatory bodies. Other methods, resulting from the work of the United States Bureau of Mines in cooperation with the industry, now serve to eliminate the necessity for the blowing of gas wells. No greater constructive step could have been made than the elimination of this hazard, with the resultant conservation of gas.

Another development in the operation of high pressure gas wells comes from the application of a device known as a bottom hole choke. Even before extremely high pressures were encountered, the industry was constantly subjected to the hazards of freezing. The expansion of gas from a high pressure to a lower pressure is always accompanied by refrigeration in proportion to the amount of expansion. When the refrigeration is sufficient to cause the moisture content of the gas to freeze, ice is formed and the lines become plugged up.

Operating pressures on gas pipe lines normally do not exceed 500 pounds per square inch and usually it is unsafe to subject them to exceptionally high pressures. Since well pressures often greatly exceed that figure numerous disastrous blow outs of frozen pipe lines have occurred. The freezing problem has been so serious at times that elaborate and expensive pipe line heater installations have been made. However, the best of the pipe line heaters were unreliable and required almost constant attention; one instance of neglect or mistaken judgment meant destruction, and the fire hazard was always present.

The proper application of the bottom hole choke now eliminates the necessity for pipe line heaters and makes freezing impossible. In this device the temperature of the earth is employed. We have known for some time that the temperature in the bottom of some of our producing wells is as high as 200 degrees Fahrenheit. It was not, however, until recently that we learned how to make use of this heat to eliminate our freezing problems.

The bottom hole choke, which is installed in the tubing near the bottom of the well, may be set in place in about twenty minutes while the well is completely closed in. Once installed, it restricts the flow of gas, causing the expansion and the resulting refrigeration to take place in the bottom of the well where the tubing or vertical pipe line is sufficiently heated by the temperature of the earth to prevent the collection of ice. Gas is now often delivered through the well to the surface at temperatures as high as 120 degrees Fahrenheit or 80 to 90 degrees above freezing.

Because of varying demand most gas wells must offer flexibility in rates of delivery. But the bottom hole choke itself delivers gas at a fixed rate. Its use is made practical by a companion device installed at the surface, known as a mixing valve. This device permits the production of additional quantities of gas when desired. A quantity of casing-head gas can thus be heated by and mixed with the hot gas delivered from the bottom hole choke through the tubing. The bottom hole choke has been set at depths as great at 8,500 feet. It is controlling the deliveries of gas in quantities varying from 100,000 cubic feet per day up to 12,000,000 cubic feet per day, expanding gas from bottom hole pressures as great as 3,500 pounds down to line pressures as low as 250 pounds. These results are being obtained with no freezing.

Innumerable improvements in equipment have been made. Only that equipment which has withstood the tests for efficiency and safety has survived. Manufacturers are striving not only to improve equipment to make possible the drilling of wells to greater depths and to withstand high pressures, but also to accomplish this with the greatest safety to workers. We must not overlook the effectiveness of the research and engineering work of the manufacturers of equipment, and steel companies who now are able to meet almost any desired specification. Equipment is thoroughly tested and has a high factor of safety.

As deeper wells have been drilled, drilling equipment generally has been made heavier, stronger and safer. Derricks have jumped from 64 to 84 feet up to heights as great as 164 feet. The wooden derrick therefore has been replaced by the steel derrick. The desired strength and security have been obtained only through the introduction of steels of greater elasticity and the manufacture of derricks accurately designed to withstand the great stresses and strains imposed.

An illustration of the attention now given to safety is found in the equipment in use for the rotary drilling wells. The modern draw works, or machinery which operates the drill and handles the heavy equipment, is not only sufficiently rugged to carry the drilling operations to great depths, but it has been equipped with guards and shields to protect the workmen from moving parts such as chain drives, shafts and sprockets. The draw works cathead or wench, used for making up and breaking down pipe joints and for lifting heavy equipment, was formerly operated by a cathead man on the derrick floor. This man was forced to go back and forth between the cathead and the pipe tongs, with the constant danger of becoming entangled in the tong-rope or the cathead itself. Today we have the safety and automatic types of catheads operated by the driller at his regular post on the opposite side of the draw works, and the cathead man does not have to leave his position at the pipe tongs. Modern equipment includes shields or covers for crown blocks, traveling blocks and rotary tables, giving the workmen the maximum protection against injurious or fatal entanglements in the equipment, a good part of which is operated at high speed.

The manufacturer of equipment has become accident conscious along with the personnel of operating companies. The cooperation between these two and the tendency toward specialization in the industry have had no small part in the reduction of the hazards.

What I Have Learned from High Pressure Equipment Inspection

By FRANKLIN L. NEWCOMB

Supervising Engineer, General Engineering Dept., Standard Oil Development Co., Elizabeth, N. J.

Since the inception of the petroleum industry, some kind of inspection of equipment has been found necessary. The investment in equipment has been so heavy that it has been necessary to obtain reliable and continuous operation to assure a fair return on the investment and still meet competitive prices. The failure of a comparatively minor piece of equipment might result in a fire which would damage a major part of the plant and render operations impossible over a considerable period of time.

Before pressure equipment was extensively used in oil refining, inspection was carried on by the mechanical forces, the inspection being made by mechanics from the trade most familiar with the equipment involved. Since most of this equipment operated under only a few pounds pressure (3 to 5 pounds maximum) or under a very slight vacuum, it was usually safe enough if it did not leak or show signs of distortion. In addition, most of the crude handled at that time was sweet and very little corrosion was experienced. Inspection usually consisted of a visual examination supplemented by hammering to detect thin areas or metal which had been overheated.

At about the same time that cracking equipment was first used, oil was received from Mexico which contained highly corrosive and toxic sulphur compounds, including hydrogen sulphide. Today a considerable part of the crude oil being refined has similar corrosive properties but the rate of corrosion varies with crude oil from different sources. The severe corrosion caused by these oils, coupled with the increased use of pressure equipment, necessitates a more systematic and thorough inspection than was formerly necessary. The type of inspection required today necessitates an organization in charge of a competent engineer thoroughly familiar with the design, construction and operation of the equipment. Both graduate engineer inspectors and mechanical inspectors are necessary to carry on this kind of inspection.

The organization required to make competent inspections of the equipment in a refinery or group of refineries is dependent upon the nature of the equipment, the

amount of equipment and whether or not the organization is local, that is, confined to one plant, or whether it is intended to coordinate the work at several plants.

For a large oil company with refineries widely scattered, such an organization would probably require a central group which would make general periodic check inspections of the equipment at stated intervals. In addition, there would be a local organization at each of the individual refineries to care for equipment which requires inspection at more frequent intervals than the general periodic inspection. Each of the local organizations should also be in charge of a competent engineer thoroughly familiar with the design, construction and operation of refinery equipment. As the amount of equipment and number of refineries to be inspected decrease, the inspection organizations would become more simplified until we reach a case of a single small refinery where the organization would reach its simplest form being in charge of a competent engineer with sufficient men under him to handle the actual inspection work.

Regardless of the type of organization, it appears inadvisable for the inspection force to come directly under the jurisdiction of those primarily in charge of either production or maintenance of the equipment. Where there is an independent technical organization, it is felt that the inspection forces should come under such an organization so that they will be free to express their opinion without being influenced by someone whose primary interest is either in getting the maximum out of the equipment or of maintaining it at the lowest cost.

A modern, complete refinery contains a complexity of equipment. Certain of the equipment may come under the jurisdiction of some state or local ordinance requiring inspection by persons employed or licensed by such authority. Such equipment would include boilers and, in some states, air receivers and the like. Where the law requires inspection of equipment by designated authorities and competent inspection is made, it would not appear necessary for such equipment to be inspected by the oil company's personnel. Certain other equipment, such as electrical equipment, pumps and machinery, can probably best be cared for by the mechanics most familiar with such construction.

This leaves for the inspection department all types of vessels containing oil, vapors, gases, air, acid and various chemicals whether they operate under a vacuum, no pressure other than the head of liquid, or elevated pressures. It also brings under the jurisdiction of this department pipes, valves, fittings, structural work and any other equipment not specifically assigned to other departments.

Experience has indicated that it is just as important to inspect low pressure as high pressure equipment and that the effects of a failure may be practically as serious in one case as in the other since frequently in both cases flammable products are handled.

The principal factors affecting the frequency of inspections are: (1) the character of the contents, (2) pressure, (3) temperature, (4) material used in construction, (5) amount of material, above that required for strength, available for corrosion, (6) protection against corrosion.

Vessels and pipe lines may contain oil, acid, strong alkalies, gas, air and various chemicals used in the refining process. Many of the oils handled are high in sulphur and other corrosive compounds. The gas handled in the refinery is largely the product of the oil handled and its corrosive characteristics closely follow that of the oil. The air supplied to the compressors may be polluted with acid fumes or other corrosive gases. Some of the latest developments in oil refining require the use of chemical solvents. The experience with some of these has been so limited that little is known concerning the corrosion which may occur.

The pressures and temperatures prevailing frequently have a decided effect upon corrosion. In general, the higher the pressure and/or temperature the more corrosive the substance.

The material of construction will have an important bearing on the corrosion experienced. Some materials may be easily attacked. Other materials may present considerable resistance but still show a definite corrosion rate. Still other materials may be entirely resistant to the corrosive substances present.

In many cases the material may be protected against corrosion. Material exposed to the atmosphere is usually painted or coated with some protective substance to prevent atmospheric moisture and fumes from reaching the material of construction. The interior of equipment is frequently protected with coatings such as sprayed-on metal, sheets of corrosion-resistant material, concrete, acid-resisting brick, etc.

In order to determine the frequency with which inspection should be made, one must consider all of the factors which may affect the strength of the structure. The API-ASME Code for Unfired Pressure Vessels for Petroleum Liquids and Gases gives certain rules for determining the maximum period between inspections. Since this code represents the joint experience of the petroleum industry, it is considered safe and it is recommended that pressure vessels containing petroleum liquids and gases should be inspected at least as frequently as required by the inspection section of this code. Other pressure vessels do not differ materially from petroleum pressure vessels, except in that generally they operate under lower temperature. It would, therefore, seem logical to determine the maximum periods between inspections for such vessels by the same API-ASME Code rules as are used for determining the inspection intervals for petroleum vessels.

Since a great deal of equipment in a refinery may not come under the category of pressure vessels, it is also necessary to determine intervals between inspections for such equipment. To do this, one must take into consideration all the factors affecting the safety of the construction and determine the probable rate at which it is approaching a dangerous condition.

It should be borne in mind that usually an operating unit in a refinery consists of a combination of different pieces of equipment, frequently including pressure vessels, pumps, furnaces and a great deal of piping. While one piece of equipment in a unit might require infrequent inspections, another might require quite frequent inspections. The piping being of thin walled construction might deteriorate at such a rate that, unless inspected at more frequent intervals, it would become unsafe and might even fail. It is frequently the practice to inspect certain parts of the equipment at the completion of every run to determine that no unusual conditions have occurred and also to make a complete inspection of the entire unit at fixed periodic intervals, even though the rules for determining the frequency of inspection of some of the parts might permit longer intervals.

Pressure vessels containing petroleum products and gases seldom operate as isolated pieces of equipment. They are usually part of a complex group of equipment interconnected with piping. Different pressures may prevail in various parts of the equipment and different vessels constituting part of the same equipment may be designed for and operate under different pressures. Various pressures in different parts of the equipment may be maintained by automatic devices or by hand-throttling. Temperature may also vary considerably throughout a unit and may be controlled either manually or automatically. Both temperature and pressure may be varied from time to time, depending on the stock being processed or the products being made.

Owing to the interconnection of a number of vessels in one system by piping and dependence on valves for controlling pressure in the various parts, it is not feasible to divorce the inspection of vessels from the other parts of the equipment. Failure of piping may discharge the entire contents of a vessel or an entire system onto the ground. The contents being flammable and frequently of high temperature may result in a fire or explosion. It, therefore, follows that the entire unit must be subjected to the same careful inspection.

Valve failures may cause the contents of a vessel under high pressure to discharge rapidly into another vessel designed for much lower pressure. Therefore, safety relieving devices must be adequate for emergency conditions and must be in first-class operating condition at all times. The relieving capacity of a safety valve is dependent not only on the pressure under the valve but on the molecular weight and temperature of the vapor being discharged. The adequacy of the safety valves can only be determined for each case by calculation which requires a knowledge of the stocks being processed and the pressure and temperature used.

Research and experimental work frequently leads to changes in operating pressure and temperature involving conditions not anticipated at the time of design. It then becomes necessary for the inspection organization to recompute the equipment for the changed conditions.

All types of corrosion are involved. In some cases it is plainly apparent that corrosion is occurring, as evidenced by pitting, grooving and the like. Much more frequently, however, the effects of corrosion are not so readily apparent. Frequently the corroded surface is as smooth as the original surface. In riveted construction the metal in the vessel corrodes in such a manner that there still appears to be a

full rivet head. Only by careful examination to find the line of demarkation between the rivet head and the vessel wall can one determine that the rivet head is seriously corroded. Cast iron parts are frequently subject to graphitization. This is a leeching out of the iron content, leaving the graphitic content intact. The wall of the casting will remain its original thickness, unless there is erosion, and the appearance of the material will not change other than to appear slightly darker. This graphitic material has practically no strength and may constitute a serious weakness in cast iron or semi-steel equipment.

No positive statement can be made as to where corrosion or other deterioration *will not be* found. On the other hand, experience has provided many guiding principles by which it can be stated with a fair degree of accuracy where trouble *is most likely* to be experienced. The attitude of the inspector must always be that he may find corrosion anywhere. Whenever any change is made in the operation of a piece of equipment, whether it is a change in pressure, temperature, character of the contents, substitution of a corrosion resistant material for one which was formerly badly attacked, or any other change, the inspector should again take the attitude that corrosion may be found at any point.

Not only is the proper operation of equipment dependent on the condition and accuracy of the various instruments and gages but, to a large extent, the safety of the equipment is also affected. The adjustment and repair of the many modern recording and controlling instruments is a highly specialized field and it should not be expected that the inspector will be familiar with such details. However, it should be his duty to see that all instruments and gages are checked periodically.

Owing to corrosion and the possibility of deposited coke, tar, wax and the like causing sticking, safety valves suitable for steam are not suitable for oil and its vapors. The inspector should ascertain that suitable safety valves are installed and that they are removed, tested, cleaned and reset as often as necessary.

Control of Electrical Hazards in Petroleum Industry

By S. E. WHITING

Assistant Chief Engineer, Liberty Mutual Insurance Company, Boston, Mass.

Because of the very recent development of special forms of electrical motors, electrical power control devices and electrical wiring devices and also because I have no extensive practical experience in the operation of oil wells, pipe lines, refineries and gasoline filling stations, I can discuss my subject only along elementary lines and entirely from the outside viewpoint of an insurance carrier.

Excellent Record of Petroleum Industry

From this viewpoint I feel that your industry as a whole deserves congratulations for the good showing it has made in the prevention of personal injuries and destruction of property in spite of your necessary handling of a highly flammable material in enormous quantities. We insurance men learn of repeated instances where only relatively trifling quantities of flammable liquids and their vapors have resulted in death to one or more persons, sometimes from extensive burns due to clothes getting on fire, sometimes from being in the path of a severe blast of flame, and occasionally from explosions of vapor and air mixtures. Even as little as one quart of alcohol spilled on the clothing has been known to cause fatally severe body burns and even under the prompt first-aid action that resulted from the accident occurring right in the midst of a large group of workers. The element of ignorance of potential fire and explosion hazards is usually a dominating one for this type of injury in general industries. Of course, these accidents are not all from gasoline but include the other common flammable liquids such as the alcohols and ethers.

Hospital Treatment of Extensive Body Burns

The medical profession has made distinct advances during the past decade in the treatment of extensive body burns. The old medical prophesy that when more than one-third of the body surface has been burned or scalded, the outcome is sure to be fatal is no longer true. The situation has now become much more optimistic through the adoption of a hospital technique in treating these burned areas with

wet compresses of tannic acid, gentian violet or similar preparation that will in a few hours cover the denuded area with a relatively dry protective scale that permits open treatment with a minimum danger of bacterial invasion, loss of fluidity of the blood and absorption of toxins into the system. Apparently this technique leads to better results even including reduction in scarring. While doctors may still disagree to some extent, my basis for calling this change to your attention lies in the knowledge that large metropolitan hospitals have standardized on this newer treatment for extensive body burns in preference to the older methods and have recommended its adoption to others. This change in hospital technique has some direct interest to the safety engineer wherever his duties cover the functions of a first-aid department. The treatments involve the application of aqueous solutions directly to the burned area, so that it becomes important for the first-aid worker not to make a preliminary application to the same area of a burn ointment that contains oil, vaseline or other substance that is not readily miscible with water, thus requiring preliminary removal in the hospital treatment or delaying the desired formation of scale or what the doctors call "precipitated proteins." Fortunately there are already on the market for first-aid workers at least three burn treatment preparations that have taken this factor into account by using a base that is miscible with water. Indeed, these first-aid preparations have gone still farther and include in them the active principle of the tannic acid or gentian violet hospital treatment. I may also suggest to those of you whose properties are widely scattered that you make a specific check-up with the local hospitals that serve your serious accident cases as to whether they have adopted this modern burn treatment and, if not, that you refer them to the existing medical literature on this subject.*

National Electrical Code

The particular type of electrical equipment in which you are interested and to which we can confine our discussion is the kind that has been approved for so-called "hazardous locations." You can have every confidence in accepting the authority of the National Electrical Code (N. E. C.) in this connection for it represents over a generation of experience from fires ignited by electric power of one sort or another. Every few years the N. E. C. is carefully considered by a committee of experts and where accident experience or advancing development in electrical equipment design justifies it, this Code is modified but only along genuinely practical lines. Thereafter no additional wiring can be installed without full compliance with the latest N. E. C. rules. It is true that these modifications are not made retroactive. For example, in my own home, I still have in service some wood molding although a fire insurance company is still willing to cover my property. In your petroleum industry, however, I would very strongly recommend that you stand on no technicalities whatever in respect to the N. E. C. but bring your existing equipment up to all new Code standards as they develop, since you are handling property values ranging into the millions and have a duty to many precious lives.

Standing Committee on Special Electrical Hazards

I cannot authoritatively define what portions of your properties come within the designation of hazardous locations. Any Code authority such as the Electrical Committee of the National Fire Protection Association will be glad to advise you specifically. As a layman, I would suspect that most all of your premises where you have oil wells, refineries, bulk stations or filling stations could well be considered as hazardous locations, if for no other reason than because gasoline sometimes does get spilled or leaks out and that its vapor tends to pocket and run along the ground for extraordinary distances before diffusing to a dilution below the minimum ignition point of about 1 per cent. Furthermore, the N. E. C. places your

* "Tannic Acid in the Treatment of Burns," by E. C. Davidson, M. D., Surgery, Gynecology and Obstetrics, August, 1925.
"The Treatment of Acid and Alkali Burns," by E. C. Davidson, M. D., Annals of Surgery, January, 1926.
"First Aid Treatment of Burns with Tannic Acid," by Frederick Christopher, M. D., The Journal Lancet, July 15, 1930.
"Six Years of Tannic Acid Treatment of Burns," by D. M. Glover, M. D., Surgery, Gynecology and Obstetrics, May, 1932.
"Treatment of Burns with Gentian Violet," by Connell and Associates, Journal of American Medical Association, April 22, 1933.
"Tannic Acid Treatment of Burns," by J. D. Martin, Jr., M. D., Southern Medical Journal, April, 1933.

industry, so far as electrical equipment is concerned, not only in Clause 32 but further in Class 1 which is that type of hazardous location which is believed to have the greatest hazard or greatest sensitiveness to ignition and explosion. Thus your industry is placed at the head of the list so far as the need for ignition-proof electrical equipment is concerned. I do not know whether or not the high officials of the American Petroleum Institute entirely agree with this designation but, even if there is any doubt, it is best to play safe by accepting all of these electrical standards because of the large quantities of material you are handling and because a very small and apparently negligible defect, if it is an ignition source, can build up to an uncontrollable conflagration.

First Principle of Safety—Mechanical Protection

In general, all conductors of electricity whether in motors, controlling devices or wiring, are designed only to carry current and the insulation around them is designed only to confine that current to the conductors. Neither the circuits nor the insulation are themselves capable of withstanding mechanical injury. Therefore, your equipment for hazardous locations should *all* be enclosed in mechanical covers of adequate strength; conduits, junction boxes, switches, lighting fixtures, control devices and motors. It is worthwhile emphasizing the word "all" because of the obvious stupidity of installing expensive Class 1 equipment in a hazardous zone and including a few minor service outlets where portable lights and tools can be attached, thereby easily neutralizing the entire system of protection against a fire or explosion. As an insurance inspector, I have repeatedly seen such lack of common sense in electrical installations, but I will admit that none of these gross errors have been noted in any up-to-date refineries or large bulk stations. So far as permanently installed and fixed location equipment is concerned, the market already affords a full line of dependable equipment of this sort. However, for temporary or semi-portable equipment, the full solution has not been attained as yet and this weakness is admitted by the N. E. C. Code authorities. Probably certain types of repairs require the use of a temporary localized light that can only be furnished by an extension lamp and that certain repairs practically need the electric power of a portable electric drill. To make the electric cables damage-proof by metallic armor appears to me to be an extremely clumsy job at the present state of the art of cable manufacture because of your proper demands for flexibility. However, the present highest N. E. C. Code requirements for rubber covered portable cord meet this situation to a substantial degree providing you watch out closely for maintenance of such cords. You will secure this supervision adequately only if all such portable lights and cords are issued for the day of use and returned to a responsible electrical maintenance department for fresh approval on each and every job. There is no type of electrical equipment that has been so grossly abused and neglected in maintenance as portables so far as industry in general is concerned.

Second Principle of Safety—Grounding of Enclosures

Beside the principle of protective enclosures of all electrical equipment there is the second need of protection against unexpected failure in the insulation. Nothing is infallible in this world, not even electrical insulation of the highest grade although it has developed to a wonderful degree of perfection. If the insulation fails, the current escapes from the conductor (whether in the wire of a conduit, the contacts of a switch or the windings of a motor) and thus places a charge upon the external metal parts of the device that are not designed to carry any charge. It is the unfortunate but accepted practice to call this condition "grounded." Evidently if this charged condition exists on the external dead-metal parts of electrical equipment you have an immediate potential ignition source since contacting of this charged dead-metal part with ground causes a flow of electricity across the ground contact point or arc and thereby a source of ignition of gasoline or any other flammable substance. We should not leave the security of any gasoline handling equipment to this element of chance failure of electrical insulation, however high-grade it may be, nor can we by periodic electrical tests anticipate approaching failure. The practical answer, however, is readily applied.

If the exposed metallic parts of electrical equipment are permanently bonded to ground then, when the insulation breaks down, the electricity is carried through the grounding wire without any arcing and with *entire safety back into the circuit.* If a fuse is blown or a circuit breaker opens, no harm is done from the ignition stand-point merely an interruption of service which calls attention to the defective insulation so that it can be safely repaired or replaced. Thus, the answer to any

grounded electrical equipment is to ground it,—a confusion of terms that is unfortunate but the real meaning is that the answer to any accidental charging of external metal parts of electrical equipment is to attach a protective ground wire to them. The rest of the problem is merely a mechanical one of safely installing the grounding wire so that it will not itself be broken, thus destroying the protection. For portables this means a *third conductor* in a two-wire cable suitably identified so that each wire can function as designed: the first two wires for the power, and the third wire for the protective ground, or if the power is three-phase, three wires for the power and a fourth wire for protective ground. As to fixed equipment, the metallic conduit that connects all circuit wiring to all electrical devices can itself be used as the protective grounding circuit, but only where this conduit is installed with screwed joints (not lock nuts) and has no open sections in it where the wires jump through the air from one piece of conduit or equipment to another piece of conduit or equipment. Unless this mechanical assembly of conduits, junction boxes, switch boxes and motor frames is a perfect one, it is good practice to carry a separate grounding wire throughout the system and bond it firmly onto each and every part of the whole enclosing structure.

Third Principle of Safety—Enclosure of Ignition Sources

Beside these two principles of design, first, the protection of the conductors and their insulation by mechanical enclosure, and second, the grounding of dead-metal parts against accidental charge due to insulation failure, we have the third principle of electrical equipment which you must apply in hazardous locations to save lives and property; the enclosure of the particular portions of the electrical system where arcing takes place under *normal operation.* Examples here are the opening and closing of switches, the blowing of fuses, the burning out of lamps and in the running of motors that have commutators or slip rings. All of these are inevitable sources of arcing and hence potential ignition sources. In addition, if something goes wrong we get certain abnormal arcing; such as the breakage of a wire in a conduit, the burning out of an overloaded motor, etc. What can we do to protect against these things and how important are they? Well, in the petroleum industry, any one of them, even the blowing of a 10-ampere fuse, could fire an oil well or set a field storage tank on fire, which is important enough.

Explosion-Proof Equipment

Some years ago, the N. E. C. specified certain standards then developed of so-called "vapor-proof" equipment which meant that the equipment would not ignite any flammable vapor in its vicinity. This term has now been abandoned and a new term has been substituted "explosion-proof." This term came into use so suddenly that I confess, even though I was once an electrical engineer, I had immediately to sit up and take notice. The distinction developed not as a theoretical proposition at all but because of serious fires being set by the former equipment of low standard called "vapor-proof." These electrical experts found by actual experience that gasoline and other vapors are so insidious that they crawl inside of the enclosing conduits, junction boxes, switch cabinets and motor frames of electrical equipment, and if there is air also present, the normal sparking action just referred to proceeds to explode the mixture and vent itself by bursting the device or at least shooting out hot flame that will ignite any flammable substance in the vicinity. It became necessary to re-design the equipment entirely. Apparently it was felt to be hopeless to attempt to prevent all inward leakage on this equipment because of the innumerable joints in it (of which there may be thousands in the electrical equipment of a large refinery), so the manufacturers proceeded to re-design their entire equipment to make it literally and genuinely explosion-proof. This necessarily involved some increase in expense.

In Section 32, Class 1, this explosion-proof equipment is now made a standard requirement of the National Electrical Code, which gives you merely the alternatives of (1) confining all ordinary electrical equipment strictly to clearly non-hazardous zones, as by placing motors in a separate room with shafts running through flame-proof holes in the walls, etc., or (2) adopting this higher but essential standard of explosion-proof equipment. My understanding is that all leaders in your industry have already accepted this new requirement and have installed it throughout their hazardous areas. The magnitude of the potential hazards inherent in any large-scale operations with crude oil or gasoline fully justifies this rather expensive type of electrical motors, controllers, switches and wiring.

THURSDAY MORNING SESSION

October 17, 1935

Opportunities and Responsibilities of the Safety Engineer

By J. E. HOWELL

General Superintendent, Oil Production, The Empire Oil & Refining Company, Bartlesville, Oklahoma

We first must think of the qualifications of a safety engineer, and the first of these is that he have a working knowledge of the particular problem at hand. Should he be a safety engineer in the refining division or oil producing division, he must have a working knowledge of that division; a man who has had practical operating experience. This is highly important because contact with the men themselves must be made through the foremen and unless the safety engineer can discuss problems with the foremen as a foreman, he is hardly qualified to advise with him on the elimination of waste through accidents, mishandling of tools, equipment and men. He must also be able to deal with workmen and superintendents.

He must have an analytical mind and be able to analyze the activities of his assignment, with the view of eliminating hazards in work, in material, in machinery, and above all, in the attitude of personalities.

Engineers as engineers, are commonly dealing with exact science. Safety engineers are of a different type—they are dealing with human beings, far from an exact science. Their problems cannot be solved with a slide rule, but require ingenuity, psychology, patience, and study of human nature. A safety engineer, must be a many sided individual, not just a good cartoonist and one who prepares safety bulletins.

Safety activities that obtain results are directed through the foremen of an organization, it matters not how large or how small. The safety engineer's responsibility is in the foremen, or supervisors,—gaining their confidence in his ability to handle his job and be of service to them in handling their problems; making the foremen realize that they are responsible for the condition of their material, equipment and men. A safety engineer *cannot* succeed who does not appreciate the fact that the foreman is the main contact for his activities.

My observation is that the usual policies employed in safety activities have given to the average foreman a feeling that the movement is sponsored by the company largely as a humane measure and administered through a special department, not properly identified with his job. The entire safety movement should be welded to the operating organization, leaving no divided responsibility for any specialized department, except in a supplementary capacity. Another major opportunity lies in economies through his activities. He should reduce costs by organizing and maintaining a proper safety program; be in a position to back up recommendations with cost figures, (for example, cost of handrails vs. injuries from falls); keep executives informed on total cost of accidents of various kinds, and use such figures as a basis of justification for future safety expenditures; instill in each foreman the thought and appreciation that the cost of accidents is as much his responsibility as the cost of other operations, and make the foreman feel that his activities are an aid in reducing accident costs.

The responsibilities, then, of the safety engineer are as follows:

First. He should be qualified, through actual experience, to discriminate between good and bad in all phases of operations and employee relations. This requires an intimate knowledge of human nature, job routine, equipment, tools, materials, production and operating theory.

Second. He should be able to speak the language of the worker, and have a practical perspective of the problem from the viewpoint of the foreman. His responsibility merely supplements that of the foreman, and his efforts, however worthy, are futile if not advanced in cooperation with the foreman.

Third. He should be capable of intelligently evaluating all organization and operating difficulties, and his viewpoint and judgment must warrant the confidence of the employee as well as the foreman and his management.

Fourth. He should analyze the program from the economic side and back up his recommendations with sound consideration of costs.

Fifth. He should stimulate interest and activity in the foreman, supervisor and employee and devise means of approach which carry appeal and practical justification.

His opportunities are to develop foremen, and to eliminate waste and inefficiency as they relate to safety.

Bettering Public Relationships Through Service Station Safety

By A. A. NICHOSON

Manager, Personnel Department, The Texas Company, New York City

There are two reasons for the promotion of a plan to inoculate motorized America with safety consciousness, one of which is unselfish, the other selfish. The unselfish reason is indicated in the word, "service." Whenever the opportunity arises for human beings to contribute to the betterment of each other through the dissemination of knowledge, it should not be foregone. The desire to serve others is inherent in the human family. Therefore, the moral responsibility for assisting a careless and an ignorant motorized public to a better understanding of their problems remains to those in whose power it lies to help.

The selfish reason is obvious inasmuch as it unquestionably indicates revenue, a portion of which might be difficult to trace to the ledgers of the industry but which is always in evidence in the form of better public good-will and public relationships. There is no phase of retailing that receives a greater percentage of exposure than the petroleum industry, nor is there any line of selling where the exposure is secured with so little effort by virtue of the fact that the need of the automobile still remains gasoline. Therefore, the promulgation of a public safety service which smacks of sincerity and honesty of purpose must reflect in a business betterment which will make a mutual contribution to manufacturer and distributor.

For a long time a definite need for educating the public into better road conduct has been apparent. And by virtue of the fact that the oil industry has, in round numbers, some 500,000 retail outlets forming a country-wide network, it would seem that this particular machine offers the easiest and most efficacious medium for promoting such a plan. An investigation into the very mediocre experimental work which has been done will disclose a healthy and receptive attitude on the part of the public. Ignorance begets opposition and the failure of the average individual to comprehend his moral and mechanical responsibilities is one of the reasons why he has given so little heed to the general problem of safety. Therefore, the issue becomes one largely of education coupled with a peculiar form of psychological advertising.

For the sake of argument, let us assume that the oil industry willingly accepts the responsibility for improving and increasing its public service through the promulgation of a safety program. Then I think the question that follows in logical sequence is, "What are the possible accomplishments from a plan of this kind?"

The monetary returns have been touched on, but besides the money which may come to those units who foster it, it will bring a satisfaction that goes far beyond any that now may accrue from the rendition of service as we interpret it in retail petroleum outlets. The benefits possible might include advertising, prestige, confidence, contact, etc. Therefore, it becomes obvious that there are definite benefits to be expected by the industry as a whole.

But the benefits are not one-sided, by any means. Stepping over into the shoes of the motorist, we find many benefits which go beyond the measurement of money, although it can truthfully be said that the monetary savings to the motorists will be proportionally as great as those to the promoter. These savings will accrue from better mechanical operation of his car, longer life, possible lowered insurance rates, elimination of claims and disputes that are all measured by money. It will also bring to him a mental freedom that he has long desired to enjoy. It will give to him an assurance of confidence and security essential in the developing of a healthy attitude toward these ever-changing hazards on millions of miles of American roads. It will

contribute to his uninterrupted happiness through the absence of mishap to himself and his family.

Thus when we view the possible benefits, they immediately seem to outweigh any reasonable question of cost in the establishment and promotion of such a plan.

But now I hear you asking, "How should such a plan operate?" My answer, frankly, is that I do not know. I do feel, however, inasmuch as this has all of the earmarks of a business operation, that there are three general divisions. First is the question of administration after the details of the plan have been worked out. Secondly, there is the matter of advertising; and thirdly, there is a direct selling issue because the sale of such a plan incorporates much more than a mere idea and goes into these matters of accrued benefits which obviously must be backed up by service, good quality, performance, etc.

The advertising offers many fertile avenues of approach. Among these is the radio. Then there is magazine and newspaper advertising. Billboards might carry a pertinent message to the motorist. Small boards at service stations would provide regular safety bulletin service to arouse the attention and interest of each customer. Add to this the general safe set-up of every service station in America and that valuable word of mouth caution from the man at the pump.

Reaching Small Groups in Remote Locations

By C. L. HIGHTOWER

Safety Engineer, United Gas System, Houston, Texas

It has been my experience that small groups at isolated points are invariably more interested in the accident prevention program and in first-aid training work than the individual employees of large groups in cities or in more active communities. Also it is the experience of a number of the larger companies that the accident frequency rate is much lower among these smaller groups than among the larger groups concentrated at central points.

There is an explanation. In the case of employees at isolated points there are usually few activities outside of the job to which the men are attracted. Picture shows and other social events therefore do not conflict and such groups find in the safety meetings an opportunity to visit and fraternize. Smaller groups do not receive as close supervision as a general rule as do employees working at central points, and because of this fact consideration is given to placing on these jobs in remote locations men who are fully experienced, well qualified for the work, who possess initiative, and have the proper mental attitude toward their company and their jobs. It is true, of course, that an effort is made to secure this type of employee for every job, but it is of the greatest importance where a man does not receive constant supervision and must rely upon his own judgment for working out many of his problems.

Desired results are not obtained by high pressure selling methods or through appeal to the emotions. Unfortunately I think we relied on these in the early days of industrial safety work to interest the workman and to get him to improve his methods of work. Such a plan, if it were successful in arousing the interest of the individual in accident prevention work, went only part of the way because we did not instruct the individual in correct methods.

We know that accident prevention work is not a campaign or a crusade that is dependent upon stunts or high pressure methods but is a question of developing job efficiency. Effective accident prevention work is dependent upon three things. First, we must have foremen who know their jobs and who possess qualifications for leadership. Second, we must have workmen who are trained regarding correct job procedure and who have the proper mental attitude toward their jobs, their company, and their fellow employees. Third, we must apply engineering knowledge in the design, layout, and maintenance of equipment.

In order that the thoughts presented on the subject would not be confined to the experience within one organization, a set of questions designed to develop information on the subject of reaching small groups at remote locations was prepared and sent out to eight major oil and gas companies whose combined operations extend over practically all of the states. I have prepared a summary of the replies received

to the eleven questions contained in the questionnaire. The questions and summary of replies follows:

1. Does your company place the responsibility for accident prevention on foremen, district managers, and others in a key position?
   All eight companies replied "yes" to this question.
2. Do you rely on your form-bosses, foremen, and other field supervisors to conduct employee safety meetings?
   Five companies replied "yes" to this question; two companies replied that a chairman and a secretary were elected from the employee group; while the eighth company reported that the meetings were conducted by members of the safety department.
3. If so, do you provide material for use in preparation of programs?
   Six of the companies furnish material each month for use in preparing meeting programs. This is sent out at a definite time and the same medium is used for supplying the material each month in the form of bulletins and posters. Two of the companies furnish material occasionally but rely almost entirely on the foreman or meeting chairman to develop the programs.
4. Does a representative of the safety department attend all safety meetings?
   Six reported that a representative of the safety department attended meetings as often as possible while two companies made it a practice to have a representative of the safety department attend and take part at every meeting.
5. Do you consider that group meetings of employees monthly, bi-monthly, or weekly are of particular advantage in safety work?
   All eight companies advised that meetings of employees were being held. In practically all cases the meetings are held once a month, and two companies expressed themselves as being opposed to holding meetings more often.
6. Do you hold meetings of the supervisory force?
   Five companies reported holding separate meetings each month for the supervisory force, while one reported holding meetings of this type in several departments. Two reported that they did not hold such meetings at all.
7. If so, is all the time given over to a discussion of safety work?
   Five of the six companies reporting that they held foremen's meetings advised that general operating as well as safety problems were given consideration at these supervisory meetings while one of the six holding such meetings reported that safety matters only were discussed.
8. Do you attempt to train employees in remote locations in first-aid work?
   All eight companies answered "yes." One company reported that it did not train where there were less than 20 employees and one company does not train any group less than six.
9. If so, is this training work done by an instructor from the safety department?
   Only three of the eight companies reporting have a company trainer who goes from place to place and spends all of his time on first-aid work. The others depend upon the foremen or some individual member of the crew who has had first-aid training.
10. Do you consider that employees working at remote locations have a higher accident frequency than larger groups at refineries, etc.?
    Only one of the eight companies reported a higher accident frequency rate among small groups working in remote locations.
11. What do you consider the most effective means of keeping employees in remote locations interested in accident prevention work?
    Most of the companies feel that personal contact with smaller groups through the supervisory force and occasionally by a member of the safety department is essential to maintaining interest in safety work. Also all companies expressed themselves as being in favor of providing safety literature in the form of reports of accidents, monthly safety bulletins and posters in order to keep these small groups informed regarding the safety activities of the organization as a whole.

The first essential toward getting the field force to use the service available

through the safety department is to inform men in key positions of the service which the safety department has to offer and how it can be applied. In our own organization we are attempting to do this through the medium of our accident prevention handbook. This booklet, prepared in looseleaf form, includes a section on each of the following subjects:

1. Safety organization set-up:
   The various activities that make up the company's safety program and how these different activities tie in with each other and with the safety department.
2. Schedule of foremen and safety meetings:
   This section includes the annual schedule of safety meetings and also the monthly schedule showing dates and schedule of both foremen and employee meetings. It is filed in the handbook so that it may be referred to readily.
3. Report of accident to employee:
   The procedure the foreman is to follow in making his investigation of accident involving a member of his crew and in submitting his recommendations is explained here.
4. Safe operation of cars and trucks:
   Here we cover the use of our driver's test card and an explanation of our safe drivers' awards.
5. Procedure for foremen's meetings:
   The purpose of and the manner of conducting foremen's meetings is explained under this heading.
6. Order of business for employees' meetings:
   This section outlines the procedure to be followed in conducting employees' meetings and also contains helpful suggestions which are intended to aid the chairman in conducting the meetings in an interesting manner.
7. Monthly Safety Bulletin:
   A copy of the National Safety Council Monthly Safety Bulletin is filed under this section as it is received.
8. The Safety Meter:
   A copy of The Safety Meter, our employee safety publication, published monthly, is included in this section.
9. First-aid supplies:
   The types of kits provided for field use are described here, as well as the manner in which the supplies are to be replenished, and the kits maintained.
10. First-aid Training program:
    This section outlines the company's program for first-aid training and also includes copies of the first-aid training guide and of the two certificates issued.
11. Fire protective equipment:
    Various types of equipment are illustrated here, and the type suited for each location is described.
12. Personal protective equipment:
    This section describes types of personal protective equipment. The use of each piece of equipment, protection afforded, maintenance, limitations, and precautions in use are covered.
13. No-accident contest:
    The annual no-accident contest is outlined in this section.
14. The last section of the handbook provides a place for the filing of monthly accident comparison reports. These comparison reports, one covering automobile accidents and the other covering personal injury employee accidents, are sent out to every district and are filed in the handbook so that they may be referred to readily.

A copy of this handbook is to be placed in the hands of every man in the organization occupying a key position. By that I mean district managers, department heads, local managers, foremen, and employees who are serving as chairmen of safety councils. Like any other handbook or set of instructions, it is read and is put into practice only when a follow-up is made. We assure this follow-up by providing a place on our foremen's meeting programs for a discussion of all the subjects covered.

In conducting foremen's meetings we draw in every supervisor who has the responsibility of employing and directing workmen. This means that we have in attendance the foremen or local managers having charge of even the smallest groups in the most isolated locations. We get very valuable contact with these small groups through the foremen on both safety and general operating problems.

Our district managers are relied upon to prepare programs for the foremen's meetings, but we render assistance by sending out on the first of each month a list of suggested topics prepared by our general safety committee which is made up of department heads with the safety engineer serving as secretary.

Regardless of how small the group or how far removed from a district office, all of our employees attend a safety meeting once each month unless they are actually at work or excused for justifiable reasons. A representative of the safety department attends these meetings occasionally and contacts the men in the field.

Another effective contact that the safety department has with the field, both at isolated points and where large groups are concentrated, is through the first-aid trainer. The first-aid training car goes into a district, and classes are conducted at times and places convenient to the employees. The Bureau of Mines manual is followed in conducting the course, but we have advanced a step further than first-aid and are devoting one two-hour class to a discussion of personal protective equipment. Interest is keener in this fifth class than in any other, and we feel that it is of great benefit in the interest of accident prevention. We were surprised when starting the training work to find such a large number of employees who had no knowledge whatever of some of the protective equipment provided.

We have found that our employees prize a company first-aid certificate more than they do a certificate from some other organization, regardless of how well known such organization is. Our certificates are certified by the instructor and approved by the safety engineer and the operating vice-president having jurisdiction over the department in which the employee works. This brings the executive department into the program and thus enhances the value of the certificate so far as the workman is concerned.

In addition to issuing a company certificate we also issue American Petroleum Institute certificate because employees feel that a certificate from the A. P. I. would be valued more by another organization should they leave our service and seek employment elsewhere.

It is our intention to follow a continuous program of first-aid training, bringing the instructor back to each district at least once every two years. This will afford an opportunity to train new employees coming into the district and will also make it possible for us to hold review classes for employees who have had the training.

In addition to conducting these training classes the first-aid trainer checks first-aid kits and personal protective equipment in the district visited. We have found a surprising number of defective masks, life belts, and other equipment. The location and replacement of this defective equipment has been of definite value in cutting down accidents and in providing safeguards in the event of an emergency.

The Safety Meter, our monthly safety publication, carries a personal message of safety to each employee. Copies are distributed with pay checks released on the fifteenth. In this way we are assured that every employee gets a copy. We have attempted to develop personal interest in the Meter by including news items concerning individual employees. The reports of first-aid treatment rendered to outsiders, mention of safety talks made at company meetings, and other items such as these are featured in the Meter. Also we have secured from each district manager some pertinent message and one of these messages with the district manager's caricature humorously portrayed is included each month under the heading "The Safety Saying of the Month." We have found this particularly helpful in interesting the district managers in the publication of the Meter, and a large part of the material used is contributed by the district managers and employees.

In addition to these activities a representative of the safety department endeavors to contact every district in the organization at least once every sixty days. Of course, due to the size of our organization and the territory we serve it is impossible to visit each individual employee at his working place, but by bringing them all in to the monthly meeting at some central point fairly close contact is accomplished.

Petroleum Section Safety Contest

The statistics of the contest were presented by H. N. Blakeslee, secretary, American Petroleum Institute, Dallas, Texas, as follows:

Participating units in the Petroleum Contest this year numbered 217 with 251,458 employees working 266,747,340 man-hours. The average frequency rate was 11.903, a decrease from the frequency rate of 12.710 in the last contest. One hundred four units operated with a lower frequency rate than this and 34 had perfect records. In this contest 32 plaques were awarded and fourteen certificates.

The plaques were presented to contest winners by C. B. Scott, President, Bureau of Safety, Chicago, and Past President of the National Safety Council, as follows:

Manufacturing Department, Group A—Empire Oil & Refining Co., Bartlesville, Okla., 824,686 hours, 1 injury.

Manufacturing Department, Group B—Nine tied for first place—Indian Refining Co., Lawrenceville, Ill., 555,323 hours, no injuries; The Ohio Oil Co., Findlay, Ohio, 308,100 hours, no injuries; Wadhams Oil Co., Milwaukee, Wis., 196,234 hours, no injuries; Shell Oil Co. of Canada, Ltd., Montreal East, Que., Canada, 113,285 hours, no injuries; Lago Petroleum Corp., Maracaibo, Venezuela, S. A., 109,338 hours, no injuries; Anderson-Prichard Refining Corp., Cyril, Okla, 104,398 hours, no injuries; The Derby Oil Co., Wichita, Kans., 94,697 hours, no injuries; Pasotex Petroleum Co., Texas, 68,296 hours, no injuries; Stanolind Oil and Gas Co., Tulsa, Okla., 67,347 hours, no injuries.

Marketing—Wholesale Department, Group A—Continental Oil Co., Ponca City, Okla., 3,633,441 hours, 11 injuries.

Marketing—Wholesale Department, Group B—Three tied for first place—The Oil Co., Findlay, Ohio, 376,529 hours, no injuries; Texas Pacific Coal & Oil Co., Fort Worth, Texas, 143,749 hours, no injuries; The Derby Oil Co., Wichita, Kans., 120,679 hours, no injuries.

Marketing—Retail Department, Group A—Standard Oil Co. (Indiana) Chicago, Ill., 14,293,732 hours, 40 injuries.

Marketing—Retail Department, Group B—Three tied for first place—Texas Pacific Coal and Oil Co., Fort Worth, Texas, 199,310 hours, no injuries; Cities Service Oil Co., Chicago, Ill., 160,613 hours, no injuries; Pan American Petroleum & Transport Co., New York, N. Y., 88,046 hours, no injuries.

Drilling Department—The Carter Oil Co., Tulsa, Okla., 67,433 hours, 1 injury.

Producing Department, Group A—The Continental Oil Co., Ponca City, Okla., 1,391,749 hours, 4 injuries.

Producing Department, Group B—Hope Construction & Refining Co., Pittsburgh, Pa., 357,640 hours, 1 injury.

National Gasoline Department—Four tied for first place—Lone Star Gasoline Co., Dallas, Texas, 194,912 hours, no injuries; Shell Oil Co., Los Angeles, Calif., 118,204 hours, no injuries; Hope Construction & Refining Co., Pittsburgh, Pa., 108,272 hours, no injuries; The Ohio Oil Co., Findlay, Ohio, 97,095 hours, no injuries.

Pipe Line Department, Group A—Standard Pipe Line Co. Inc., Shreveport, La., 510,168 hours, no injuries.

Pipe Line Department, Group B—Six tied for first place—Oklahoma Natural Gas Co., Tulsa, Okla., 207,205 hours, no injuries; Ajax Pipe Line Co., Tulsa, Okla., 144,513 hours, no injuries; Tidal Pipe Co., Tulsa, Okla., 128,546 hours, no injuries; Tide Water Pipe Co., Ltd., Bradford, Pa., 127,414 hours, no injuries; Shell Oil Co., Los Angeles, Cal., 124,448 hours, no injuries; Standard Oil Co. of New Jersey, New York, N. Y., 50,613 hours, no injuries.

ADJOURNMENT

Power Press Section

Officers 1934-35

General Chairman—T. O. Meisner, American Can Co., Chicago, Ill.
Vice-Chairman—E. J. Wallman, Great Lakes Forge Co., Chicago, Ill.
Secretary—R. M. Zelder, Edison General Electric Appliance Co., Chicago, Ill.
News Letter Editor—H. C. Howsam, Hubbard Spool Co., Chicago, Ill.
Engineering Committee Chairman—Louis Boraks, Liberty Mutual Insurance Co., Boston, Mass.
Exhibit Committee Chairman—G. H. Berry, Western Electric Co., Chicago, Ill.
Health Committee Chairman—Dr. R. M. Kelly, Western Electric Co., Chicago, Ill.
Membership Committee Chairman—A. J. Holmes, Cutler-Hammer, Inc., Milwaukee, Wis.
Poster Committee Chairman—E. C. Schultes, Jr., C. Hager & Sons Hinge Manufacturing Co., St. Louis, Mo.
Program Committee Chairman—B. E. Rockhoff, Detroit Steel Products Co., Detroit, Mich.
Publicity Committee Chairman—C. E. Libby, Scintilla Magneto Co., Sidney, N. Y.
Statistics Committee Chairman—G. S. Thompson, Central Mutual Insurance Co., Detroit, Mich.
Slides and Safety Kinks Committee Chairman—J. D. Lyle, Fisher Body Company of Cleveland, Cleveland, Ohio.
Members at Large—
J. B. Gibson, Western Electric Co., Chicago, Ill.
W. J. Graves, Michigan Mutual Liability Co., Detroit, Mich.
J. W. Henning, Automatic Electric Co., Chicago, Ill.
A. L. Kaems, Employers Mutual Liability Insurance Co., Wausau, Wis.
G. A. Kuechenmeister, Dominion Forge and Stamping Co., Walkerville Ont., Canada.
V. G. Pendleton, West Lynn Plant, General Electric Co., West Lynn, Mass.
S. H. Slaymaker, Fairbanks, Morse & Co., Beloit, Wis.
E. J. Smith, Western Electric Co., Chicago, Ill.
H. L. Vits, Aluminum Goods Manufacturing Co., Manitowoc, Wis.

Officers Elected for 1935-36

General Chairman—E. J. Wallman, Great Lakes Forge Co., Chicago, Ill.
Vice-Chairman—P. G. Hunter, Motor Wheel Corp., Lansing, Mich.
Vice-Chairman (In Charge of Membership)—B. E. Rockhoff, Detroit Steel Products Co., Detroit, Mich.
Secretary—E. H. Meeks, Transue & Williams Steel Forging Corp., Alliance, Ohio.
News Letter Editor—R. M. Zelder, Edison General Electric Appliance Co., Chicago, Ill.
Engineering Committee Chairman—Louis Boraks, Liberty Mutual Insurance Co., Boston, Mass.

Health Committee Chairman—DR. R. M. KELLY, Western Electric Co., Chicago, Ill.
Exhibit Committee Chairman—V. G. PENDLETON, West Lynn Plant, General Electric Co., West Lynn, Mass.
Poster Committee Chairman—G. S. THOMPSON, Central Mutual Insurance Co. of Chicago, Detroit, Mich.
Program Committee Chairman—H. C. HOWSAM, Hubbard Spool Co., Chicago, Ill.
Statistics and Publicity Committee Chairman—G. H. BERRY, Western Electric Co., Chicago, Ill.
Slides and Safety Kinks Committee Chairman—E. C. SCHULTES, JR., C. Hager & Sons, Hinge Manufacturing Co., St. Louis, Mo.
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G. A. KUECHENMEISTER, Dominion Forge and Stamping Co., Walkerville, Ont., Canada.
C. E. LIBBY, Scintilla Magneto Co., Sidney, N. Y.
J. D. LYLE, Fisher Body Company of Cleveland, Cleveland, Ohio.
T. O. MEISNER, American Can Co., Chicago, Ill.
S. H. SLAYMAKER, Fairbanks Morse & Co., Beloit, Wis.
E. J. SMITH, Western Electric Co., Chicago, Ill.
H. L. VITS, Aluminum Goods Manufacturing Co., Manitowoc, Wis.

MONDAY AFTERNOON SESSION

October 14, 1935

The opening session was called to order by General Chairman T. O. Meisner, American Can Company, Chicago, Ill., who spoke briefly on "Progress of the Power Press Section," mentioning particularly the activities of sectional committees.

Progress of Our Section

By T. O. MEISNER

General Chairman

Your section is now enjoying its ninth year of existence, having been inaugurated in Chicago in 1927 by a mere handful of men. Within a period of three years, our membership has increased to 402. However, the toll of the last depression played havoc with our section as it did with everything else, and in 1931 we had 91 cancellations and 32 new members, making our total membership at that time 343. In 1932, we had 12 new members and 111 cancellations, leaving a total of 244. In 1933, we had 9 new members and 74 cancellations, leaving us 179 members. In 1934, there were 18 new members, and 21 cancellations, leaving a total of 176, and in the present year there are 33 new members and 14 cancellations, leaving a total of 195, the first time we had an increase in members since 1930. With business conditions improving as they appear to be, I am very hopeful that all of our old members will be back very soon. Of the 30 sections in National Safety Council ours is the sixth largest. What can you, as members, do to aid our progress? There are three very difficult committee chairmanships in our executive committee—Program, News-Letter Editor, and Exhibit. The chairman of the program committee starts his work immediately after this Congress and his work never ceases until the completed program is turned over to the correlating committee in April. Immediately upon leaving this Congress, your thoughts should turn to the program for next year, and you should jot down suggestions for topics to be discussed and list the speakers who, you think, could cover the subjects you suggest. Mail these immediately to the chairman of the program committee.

Now for the News-Letter. This is possibly the most difficult job of all. The man is expected to edit a News-Letter to the membership once each month, starting with the month of November. He should be supplied with material. In your News-Letter you have an organ; a splendid medium for the exchanging of ideas. Ofttimes, you have a problem confronting you. Why not write about this problem to the news-letter editor? He will get you an answer. He will be glad to communicate this question to the other members for their advice or opinion.

The news-letter editor during the past year was a general superintendent of a good sized factory, a busy man; yet he edited a creditable news-letter once each month. This year, your candidate for that job is the personnel director of a large concern. Help him and really make the letter your own!

The third and last difficult job is chairman of the exhibit committee. I know more about this job than the others because I have had my finger in the pie since 1926 when our exhibit was born. It now consists of almost 225 photographs and a few drawings. This is the only collection of its kind in existence.

Each year we have a special committee, usually of three members, who have charge of this exhibit. They write to members, collect photographs, review them, take out the old stuff and add the new. When you receive a letter requesting a photograph check up immediately. I am sure that you will find something that has been developed in your plant during the year that will be of benefit to another member of our section. Have a photograph taken and send it in to the chairman. I can tell you from experience that it is awfully discouraging to send out 400 or 500 letters and receive 50 promises—and 10 to 12 photographs! This Exhibit is yours. It has been instrumental in teaching people how to safeguard punch presses, thereby saving the mutilation of a lot of hands.

It has been a pleasure to serve as your chairman during the past year. I have been indeed fortunate in having a hard working executive committee. In a very short time, your officers for the coming year will be elected. I want to assure you that every one of them will work just as diligently in the future as others have in the past.

Trend of Accidents in the Power Press Section

By G. S. THOMPSON

Safety Engineer, Central Mutual Insurance Company of Chicago, Detroit, Mich.

In this city in 1924 before we had a Power Press Section, I spoke on "Safe Dies and Their Construction." I was criticized severely for saying that the operator of a punch press should not be allowed to place his hands between the dies in order to place or remove the finished parts and that I did not consider the punch press to be any more dangerous than any other machine in industry, if it is properly tooled and the operator is properly instructed. I had just been working with a stubborn tool maker and had directed the redesigning of eight sets of dies that had had a very bad accident record; we had not only made them safe but had increased production, so naturally I knew my statements to be facts.

There were many others who were firmly convinced that punch presses could be operated safely and were working in this direction. Our chairman, Ted Meisner, August Kaems, Elmer Smith, Louis Boraks, Walter Graves, are some of the pioneers who deserve a great deal of credit for their work in eliminating punch press accidents. These men and many others have seen the losses of fingers decrease with the development and use of better guards and feeds. Such observations are confirmed by the accident records of large users of punch presses which have been equipped with the latest safety appliances. There are, on the other hand, thousands of presses in the country that are inadequately guarded and one of our major problems, in my judgment, is to get the knowledge we have acquired about safe punch

press operation into the hands of the owners and develop in them a determination to use it.

The elimination of punch press accidents is very important, but in addition, we have numerous other problems in our plants involving other kinds of machinery. The manufacture of metal products, of course, requires a wide variety of mechanical equipment. Of eleven important types of accidents, machinery accidents account for about 31 per cent or almost one-third of all compensable cases. The size of our problem involving machine hazards is emphasized further by the fact that machinery accidents account for only 12 per cent of the total compensable cases for industry as a whole. There can be no let-up, therefore, in our efforts to guard presses and other types of machinery and to develop skilled operators.

We have another type of accident which ranks slightly below machinery accidents in importance. An employee is handling steel plates and for some reason, one slips and he loses part of a finger or even part of his hand. Accidents of this type account for about 28 per cent of our total. "Handling objects" and "machinery" accidents combined, therefore, are almost 60 per cent of all compensable injuries. None of the remaining nine types of accidents exceeds 7 per cent of the total. These two very important kinds of accidents indicate where we should direct our efforts in order to achieve the best results. Each safety engineer in our industries should ask himself, "What is our experience with accidents involving machinery or handling objects?" If he has been keeping adequate accident records, he will know the answer, but if not, he should take steps to learn and if necessary put into practice the safest and most efficient known ways, for example, of handling sheet steel or guarding a grinding wheel.

Members of the Power Press Section are making progress in eliminating all types of accidents in their plants. Figures compiled by the National Safety Council show that companies engaged in the manufacture of hardware, metal stampings and metalware, and other sheet metal products had an average reduction in frequency rates of 39 per cent and 49 per cent in severity from 1926 to 1934. While the improvement in frequency has not equalled the reduction made by industry as a whole, the decrease in severity rates has been larger in our plants. During the last two years, however, the injury rates of our manufacturers of light metal products have risen quite sharply. In 1934 large plants made reductions over 1933 in both injury rates but middle-sized and small organizations had sharp increases. These unfavorable recent changes may be only temporary but nevertheless current records will bear close observation.

Accidents among our members engaged in the manufacture of wire, drop forgings, bolts and nuts, and similar metal products have decreased also quite steadily in both frequency and severity since 1926. Their 1934 frequency rate was down 61 per cent and the improvement in severity amounted to 30 per cent. These reductions compare favorably with the progress made in other industries.

1934 injury rates for the entire Power Press Section averaged about 14.5 for frequency and 1.35 for severity. Our frequency rate is slightly below the average for all American industries and our severity rate is about 20 per cent lower than the general average. There are wide differences, however, in the injury rates for the various types of plants represented in the section; for example, manufacturers of hardware average 9.55 for frequency during 1934 in comparison with 45.48 for drop forge plants, and corresponding severity rates were .98 and 2.94. Some of our members in the high-rate groups, however, are demonstrating that numerous and serious hazards can be eliminated. The forgings and foundry division of the Western Electric Company, for example, had a 1934 frequency rate of only 4.63 and an exceptionally low severity rate of 0.04. Possibilities for future improvement, however, are not confined to branches of the section with the highest rates because there are wide variations in the records of plants in branches that have low rates. Frequency rates for eleven large manufacturers of hardware, for example, varied from 2.54 to over 30.0 and severity rates ranged from 0.04 to 4.92 during 1934.

We should also be able to count on better records in the future from plants that now have very low injury rates. A few years ago no-injury records of 500,000 man-hours were considered extremely fine accomplishments for plants manufacturing metal products but today they are quite commonplace. The American Can Company has a number of plants with records exceeding 1,000,000 man-hours and the C. Hager & Sons Hinge Manufacturing Company of St. Louis, Missouri, had an unbroken record of over 2,500,000 injury-free man-hours on June 30, 1935. This record extends over a period of almost five years, and when one considers that long periods have been required to achieve many of the other fine records made by members of the section, our goal of plant operations without accidents does not seem so impossible.

What Have You Done in Your Plant to Prevent Accidents?

By H. C. HOWSAM

Supt. Hubbard Spool Co., Chicago, Ill.

Some years ago, after a very serious accident, our company decided to correct the hazardous conditions in our plant. Since the president is sold 100 per cent on safety, the rest of us have taken this subject in a very serious manner. The attitude of the management has more effect than one would imagine.

The study of safety brought out many things. Equipment was found to be not only unsafe, but very slow. We discovered that we were far behind in guarding dies, tools and machines. It was planned to take up first one die after another and arrange a guard, chute or slide, whichever was necessary. Until each and every piece of equipment was completely guarded. This has proved to be a big job, but we are gradually accomplishing it.

We joined the National Safety Council and through them have learned how to hold safety committee meetings and to use posters.

Probably the most important thing we have done has been to make each employee safety conscious. Now an older employee will take a new man in tow and see that he gets started right. Many times an old employee has reported a condition that is unsafe on a machine, that a new employee is operating. We have made each employee feel that he is responsible for the safety of his fellows.

Each foreman is a member of the safety committee reporting to the superintendent who heads this committee. Safety is kept constantly in the minds of all. Guards, while treated in a secondary manner, are soon installed because when a request for a safety device is made by an employee to his foreman, some temporary guard is installed at once. A record of this need is then made and at the first opportunity a permanent device is installed.

I feel that we have done more to prevent accidents by constantly preaching safety than any other one thing. However, I do not want to discount guards, as they have their place and are important. A story will probably illustrate more clearly what I mean. The other day, while in conversation with a foreman, I noticed a large amount of oil on the floor in one of the aisles. The foreman advised that he had just noticed it also and was going to have it cleaned up. Just then one of the men came along this aisle and I remarked, "Here is a chance to see if all this safety talk has done any good." This employee slowed up, looked at the oil, went to a rack for some waste and wiped up the oil. He did not know that the foreman and I were watching him. Keeping the employee alive to the subject of safety at all times is one of the most important things in developing a safe plant.

Why Did Accidents Increase in Our Plant

By E. J. WALLMAN

Safety Engineer, Great Lakes Forge Co., Chicago

Many safety authorities think that unemployment and the over-anxious attitude of old employees have been the chief causes for the increase in accidents. In my estimation it is just one of the important reasons. The others are: improper housekeeping, improper instruction, inadequate supervision and improper tools.

For business reasons many industrial concerns have curtailed expenditures on each one of these items to the extent that they have been the cause of many an avoidable accident.

Our Accident Frequency for 1932 was 10.289—Severity 1.70
Our Accident Frequency for 1933 was 25.456—Severity .93
Our Accident Frequency for 1934 was 16.206—Severity 2.94

The increase in accidents at our plant has not been caused by new men, as we have had few new men employed. They are happening to men with 10 to 20 years of experience and to men that have been in our employ for 10 years or more. We had enjoyed a downward accident curve since 1925; in fact, 1932 was just 10 per cent of 1925; when all of a sudden 1933 climbed 250 per cent over 1932.

In that year business was very poor. The men were working less than 25 per cent of the time. As business picked up slightly the Blue Eagle came down on us and hours were shortened; earnings were reduced by the shortened hours. Piece workers tried to earn as much in 40 hours as they had earned in 50; consequently they tried to cut corners and many times did not follow the safest route.

Men returned to their jobs after long lay-offs, having lost their knack or skill. Machines were operated that had stood still for years. The uncertainty in the minds of business leaders toward the administration in Washington would not warrant the purchase of new equipment, and the work had to be done on the old. Repairs and replacements were held down to a minimum.

Men were placed on unfamiliar jobs, their own trade not affording them enough time to make a living. They were placed in other departments. Many times an employee would go to two to three departments in one week.

The supervising force was cut down. Foremen and supervisors were given additional jobs and many times were working foremen. Naturally, they were not giving thought to safety as they did before.

Often a minor injury would result in a lost-time case because of malingering.

The market conditions for forgings were such that the customer would not purchase his requirements until the very last moment; consequently, most every job in the plant in the past few years has been a rush job. Men would be hurried into the plant and start working; they would come under any circumstances, many times when they were not feeling well and could not stay the whole shift. Then other men would be called in to take their places. Often night shifts would be organized on a few hours' notice, unable to get their needed rest before coming on the job.

All these things, together with their own personal worries, have placed all of our employees under a terrific handicap, and I think our employees have done well by keeping down accidents as well as they have. During the current year, however, operations have been somewhat normal and thus far the boys at the plant have made a fine record.

How Can We Make New Men Safety Minded

By EMIL C. SCHULTES, JR.

Safety Director, C. Hager & Sons Manufacturing Co., St. Louis, Mo.

The approach to the problem is through these questions—"New Men in what kind of organization?

What kind of organization? Are the executives safety minded? Are they sympathetic toward a safety program—or do they know what a safety program is?

What kind of supervision? Do we have lip service, bulletins and hullabaloo but no follow up?

What kind of instruction? Do we hand the new man a book of rules, a number and put him at a machine and expect him to find his way around?

Do we have safety committees? Are accidents followed up and responsibility fixed or do we hope that we won't have another accident and that Tom Smith will be more careful in the future?

A new man in a plant which is not safety-minded and not organized to combat accidents is in a fair way of being subjected to hazards regardless of his own efforts

to work safely. A new, greenhorn, in a safety-conscious plant and beginning a job after proper instructions, and doing that job under continuous supervision, is a relatively safe man.

The employee can sense the attitude of management. He knows whether management is sincere in its safety program.

The first thing to do to "make a new man safety minded" is to make the "tops" safety minded. How many of your big executives know what the safety program is in your plant? Does the president or any other major officer ever talk with you in a manner that would indicate that he knows a few of the details?

Do you ever get a chance to impress the executives with the idea that your accident prevention work is just as important as production and sales?

Do your executives ever sit in on the safety meetings? Are they interested?

Here is the way we approach the new employee problem.

Procedure.

1. A new employee receives explanation of our safety program. We tell him what it means to him, his family and to the company to be a safe worker.
2. He is then taken to the Foreman and introduced. We make him feel at home in his position and he is told what is expected of him in work, department and general attitude.
3. Foreman talks to him then assigns him to job as an assistant to old and experienced employee. He spends one week or two weeks on that job until he gets accustomed to routine and noises. This is the probation period, during which time he learns about the machine he is to operate.
4. He is put on the simplest machine but gets full instructions on:
   (a) How to operate it and what to do,
   (b) If something goes wrong he calls assistant foreman. He is not permitted to try to fix or make repairs.

   Periodic check-up several times a day.
   (a) Material—how piled, etc.
   (b) How he is handling machine
   (c) No "monkeying" with guards.

   If guard is removed a worker is sent home for two days; second offense, three days; third offense, dismissal.

   General safety meetings of entire plant are held twice a month.

   Report made of all accidents—no names mentioned.

   Ten department heads are held responsible.

   We do mention the department the accident occurred in; no comments are made at open meeting; details are handled by the safety committee.
5. Suggestion Box.

   All questions and suggestions considered, and acknowledgment is made—
   (a) Either in open meeting or
   (b) Taken up individually with the man making the suggestion.

   This keeps interest stirred up. It develops consciousness that company is interested.

In our work with the *new* men we don't forget the *old* men—the old employee needs checking and supervision too.

An important thing to keep in mind is this. An old employee on a new job or a different kind of machine is a green man so far as his new job is concerned. He needs instruction and supervision as well as the new man does.

No better example of this can be found than in the experience of many industries during the depression. During the year of the rehiring period after the depression shut-down, accident frequency of some 100 industries in the St. Louis Safety Council's Inter-Plant Safety Contest increased from 6.8 to 12.58, an increase of 85 per cent.

What causd these accidents? Who was having them? Not new, green men, but old employees who were being put back to work.

No instructions—no check up to see if the men knew what to do. Just because they were old employees it was taken for granted that they knew everything about all jobs.

The Hager Hinge Company takes nothing for granted. When we employ a man for a job we see that he is first fitted for the job; second that he understands his job and third, that he also understands his responsibilities.

No man is taken on "green" and is expected to handle a process job. He has to be broken in; first, as a helper on material, trucking, stacking, etc. Then he assists an operator—he begins to get accustomed to surroundings, noises, machine operations, etc.

After that he is given a machine if he wants it but only after he has been instructed. After he begins as an operator he is checked and the machine is checked regularly. Nothing is taken for granted and everyone from top to bottom is sold on safety.

Our firm joined the St. Louis Safety Council in 1929. Our frequency rate was 30.0 in 1928 and you could measure the years of service by the absence of our workmen's fingers. Our first year in the Inter-Plant Safety Contest saw our frequency drop to 3.88. In 1930 we reduced our frequency to 1.41, and in the last four and a half years have had no lost time accidents.

Figures used sparingly are more eloquent than words. Here is a brief outline of our progress since 1928.

Year	Man Hours	Lost Time Accidents	Lost Time Injuries	Days Lost	Medical Costs
1928	No Record	103	30	207	No Record
1929	1,030,073	81	3	31	916.50
1930	708,900	24	1	41	346.00
1931	572,084	21	0	0	260.19
1932	407,659	2	0	0	41.50
1933	631,746	12	0	0	179.00
1934	597,913	11	0	0	155.50
1935 (1st 6 mos.)	287,580	9	0	0	74.00

TUESDAY MORNING SESSION

October 15, 1935

Latest Developments in Safety Appliances for Power Presses

By LOUIS BORAKS

Mechanical Guards Supervisor, Liberty Mutual Insurance Company

All safety appliances have merit; proper guarding lay-outs for any power press department must start with a consideration of construction of dies, quantity of production, product, type of presses, and kind of raw materials to be worked on.

In this paper, I am confined to "*Latest* Developments" and, therefore, any ideas used should be considered with this in mind.

There has been continual and efficient progress in the building and designing of automatic presses and press operations. Automatic presses can be built for almost any kind of press operation. It is just a matter of dollars—the amount of money one can spend for the machine. We know that automatic presses are comparatively non-hazardous machines, and with the addition of barrier or enclosure guards, they are as safe as any machines can be.

The safety problem connected with power press operations is on work where the operation of feeding is manually performed.

Considerable progress in guarding has been made by individual plants, insurance companies, departments of labor, the National Safety Council, and guard manufacturers. All of us are familiar with slide feeds and the usual press guards. Therefore, I call your attention to a distinct trend in the building of new press guards.

The foot treadle operates the guard, not the press. The guard operates the press. A new idea. The guard, operating before the press, can, by reason of the timing, add to the safety of the operator.

If a gate guard is used with this idea in mind, the gate descends and after it reaches a closed position, the press trips either mechanically or electrically. The same idea is applied to sweep guards, two hand trips, and push feeds, and it can be adapted to almost any type of press guard.

The automotive industry uses large, heavy presses. In some plants, the press is run continually and the parts are fed to the press manually, getting every stroke of the press. No guards are used. Other plants use electric button trip guards, but these slow up production. A new development is a pump bar assembled to the ram. The bar is hinged at one end. If the operators' hands come in contact with it, the bar raises, contacts a switch, which in turn, through a solenoid, throws the clutch operating lever, shutting down the press. This idea is of real value on slow-running, large, friction drive presses.

A recent development in drop hammer operations, particularly on cold work, is the use of a new machine known as a Percussion Power Press.

These presses are built in sizes exerting a pressure of one to 900 tons. They are friction driven, with no crank shaft. They strike a dead blow, like a drop hammer, and return to a neutral position like a power drop hammer.

The Percussion press is an improvement on a drop hammer on cold work for the following reasons. We all know the tremendous vibration of a drop hammer. So much vibration, that if you were to equip the hammer with a dial feed, slide feed or any automatic or semi-automatic feed, it would not operate successfully for any great length of time. Bolts and pins of the fixtures would loosen up or crystallize and break, and accuracy would be almost impossible. The percussion press has less vibration than an average power press operation. Because of this fact, it can be fitted with *safety feeds* that will function as well as on a power press and with as much accuracy.

It does take more time to set up dies in a drop hammer. Dies for percussion presses can be sub-pressed as on power presses. The result is an easy set up. On a drop hammer it is difficult to hold the punch and die in accurate alignment because of vibration. There being little vibration on the percussion press, there is no difficulty along this line.

There is also an advantage in the life of the dies, as little skill is required for operation. I have seen them operated by girls, and practically all of the safeguards used on power presses can be used on percussion presses.

There has been a strong movement during the past year to equip power presses with non-repeat devices. As a result, a number of these devices have been designed by different plants, press manufacturers, etc., and they are in operation in New York. The non-repeat devices that I have seen will prevent the type of press accident that occurs because the operator has kept the foot treadle depressed for too long a time.

From such statistics as my Company has been able to gather on the 17,000 odd power presses in plants that we insure, I would say that not over 3 per cent of all press accidents arise out of this source. A new type of non-repeat device has been designed and these can be procured from a number of sources. My feeling is that an operator who has been using a press equipped with a non-repeat device and who then uses one not so equipped is open to additional hazards because of the habit of operation.

A new guard material known as "Fibestos" is being used to some extent. This material is suitable for any guard, power press or otherwise, where good vision of the die or tool is necessary. It is transparent, almost as clear as glass, and almost as good as a safety glass for some guards. It can be molded to any shape by placing it in boiling water, and can be drilled, cut, or machined with ease.

Air has been used for sometime on power presses for ejection of finished parts, etc. A new development is the use of air for the operation of magazine feeds, push feeds, and for taking the place of a mechanical action. This idea reduces the cost of automatic and semi-automatic feeds where it can be applied.

The photo-electric safety control, or electric eye, for power presses has been available to power press users for about the past two years. A guard manufacturer has developed this. I have been asked as to the value of this electric eye guard many

times during the past year. I have never seen it, but I believe it to be practical but limited in the type of accidents it can prevent.

A gate guard used with an electric eye would be an improvement for both guards, because the press could not be tripped until the gate was at a fixed position, allowing the beam of light to pass. I feel that the electric eye guard has a future.

I can't let this opportunity pass without saying a word for progressive dies. No doubt, many of you have seen the models of progressive die work in the Power Press Section Exhibit. Now, progressive dies, combining a number of operations, are not a new idea. I know some plants have been building them for at least fifty years. We are considering late developments on power presses. Let us not forget the old ones, and I'll venture to say that the progressive die is not a very old idea to many of us. As a safety appliance, it is unique in that it *eliminates* hazardous press operations. You just don't have them. I appreciate the fact that progressive dies should only be built for quantity production. What is quantity production—5,000 pieces or 100,000? I would say that with a yearly production of 50,000 pieces on a part having about six operations, it would be *worthwhile* from all angles, safety production cost, and die cost. I know that there is a general feeling that progressive dies are expensive. When I am confronted with that kind of a statement, I have only one answer—Have you figured the cost of your progressive die against cost of individual dies. The answer is usually No. Well, do so; the results may surprise you. Especially if your plant has good die makers.

There is no limit to the possibilities of better safeguards, increased production, and the development of new ideas for pressed metal parts. It is possible to get information from many sources on power press safety that is practical. There is no question as to whether a press can be guarded. It is merely a question of the best method for the problem at hand.

Safety in Tool Design

By GEORGE T. KOCH

Chief Die Designer, The Murray Corporation of America, Detroit

It is possible to add some safety features after a tool has been completed, but it certainly is easier and cheaper to incorporate them during construction. In many cases it is impossible to change tools or dies satisfactorily after they are completed.

Press guards are of many types. You are all familiar with the gate descending ahead of the ram clearing arms or hands away before the press closes. There is the electric button control which requires the operator and his helpers individually to press an electric starting button before the press will trip, thereby eliminating all danger of their hands or arms coming in contact with the press. There is the type where the operator's wrists are shackled and his hands are automatically and forcibly pulled away as the ram descends. There are numerous others, all effective and helpful in reducing accidents in one of the most dangerous departments in the automotive industry.

Most of these guards and similar safety devices were created because of the lack of safety thinking in the designing department. The safe handling of the die during the period of its construction is important. Some of our draw die rings weigh as much as ten tons and represent only one-quarter of the die. Provision must be made to handle this weight in the lifting and machining necessary. We bore holes through side walls for chains; incorporate chain slots in the flanges and clamping lugs for holding while machining; and drill and tap holes in some faces for eye bolts for lifting. All these precautions are necessary for handling the die safely during construction.

It was peculiar how some of our safety problems presented themselves. For instance, we used to allow the tool maker to tap any size lifting hole in his die he desired. This practice led to several irregularities; the size tap in some cases was too small for the weight of the die and the tool maker would only screw the eye-bolt thread in one or two turns, with the result that quite a few accidents were caused by the threads of the eye-bolt stripping, allowing the part to fall. This has been entirely corrected by having the designing department specify the size of all holes for lifting and by the use of shouldered eye-bolts, which must be screwed down to the shoulder.

Not so long ago there was no designing department in a die division. Each tool and die maker made his sketches to his own ideas, built his tools accordingly, and was personally responsible for their operation; and in some cases he ran off the production required. He was so closely in touch with the problem and the safe operation of his die so vitally concerned him, that he just naturally gave safety some thought.

This practice, however, went out. Dies were increasing in size, operations were becoming more complicated, and dies were being built for operations that had always been done by hand or on a bandsaw, rotary shear or square shear. And, more than anything else, the time of construction was cut to a point where costly machinery and the doubling of labor was necessary to complete the tool on schedule. This quickly brought a change in shop practice. Designers were necessary and men specialized in each shop operation.

The result was that very little thought was given to the press operator. The loss of a finger a day was a common occurrence in some shops, and press rooms were becoming known as the butcher shops of the automobile industry. The obvious solution was to guard the machine causing the trouble; namely, the punch press.

At first the draftsman were practical men who had had actual experience in the shop. They knew the bad conditions that existed and how to remedy them. But as the necessity of making tools faster to meet shortened schedules grew, it became necessary to secure men who were unfamiliar with the press rooms.

Guarding the presses was being given more and more consideration but the human suffering from crippling accidents was not brought back to the designer and he did nothing to improve the safety element of his designs.

Then the safety department began to function. It carried these troubles back to their source, and constantly reminded the designer of his responsibility. There is not a first class designer at the present time who does not consider safety a fundamental in his work.

The ease with which safety could be incorporated was remarkable. For example: In our press room, dies are carried from their storage balconies to the presses by means of overhead cranes. These balconies are about sixteen or eighteen feet high and some of the dies weigh twenty tons. It was possible for a die to slide through the chain until we incorporated chain slots. The cost of this feature is practically nothing. The pattern maker leaves off the clamping flange at four places for a distance of four inches and we have the slots. The feature of our chain slot that I believe is superior is that they enclose the lift chain on three sides. If one chain should break, the die would still be supported by the other.

The corners are beveled. This is done to prevent fracturing of the chain links, or to prevent a rope from being cut. If the die should be resting on a flat surface, this bevel edge would enable a man to get a pry bar under the die. These make our dies safe in handling, but they still do not make them safe in operation.

It is surprising to see what precautions are necessary to protect a man against just plain carelessness. For instance, on this chart we show a pressure pad type commonly used for stampings where a flanging operation is required and the panel must be held while being flanged. When the press is open, the pressure pad is also open to the extent of its travel. This leaves an opening usually large enough for an operator to place his hands between the bottom shoe of the die and the pad. Then, as the press ram descends, it forces the pressure pad to close and the operator has been seriously hurt. There isn't any known reason why operators should put their hands there, but they do, and that's what we must protect against. A sheet metal guard around the outer edge is sufficient; it is effective and costs little.

Now we come to one of the greatest hazards at the die. When a die operates in a press, the ram opens the die. It is then necessary to have some sort of a guide to make certain that the halves will close in perfect alignment. If the presses were absolutely square in their operation, these guides would not be as necessary, being used only in the setting of the die in the press. But to date we do not seem to have such a perfect condition, so we use what are called guide or rider pins in

the die itself. These pins are long enough to engage the two halves of the die before they close on their actual fitted sections, thereby assuring a perfect contact as the press and die close. In some cases it is possible for us to make the guide pin long enough to be engaged in the other half regardless of the stroke of the press. If this is possible, it eliminates all hazards. But in the majority of cases, we are not so fortunate, and the pin disengages the upper half entirely. This makes it possible for the operator to place his hand or arm over the pin, causing a very serious accident.

We have tried various ways and means of getting around this hazard and have finally adopted leather guards. They are fastened to the bushing or female side of the die, projecting down in front of the pin. They are flexible enough to be easily forced out of the way if contacted by any part of the die. This allows us to make them long enough to be always in front of the pin regardless of the length of the stroke; and still they are stiff enough to prevent an operator from forcing them aside to reach over the pin. These are inexpensive and easily installed.

Similar conditions exist in regard to heels. Heels are necessary wherever there is a thrust between the male and female die. Their function is to lock the die together and counteract the thrust, keeping the male and female in proper alignment. Leather guards similar to those we use on the pins are used in these cases also, preventing an operator from injuring himself by placing his hand or arm over the heel.

The development of these guards for the protection of heels and rider pins has greatly helped in reducing accidents. But the designer should go a step farther. He should consider the press operator and the method of feeding the material in the press and removing the stamping from the die. If he succeeds in having all pins and heels out of the way so the operator and helper do not have to come in contact with them while feeding the sheet in the press or removing the stamping, he has created a much safer product. We still insist, however, on our regular leather guards as an added precaution.

I have here two sketches of spring returns for cam slides. One shows the springs exposed, and in the other the springs are entirely enclosed in the lower casting. When the pad is closed, these springs are under tremendous pressure, and if the stud should break, or the thread strip, they would be freed with terrific force. A pipe and cap can be placed over the open spring, adding considerable protection, but the enclosed pad shown in the second illustration is the real answer to this hazard. You can see that any spring breakage is absolutely harmless, as it is always retained in the casting. This method has its disadvantages in spring replacement in case of breakage, and it also costs more than the other type, but we feel that the results are worth the difference and use it whenever we can.

Of course, it is generally true that each die presents its own safety problems, and for this reason the designer will create a much safer design if he can visualize his die in operation and the problems confronting the press operator. He will see that all heels and pins are out of the way so that they in no way interfere with feeding and removing stock: that all pins are protected by leather guards and that, if it is possible, the pins are long enough to remain engaged in the die at all times. He can see how much stroke is required in the press so that the stock can be fed easily and removed safely; that scrap cutters are provided so that the operator does not have to reach far under the ram to remove surplus material; and that strippers and ejectors are provided so the parts will not stick and can be removed freely. He should consider the method of feeding the material to the die, using on the smaller dies hoppers, rolls, slides, chutes, or any other devices to keep the operator's hands away. On large dies where it is necessary to feed the stock by hand, the loading and unloading sides of the die should be kept clear of any cams, cam slides, low hanging or open pads, and unprotected springs. He should see that no surfaces of the two halves of the die come closer together than two and one-half inches, except where it is necessary to form the part, so that the operator cannot injure himself. Thought must be given to the proper supporting of pads so they cannot drop.

An important and gratifying result of employing these safety devices is the increased productive efficiency of the die in operation. If the die has automatic feeders and ejectors, a small stroke, small shut-height press may suffice; but for all hand-feeds a long stroke enables the operator to get into the die to feed and remove stampings safely, and a larger shut-height provides clearance enough to allow freedom of loading and unloading. Regardless of how well we may design a die, the whole set-up may be spoiled when set in a press where everything is cramped and freedom of feeding is impossible. It was commonly believed that just enough stroke and shut-height are proper for securing the greatest production, but this has actually been proved wrong from a production as well as a safety standpoint.

Whether to clamp a die to the press or not has always been a subject for debate. Bolting the upper half to the ram and clamping the lower half is not a bad method, but bolting both is better. The fact that our dies do not run in the same presses all the time gives us some trouble, but I am sure we will soon have a satisfactory solution for this difficulty.

I don't care how capable a designer may be; there are some points of almost every design that are new and different, and the designer may not be aware of them. Unless they are brought to his attention, he will continue designing die after die omitting these items.

So if you have any ideas that will improve the construction of our dies in any way to increase safety, reduce costs, or step up production, pass them on so that all of us in the stamping industry may profit.

THURSDAY MORNING SESSION

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Building Safety into Hammers

By C. C. MILLER

Engineer, Chambersburg Engineering Co., Chambersburg, Pa.

While almost any machine tool used for forging hot metal has lethal possibilities, the deadly aspects of a hammer are more spectacular and more likely to be final than those of other metal forming tools.

A hammer is not amenable to the ordinary guard which may be used on other equipment. This condition is aggravated by the intimate relationship necessary between the hammer and the hammer operator.

The parts of a hammer which may cause injuries are relatively few and simple, but due to the terrific impact stresses to which they are subject, the removal of the hazards is not simple. Modern hammer design has gone far in the safety direction, and built-in safety has really increased the serviceability and productivity of the hammer itself. This recent improvement is probably due to the fact that the stresses to which hammers are subject had not really been comprehended until a half dozen years ago. The factor of safety as the designing engineer thinks of it has now been increased in accordance with the newer understanding of necessities. This, at the same time, has increased the factor of safety.

Hot metal working hammers divide themselves into three general classifications—the steam drop hammer, the motivating power of which is either steam or compressed air; the board drop hammer, in which the work is done by gravity and the weight lifted by an arrangement of rolls and boards; and the open frame hammer which, like the steam drop, is driven by steam or compressed air. In the first two classifications the product is usually more or less intricate in form and is produced in shaped dies. In the last classification the dies are usually flat, and any shaping is done by special tools which supplement the flat dies.

In steam drop hammers the most frequent hazards are introduced by either structural failures, the sudden separation of the rod or of the piston and rod from the ram, or by "repeating," which means that after the hammerman has caused the

hammer to strike a blow, another blow follows which is entirely beyond his control or expectation.

Structural failure in modern hammers has been practically eliminated by knowledge of the stresses which must be resisted and knowledge of the metallurgical characteristics of steels now available. Sections and bearing areas have been greatly increased. Special casting practices have been developed to insure soundness in the unseen portion of castings, and in many cases castings have been superseded by forgings of definitely known characteristics.

In old designs it was customary to maintain distance at the top of the steam hammer frames with tie bars and spacers. These tie bars would eventually fail, and this sudden failure under impact has impelled portions of them a considerable distance, constituting a hazard. Tie bars and spacers have been superseded by a forged steel tie plate of such heavy section as to be stressed far below the fatigue limits and, therefore, immune from fatigue failure.

Simultaneously the hammer structure has been redesigned to absorb the greatest shock at the bottoms of the frames, thus relieving the tops. Overhanging sections involving tensile stresses and subject to fracture due to impact fatigue have been eliminated.

Die cap keys are of such material and have undergone such heat treatment that they no longer shatter. This removes the eye hazard which previously existed. The anvil cap and ram are now very high grade forgings, heat-treated to a definite hardness and tensile strength, and the danger from flying spalls is practically a thing of the past.

All the bolts used in steam drop hammers of today's design are of high grade heat-treated alloy steel, and since these bolts are in many cases necessarily in a vertical position, the falling object hazard introduced by "bullets" of unsound or unsuitable material has been eliminated.

In a steam drop hammer the working or falling units consist of a ram, a piston rod, and a piston, the piston being shrunk and riveted to the rod and the rod being attached to the ram simply by the friction generated in a taper fit. Separation of these parts may occur by breakage of the rod, by failure of the friction grip in the ram, or by the piston working loose at the other end of the ram. This last eventuality has been practically eliminated by study of the proper taper and shrinkage fit, and the proper distribution of the riveting stock before the actual riveting.

Rod failure has been minimized by the proper selection and heat treatment of material and by polishing out tool marks which in former practice showed as stress nuclei and fostered fatigue failures. Separation of the rod from the ram itself has not been entirely eliminated. Under impact the tapered joint tightens to such an extent that the stresses on the abutting rod and ram surfaces exceed the ultimate strength of any known usable material, and eventually the joint is destroyed and separation occurs. Provision has been made for renewing this joint by the insertion of a bushing which is somewhat less structurally resistant than either the rod or the ram proper.

Nevertheless, it is inevitable that the rod and ram separate occasionally in service. When this happens the piston and rod, being relieved of the weight of the ram and die, strike the upper or closed end of the cylinder with tremendous impact. Provision, therefore, must necessarily be made to render this impact harmless. This has been done by building in an auxiliary piston, which at the moment of impact traps a live steam cushion between itself and a tough alloy cylinder cover.

The packing gland at the bottom of the cylinder in practically all old designs consisted of a rather bulky split steel casting usually bronze lined and suspended from the cylinder by a pair of bolts. The weight of this gland was conducive to fatigue failure in the suspended bolts, and failure of the casting itself was rather common. The new type of gland consists only of a plate of rolled steel, counter bored, and carrying a bronze section which positions the packing, and the weight is but a fraction of the gland of the old type. Consequently, fatigue failures in this instance also are minimized.

"Repeating," as described above, is one of the worst hazards which may be encountered in the forge shop. Not only does the repeater spoil the work, but it is sure sooner or later to hit a forging in transition between die impressions and cause injury by flying tongs or forgings, or by throwing the hammerman off balance. Repeaters are caused directly by lost motion in the valve-operating mechanism and are entirely the responsibility of the designer and the maintenance man.

In the new hammers, the number of joints which may become loose has been reduced to a minimum. The cam and arm are a one piece forging. The bearings are of a ferrous bronze selected for its wear-resistance under oscillatory motion. All fits are accurate, and by these means the time intervals between overhauls of valve mechanism have been lengthened. The importance of keeping valve mechanism in first class condition should never be forgotten by the maintenance man. In addition, there is now provided a means whereby a hammerman can in an emergency shut off the steam by a single motion of his hand and without leaving his position.

Since a hammer strikes whenever the treadle is depressed, it is evident that the treadle mechanism deserves some attention from the safety standpoint. Because the operator is required to shift his position frequently with respect to the hammer, it is in most cases impossible to use any auxiliary treadle guards. Other safety features are limited by the ease and certainty with which the hammer must respond to pressure on the treadle. If a hammer treadles too lightly, it might strike inadvertently and disastrously, and if it treadles too hard, too great a percentage of a hammerman's weight is required for the treadling operation, and he finds it difficult to maintain his balance on the foot which rests on the floor.

Proper treadling pressure has been determined and can be readily arrived at by correct arrangement of the lever arms between the treadle and the main valve.

The structural and falling object hazards of the board drop hammer, much the same as in the steam drop hammers, have been minimized in a similar manner. The rod hazard is paralleled in the board drop hammer by flying boards, which may either become detached from the ram or break, in which case either the whole board or splintered section is elevated rapidly through the rolls, and once free from the rolls falls to the ground.

This hazard is greatly reduced by the use of guards which enclose the boards above the rolls and in most cases prevent them from falling if they are released by the roll. Board guards are now standard equipment on the better hammers. An overhead screen to protect the hammer operator should be installed.

In board drop hammers the rolls may be belt driven through pulleys mounted directly on the roll shafts or they may be driven by a train of gears built into the head and powered by a motor mounted on the hammer itself. In the old type belt driven hammer the roll shafts were apparently designed in the standard manner against torsion and deflection and probably with no fatigue factor. It was not uncommon, therefore, for a roll shaft to fail between the bearing and the overhung pulley, in which case the pulley dropped and traveled down the shop until it met an immovable object. In addition the flying belt which was released by the shaft failure could easily break a man's neck or at least give him a bad brush burn.

The hammer builder's answer to this problem has been a combination of heavier sections, alloy steels, elimination of tool marks and sharp shoulders, and the shortening of the shafts by the use of anti-friction bearings. Incidentally, the anti-friction bearings with inner races shrunk on the shafts eliminate scoring, which is conducive to fatigue failures.

As a safety and service feature, all appendages and projections insofar as possible have been eliminated in the new type board hammer. There has also been eliminated a built in ram stop which for a time was regarded as a safety feature. Experience showed that since this was overhanging weight, it was subject to whip and, therefore, fatigue; and that it constituted a hazard rather than a safety feature in that it was not dependable. It is believed that no built in ram stop is equivalent in safety to the wooden block with bound ends and a handle.

Most board drop hammers are equipped with what is called a front rod mechanism. This comprises a long rod reaching from the eccentrics, in which the rolls are carried, down to the anvil, and this rod carries the cam mechanism which limits the travel of the ram and causes its reversal of direction. It has been a hazard mostly because of fatigue failures, and this possibility has been minimized in the newer type by the use of alloy steels in the cams themselves; by fatigue-resisting fibred iron as a rod material; and by a rubber-bushed mounting which affords a shock cushion to the rod itself.

Since forgings produced on board hammers are smaller and less intricate than those produced on steam hammers, it is generally possible to treadle a board drop

hammer from one position. This has allowed the use of a safety treadle which does not require any auxiliary guard, and which may be made entirely inoperative except under extremely heavy weights by lifting the foot lever to a vertical position.

Perhaps the safest board drop hammer, considering nearby workmen as well as the hammer operator, is the newer type motor-driven hammer with fully enclosed gearing and flywheel. There is no pulley or belt hazard and, except for the reciprocating boards, a man might safely climb to the top of the hammer while it is in operation without hazard from moving parts.

Increased base area not only affords better protection to the foundation timbers but also eliminates the probability of the whole structure tilting or leaning.

While in some respects an open frame or flat die forging hammer is considered less hazardous than either of the other types, there is usually an additional hazard caused by the fact that the hammer operator rarely manipulates the piece upon which work is being done; therefore the synchronization which spells safety must include not only the hammer and its operator but also the stock manipulator, whether manual or mechanical. After all points of construction and built-in safety previously discussed have been cared for in the flat die hammer, a most important additional point must be considered—an unobstructed line of vision between the operator and the work. The work must be moved from time to time, various shaping tools and cutoffs must be used, and unless the operator can see the work clearly without assuming any strange or unnatural posture, there is danger of wrecking equipment or injuring men.

The newer hammers are so designed to provide proper vision. This has meant in single frame hammers the introduction of the high frame so that the operator might remain in an upright position. This change in design has been exceedingly beneficial, the new, high-frame hammers being more versatile than the old standard types and easily equipped with auxiliaries, for forging rings and other shapes, which were impossible in the old hammers.

In the larger sizes of double-frame forging hammers, the split frame, while not exactly new, deserves mention because it permits swedges and cutoff tools to be located in the center of the die without skewing the work and at the same time serving as a partial screen for the manipulator of the tools in question.

How the Die Setter Can Promote Safety

By FRANK R. O'KANE

Edison General Electric Appliance Co., Inc., Chicago, Ill.

The die setter has usually spent many years in mastering his trade and is anxious to establish his reputation for efficiency. He is capable of seeing the importance of safety measures and by the nature of his work, is in an excellent position to promote safety. Given the opportunity and incentive to do so, he can actually prevent many accidents and can also do much to educate others in the principles of safe procedure.

In large organizations each die setter is usually assigned to a specified group of machines and operators. Sometimes there is a supervising die setter for each shift who may be called upon in emergency. In smaller organizations, the foreman of the press department may be a die setter and set the dies himself.

Dies are made by the tool and die department and are inspected before being passed on to the tool crib or directly to the presses. When the die comes from the tool crib, it is also inspected in most organizations before the die setter receives it.

In spite of these precautions dies may be found unsafe when the die setter receives them. Sometimes a bolt or screw may be cracked, broken, or missing; or the die setter may discover that a clamp is cracked. In such cases, it is far better that a little time be lost in having the defect corrected than to set up the die and let it run in the hope that it will get by one more time. Sometimes dies may be constructed to take care of a temporary operation, and later, the need for the operation may continue and the die be used again and again. In such cases, the die setter is the

logical person to notice this fact and he should bring it to the attention of the foreman so that the die may be properly safeguarded or put into proper condition.

When a die has been set, the die setter puts in place whatever safety device is supplied. No matter what type of guard is selected by the management for that particular operation, the die setter should be sure of two things: (1) that it is properly installed and operating correctly; (2) that the operator understands not only how to run the job correctly but that he does his work in the safest possible manner. In some shops, where operators run the same jobs day after day, there is not much of a problem of efficiency, but routine work often causes operators to become careless and the die setter can do much to promote safety by observing and calling attention to any laxness in operation. He can readily observe this because he is constantly concerned with the operation of all machines to which he is assigned and is always on hand, subject to call should anything go wrong.

At the time the die is set, the setter operates the press and makes the first piece, which must be passed by the inspector, who checks it against the blue print. In some shops, the safety device must also be inspected and given a written O.K. by the foreman. This practice is highly commendable, and should be followed in all shops, particularly where foremen are permitted to impose penalties on operators for violating safety regulations.

Before the press is permitted to operate, the general mechanical condition of the press, power belts, and such factors should be noticed by the die setter and any unsafe condition reported to the proper person. There should be harmonious cooperation on this score between the tool room, the machine shop, and the maintenance department. Presses are usually inspected as a part of maintenance routine but no harm can be done by the die setter who makes a habit of noticing the condition of each press before he releases it for operation. No accident was ever caused by too much inspection.

When the die setter runs the first piece, he should consider the nature of the die being used and the possibility of small pieces of metal sticking in the die or being blown into the operator's face by the air draft, if one is used. If the operator's face is endangered, the die setter should tell him to obtain goggles and to use them while operating the press. Some people might be inclined to laugh at the idea of wearing goggles while operating a punch press, but I have seen many jobs where it was far from a poor idea. Such cases do occur and the competent die setter is in the best position to recognize them.

I might mention an idea that has been used with good results in the Edison General Electric Appliance Co. We have a stick or metal rod with a hook at its end, chained to the frame of every press. The operator is required to use that device when it is necessary to remove pieces of metal left in the die after the processed part has been removed. Several of these sticks or rods, smashed flat and thin, are displayed in our factory as dramatic reminders of what can happen to a man's hand if a press is accidentally tripped.

Another point the die setter may well observe while showing the operator how the work should be handled, are gloves which the operator may be wearing. There are some punch press jobs, of course, on which the operator should wear gloves but there are many cases where the operator apparently wears them for no better reason than to keep his hands clean. It is considerably safer not to use gloves when the operator's hand are not threatened by sharp edges or corners on the work, and certainly it is highly dangerous to use old and ragged gloves on any job. The die setter should consider it his duty to warn a man against such danger and to report the incident if the man does not listen to reason.

Some of you may operate shops on a bonus basis and may be wondering what effect all this care on the part of the die setter may have on the bonuses. Is there likely to be so much time required by the die setter that the job will be delayed while he makes sure that the operation is safeguarded? The die setter himself may be earning a bonus and it is natural to wonder whether or not he can take the precautions I have suggested without losing out on his own bonus.

There is no need for worry in either direction if the problem is considered from the safety standpoint. Certainly it is better to lose a minute or two when the occa-

sion warrants than to have an accident. There is practically no extra time required to do any of the things I have spoken about here, and when there is an actual hazard due to the condition of the die, the press, the feed, the guard, or the operator's method of operation, no one will deny that a few minutes of delay are well worth while. When a die setter works on bonus system, he is allowed a certain length of time for setting up each die. So long as these allowances are fairly set, the die setter need never be so rushed that he has no time to note the hazards.

I realize that some of the things I have suggested are not actually the die setter's responsibility but no organization can go far in safety work if it depends upon its employees to do no more in that direction than their jobs actually require. Even though the foremen is responsible for seeing that safety devices are used and that operators follow safe methods, and even though the tool room, the machine shop, and the maintenance department each has responsibility for the mechanical safety of some part of the operations, the die setter can be of invaluable assistance to them all; they should welcome his cooperation and he should be encouraged to give it.

More important, however, is the die setter's attitude toward his own safety. He should, above all, set a good example. The die setter can preach a better sermon on safety by observing its rules while doing his own work than he can by hours of advice to operators.

Dies should never be set or adjusted while the power is connected to the press. If the machine is belt driven, the die setter should remove the belt before attempting any adjustments and should use a proper instrument for doing so. Many an accident has resulted from trying to remove belts with screw drivers or other improper tools.

Dies should not be lifted by hand. Elevating trucks are for that purpose. Perhaps certain small dies can be lifted safely by hand but a die weighing 50 pounds or more is too heavy for safe lifting. No harm can be done by using a lift truck for dies even lighter than that. The press should be properly blocked up while the die setter is working and hands should never be placed between dies—even when they are not in the press.

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C. B. Roclet, Wisconsin Public Service Corp., Milwaukee, Wis.
B. B. McCulloch, Bureau of Safety, Chicago, Ill.
F. M. Pepper, Illinois Bell Telephone Co., Chicago, Ill.
H. F. Webb, West Penn Electric Co., Pittsburgh, Pa.
H. M. Webber, Illinois Bell Telephone

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W. J. McVay, Consolidated Electric and Gas Co., New York, N. Y. (A.G.A.)
E. P. Noyes, Central Maine Power Co., Augusta, Maine.
H. E. Shedd, Appalachian Electric Power Co., Bluefield, W. Va.
P. K. Stiles, Compania Cubana de Electricidad, Maximo Gomez (Antes Monte) No. 1—Apartado 1715, Habana, Cuba.

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E. J. Kreh, Philadelphia Co., Pittsburgh, Pa.
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H. F. Webb, West Penn System, Pittsburgh, Pa.
H. M. Webber, Illinois Bell Telephone Co., Chicago, Ill.

TUESDAY MORNING SESSION

October 15, 1935

The first session was called to order by General Chairman E. J. Kreh, Philadelphia Company, Pittsburgh, Pa., who welcomed the delegates and outlined the activities of the section during the past year with special reference to the work of standing committees.

Bar or Tool Holder

By PAUL R. KUHN

Safety Director, Penn Central Light and Power Company, Altoona, Pa.

Several years ago the companies with which I was associated were troubled with accidents and near accidents due to the use of tools and bars which had to be held by employees while engaged in work, and a new bar or tool holder was developed.

This holder is an ideal tool for holding bars or cutting points when breaking concrete, cutting or breaking through stone and holes. It has some limitations, particularly if used in drilling operations when it becomes necessary to move the drill after each stroke of the hammer or sledge, but this limitation can be overcome through the employee, who makes use of the holder, moving around in position.

The holder is made out of 1¼ inch black iron pipe, with a piece of 1¼ inch steel seamless tubing electrically welded to the link end. Inside of the pipe and the tube is a ⅝ inch soft steel rod with a 7/16 inch piece of soft steel link attached to the rod at the holder end. The lever on the one end is made out of soft steel with an adjustable nut, designed with a short lever, so as to increase the leverage when tightening the bar or tool in the holder. A square shoulder has been placed on one side of the lever to keep it from striking the fingers of the workman holding the tool. The link is designed to make it practically impossible for a bar or tool with a mushroomed head to be conveniently used. The material in the holder should not be brittle but be made up of good quality soft steel.

The Equipment Clearance Permit as a Means of Preventing Accidents

By J. F. McCABE

Safety Engineer, Duquesne Light Company, Pittsburgh, Pa.

A "Clearance Permit" as used on the system of the Duquesne Light Company, is a signed agreement or contract between the persons involved in doing work in and about the property. The clearance permit covers in detail those items of switching and blocking necessary to safeguard the men doing the work.

The causes of electrical accidents, particularly in electrical substations, can be divided into three general classes.

Class No. 1. Accidents due to a misunderstanding between the person in charge of work and the person in charge of operation.

Class No. 2. Accidents of the unauthorized or unapproved work type.

Class No. 3. Accidents caused by improper electrical or mechanical clearance by the person in charge of operation, or by a misunderstanding of the clearances given. Under clearance, include such items as roping off live areas, erecting barricades, posting danger signs, locking high tension compartment doors adjacent to where men are working, etc.

The permit consists of a three-fold written, signed contract. To fill out the first part of the permit the person in charge of operation obtains from the person to be in charge of the work, the number, name, designation, or some positive identification of the equipment or part of station requested, and writes this in the permit under the heading "Equipment Requested." He also obtains a statement as to the scope of work and writes this in. The system operator is then contacted and his approval requested for these two items. The person in charge of operation writes in the name of the system operator who gives approval.

When the person in charge of operation is satisfied with the "Equipment Requested" and the "Scope of Work," he signs the permit.

In all cases except emergencies, the district operating supervisor approves the permit, usually a telephoned approval.

"Work to Start—Date," "Time," "Time Required," are filled in by the person in charge of operation. The person to be in charge of the work is then handed the

permit for approval by signature. He signs under "Scope of Work Correct as Described." This concludes the first part of the contract.

The "Steps Taken to Clear Electrically," are then noted, such as the opening of disconnecting switches, removal of potential fuses, etc. The "Steps Taken to Clear Mechanically," are written in, including such items as the placing of barriers, roping off working areas, posting "Danger—Work This Side Only" signs on the ropes separating the working area from the live area, closing steam valves, boiler feed lines, etc. A red danger tag, upon which is the name of the person to be in charge of the work, is posted at every point from which the blocked apparatus could be energized or made mechanically unsafe.

At this point, the person in charge of operation calls the system operator and states that Mr. ..... (naming the person to be in charge of the working party) wishes to report on the equipment requested. The system operator places the person requesting the clearance in communication with all persons who performed the switching, and the person requesting the clearance must then obtain proper assurance that the apparatus is properly cleared and red danger tags posted, on which is his name. The system operator listens in on the conversation as a check against errors. The system operator then talks to the person in charge of the working party and ascertains if he is satisfied with the clearances provided.

Whether or not a test for voltage has been made, is indicated by crossing out "YES" or "NO" on that item of the permit. The person making the test initials this item.

Where grounds are applied, the number applied is noted under that item, with initials of the man who put them on. To guard against possibility of ground remaining in place, "Number of Grounds Removed" must also be noted, along with the initials of the person removing them; the number removed must check with the number applied. Each ground is red tagged as an additional precaution. The number of red danger tags issued is noted on the permit, also the number of red danger tags returned; these items must check.

When the operator in charge is satisfied with the clearance, he signs under "Cleared and Blocked By." The safety supervisor, or any man delegated as such, signs the permit only if he is to remain on the job during its entire duration, his sole duties consisting of watching the crew to see that they do not get into dangerous territory or conditions.

The permit is then given to the person to be in charge of the work; if he is satisfied with the clearing, blocking, test for voltage, grounds, etc., he signs in the space "Checked and Accepted by Person in Charge of Working Party."

One copy of the permit is placed in a holder and posted near the job where it may be read by anyone interested in the work. The making out of the permit in itself tends to eliminate certain hazards by guiding the operator through the business of clearing and blocking in an orderly sequence, compelling him to indicate what he did.

When the person in charge of the working party has finished his job and is certain that all men are clear, that all grounds are removed, and the equipment ready for service, he notifies the person in charge of operation, and the system operator, to that effect. He then signs the equipment clearance permit under the heading "Equipment Ready for Service," with the date and time. The person in charge of operation then inspects the equipment or job, and if in his judgment it is ready for service, he signs the permit under "Equipment Accepted as Ready for Service," after which the system operator directs that the blocking be removed.

Where the permit covers items of equipment in charge of different divisions or sections, it is sometimes necessary for the permit to be signed by more than one person under "Cleared and Blocked By," also under "Equipment Accepted as Ready for Service." An example of this is where a turbo generator is taken out of service, some of the clearing and blocking is done by the electrical crews; other items of clearing and blocking of a mechanical nature, such as locking steam valves, is performed by the mechanical section and the boiler room crew. Where clearing and blocking is done by the electrical division, turbine attendants, and boiler room attendants, the permit is signed by a responsible person in each of the three divisions. When closing out the permit, representatives of the three divisions sign under "Equipment Accepted as Ready for Service."

The equipment clearance permit is used for any work to be done on substation or generating station property, except routine operating and housekeeping duties performed by the operating personnel.

A clearance permit is made out where one man does all work and all the clearing. For instance, in a one-man station, the operator, in order to make minor repairs to a rotary converter or other equipment, makes out a permit even though he must approve the "Equipment Requested," and "Scope of Work," which he fills in himself. He also approves "Scope of Work Correct as Described," fills in all the various other blanks as outlined above, and in closing out the permit signs under "Equipment Ready for Service," and "Equipment Accepted as Ready for Service."

Experience has shown the value of one-man permits. In the early days of the system it was discovered, by reviewing permits, that operators were doing work too hazardous for one man; although the work had been done for years it was not generally known until brought out by the permit review.

Numerous changes have been made in clearing, blocking, and work procedure, because of facts brought out by reviewing clearance permits long after the work was completed. No system is worth much unless it is followed up and enforced, and with this in mind permits are reviewed by the operating superintendent and supervisors and the safety engineer.

In reviewing permits, "Steps Taken to Clear Electrically" are checked against single line diagrams for discrepancies between what the permit indicated was done, and what the single line indicates should have been done.

In a survey of fatal electrical accidents in and about sub-stations, a number of significant factors stood out:

(1) Most cases of electrical contact involve a ladder or something used as such; the man had to leave the ground or floor to get into contact with the high voltage conductor.

(2) The element of misunderstanding was present; the man who was injured got the impression that the equipment was de-energized and safe to work upon.

(3) Many accidents resulted from a desire on the part of some individual to clean high voltage equipment over and above the point where such cleaning was necessary, from the standpoint of good operation.

In view of these factors, in addition to the clearance permit, a rule is enforced on substation work that: "The placing and moving of all portable ladders used in connection with work must be under the personal jurisdiction of the operator in charge." This rule minimizes factor No. 1. The clearance permit, properly executed, minimizes factor No. 2 and factor No. 3. High tension cleaning requires two or more men as a safety factor and the frequency of the cleaning is now based more on good operation than on good-housekeeping.

To keep men from becoming involved in electrical accidents, some second or third line of defense beyond the man's own sense of caution must be provided. In reviewing electrical accidents, it seems that most of them would have been a simple matter to prevent if only someone had been present to say "Stop," if a rope had been strung between the live area and the dead area, if something had been placed in the man's way to cause him to hesitate and make one more check upon himself before proceeding.

Safety Kinks

By C. H. DINSMORE

Director of Safety, Wisconsin Power and Light Company, Madison, Wis.

The "Hold Card" used by the Wisconsin Power and Light Company is not radically different from those of other companies. There is, however, one distinctive feature—a serial number is printed on it. This number plays an important part in the routine of clearing lines for work.

No foreman is permitted to start his men to work on any line until he has been informed of the serial numbers on the cards placed for his protection at every point where switches have been opened to isolate the section of line on which he is at work.

This practice eliminates the chance of going to work on a line that has been assumed to be dead.

The incident that prompted the use of the serial numbers was as follows:

The foreman had asked for line clearance in order to work. The telephone connection was poor and the dispatcher misunderstood, and later gave an order to go ahead. The foreman, believing that the line was dead and "Hold Carded," directed his men to go to work. Fortunately, the first man at the tower sensed the slight discharge from the conductor and about the insulators. He notified the foreman, who called the work off.

Had the number system been in use, the foreman would not have taken the dispatcher's order to go ahead but would have persisted in getting his numbers; and even though the phone service was poor, the dispatcher would have recognized that by the insistent call for a number, a "Hold Card" was being asked for.

These numbers are recorded in the dispatcher's log and the foreman keeps a confidential record in his notebook. When the work has been completed, he releases these cards through the dispatcher by giving the number of each card.

Furthermore, in case the foreman finds it necessary to leave the job before completion and a sub-foreman or other person is in charge, the dispatcher is informed of the change. The foreman transfers the numbers to the relief foreman, who then talks to the dispatcher, acknowledging receipt of and repeating the "Hold Card" numbers, mentioning the location at which each card was placed.

This routine also eliminates the possibility of "Hold Cards" being removed for the wrong persons. Whether under dispatcher's requirements or not, approved red "Hold Cards" properly filled out must be placed at all points where switches, valves, or levers have been operated. This rule sometimes is not easily complied with: for instance, on high voltage lines where disconnects are to be "Hold Carded," the disconnecting switches are generally not within reach, and of course should not be, as they may be energized.

In order that "Hold Cards" might be readily and safely placed under these circumstances, a "Hold Card" stick has been made up and is in regular use where we have conditions that do not permit safe access to the disconnects. This stick is about 9 feet long, but could be made any length necessary. The cards are attached to a wire loop or tied to a cord and thus attached to a large clothes pin such as is used for securing rubber blankets. The pins are 5¼ inches long and the jaws open wide enough to take hold of any disconnecting switch plate securely.

"Safety Kink"

By E. J. HANLON

Safety Supervisor, The Peoples Gas Light & Coke Co., Chicago

My "Safety Kink" concerns the transportation of long lengths of pipe on a compressor truck from the shop yards to the barrow gangs located in the shop districts.

One morning a few years ago, one of our compressor trucks, loaded with equipment and material to be delivered to the barrow gangs came to a stop before a red traffic light. When the light showed green he started to make a right turn. While in the act of making the turn he heard a loud scraping sound and looked down to find that a few lengths of pipe from the left side of his truck had worked forward about one foot. Upon getting out to investigate the cause, he discovered that the pipe had scraped the left side of an automobile that was proceeding in the opposite direction. Fortunately, no one was injured, but the left side of the automobile was practically ruined.

Particular care was taken when loading the pipe. It was placed on the body of the truck lengthwise, with the front end opposite the head lights of the truck and was kept from swaying side-ways by a brace bolted to the frame of the body at this point. The rear end of the pipe extended probably three or four feet beyond the rear end of the truck with the customary red flag. When the truck left the garage the pipe was loaded as described, but the constant starting and stopping of

the truck caused the pipe to shift forward unnoticed by the chauffeur. This accident resulted in a change in the method of transporting pipe.

We found that little danger was to be expected from the pipe sliding backward, and that a sideway motion was impossible. Therefore, it was found that the only apparent danger was at the forward end of the truck, where the pipe had a tendency to slide forward.

In order to overcome the sliding, three steel plates were welded to the brace mentioned previously. As I said before, the brace is near the headlights, and by placing the plates around this brace we were able to prevent the shifting of the pipe.

Our company recently purchased new compressor trucks and the specifications included the "safety kink."

One Safety Kink

By C. B. BOULET

Insurance and Safety Department, Wisconsin Public Service Corporation, Milwaukee, Wis.

This device was developed by some of our men following a fatal accident which resulted when a line which was being strung under energized circuits whipped up into the energized conductors.

Our men conceived the idea that something could be attached to the cross arms over which the wire was to be run, at intervals of perhaps a quarter of a mile. A device of this kind would serve two purposes: one, to ground the wire which was being strung, and two, to make it easier to pull the wire over the cross arms. It would also keep the wire from raising off the cross arm where the line was being strung over rolling ground.

This homemade cross arm device is fairly light, can be easily attached to cross arms, and is, at the same time, substantially built so that it will stand rough usage. I would like to call your attention especially to the following features:

1—While the device can be slipped over the end of a cross arm, it can also be placed between any of the pins by releasing the cotter pin at the bottom of the clamping device.

2—The cover is hinged and is kept in place with a bar and cotter pin. The upper shield, which is part of the cover, is held in place by a spring which throws pressure against the wire which is being strung, thereby giving a good contact.

3—The cover is tied into the base of the device by a tie-wire on the back side.

4—The ground wire is attached to the base and is run either to a driven, or, preferably, a permanent ground on the line.

Automobile Accident Prevention in Utility Fleets

By JOHN M. ORR

General Manager, Equitable Auto Co., Pittsburgh, Pa.

There is no magic carpet upon which we can ride our fleets to accident freedom, but we know from experience that substantial progress can be made by proper approach and treatment.

The usual public utility fleet contains a wide variety of sizes, makes, and types of vehicles. Utility work, particularly that done with trucks, exposes men and vehicles which are incidentally operated. Mileage varies from a few hundred to several thousand miles per year. Drivers are engineers, salesmen, supervisors, linemen, metermen, etc. Their operation of vehicles is subordinate to their principal occupations.

The factors most important to a good accident experience are the selection of adequate vehicles, proper vehicle maintenance, capable, co-operative drivers who realize their responsibilities, and a sincere desire of management for the safe operations.

I shall assume that the fleet maintenance practices are conducive to safety, which

leaves me free to discuss the selection of new vehicles and the development of pride in the driver of a good accident experience.

Vehicle Selection

The power and road speed of new vehicles have been substantially increased in the past few years. But many commercial operators feel that this speed is beyond the commercial need, and that means must be taken to limit top speeds or that moderately performing cars and small trucks should be used. As a result, many fleets are equipped with devices to limit top road speed.

While I am personally in favor of reasonable limits for top road speeds for commercial service, it is necessary for cars to perform so as not to obstruct normal traffic. Our vehicles should have good power, particularly in lower gears, good accelerating and decelerating ability, and moderately high road speeds.

It has long been customary to limit the top engine speed of larger trucks, to insure dependable operation and to preclude excessive maintenance costs. Governors are usually supplied by manufacturers as standard equipment. Top road speeds are lower than for smaller vehicles, although the latter may be less safe if truck chassis are not carefully chosen for the work to be done.

Ratio of power to weight and of chassis weight to gross weight, engine size, frame size, performance abilities with various transmission and rear axle ratios, size, type, and adequacy of brakes, springs, tires and lighting are but some of the factors that must receive consideration for each type of operation.

With increasing road speeds, closer scrutiny of vehicle specifications is necessary when new trucks are purchased.

Proper provision for the driver and crew is a necessary consideration. Closed cabs, safety glass, good ventilation, and windshield wipers are required. Arrangement of controls and levers must be right. Power brakes or brake amplifiers which reduce pedal pressures are now supplied on heavy trucks. The shape and construction of seats and back rests must be adequate. High visibility both front and rear is important. Heaters should be used if needed. Some believe that cigaret lighters should be regular equipment. We may say that this should not be done, but it is done. Fellow employees are admonished not to crowd the driver.

Cabs for the whole crew are one of the latest developments in construction trucks. The men are protected from the weather and the hazards of riding the road.

Safety is engineered into today's truck bodies and equipment. The cleanest design is the best design. Floors are low and roofs are high to facilitate loading and to provide head room. Aisles are wide. The old aversion to wheelhouses in body floors has disappeared. Fixed sides are as low as possible. Stake side sections are small and light weight for easy handling. Heavy tools and materials are carried low on construction trucks to minimize loading and unloading effort.

Floors and running boards are of safety tread steel or aluminum. Ladder irons are rubber covered to safeguard against splinters. Ladders or steps to towers are of self cleaning safety tread material. Heavy towers are power elevated instead of hand elevated, with top and bottom limit switches on tower travel. Tower railings are high and of light weight construction, easily raised or collapsed.

Fronts of express bodies are closed for the greater comfort of men who ride with the load. The wooden drinking water keg is being replaced with wide mouth, easily cleaned, porcelain lined steel casks enclosed in insulating material to provide clean, cool drinking water.

Closed body interiors are painted in light colors to improve visibility and to keep temperatures down. A bakery concern painted its truck roofs black. The icing on cakes melted. A roof was painted aluminum and that inside body temperature was 5 degrees lower after a three hour run.

The Driver

In discussing methods to attract the drivers' interest and cooperation in the improvement of accident experience, I should like to analyze the experience of a public utility fleet operating about six million miles per year with six hundred vehicles.

The miles driven per accident (from a scratched fender to a fatality) have been as follows: 1930, 12,953; 1931, 14,409; 1932, 16,722; 1933, 17,637; 1934, 20,869; 1935 (1st 8 months), 22,549. Accidents per 100,000 miles were 7.72, 6.94, 5.98, 5.67, 4.79, and 4.3 respectively.

The average frequency in 1934 was at the rate of an accident for each 22 months of vehicle operation. This is a long time between accidents.

Accidents should be classified as to type. As an illustration, collisions of a utility's vehicles with a stationary vehicle or object were responsible for the greatest number of accidents in a recent period. In the preceding year the highest number of accidents were in the classification of "struck while parked." Records offer an opportunity to stress the prevention of currently predominating types.

In 1934, 239 or 15.6 per cent of the 1,532 employees licensed operators were involved in 299 accidents. Eighty-four and four-tenths per cent had no accidents. One hundred eighty-eight employees had one accident each, 42 had two each, and 9 had three each. Seventy-two, or 30 per cent were also involved in accidents in 1933, which points to the probability that a part of this group is accident prone.

In 1933, the previous year, 19 per cent of the drivers had all of the accidents, and 81 per cent had no accident. Two hundred twelve drivers had one accident each and 54, or 4 per cent had more than one for a total of 124 accidents or 37 per cent of the total.

The experience in this fleet, which I believe is typical, confirms the conclusion of Dr. Alvhh R. Lauer of Iowa State College, in his extensive testing of operators. He has found evidence of three groups of drivers: the accident free who constitute from 70 to 75 per cent of all operators: the accident liable who constitute 20 to 25 per cent: and the accident prone, a minority who have the majority of accidents. He makes the statement from his experience that if 7 per cent of the drivers were removed from the road the number of accidents would decrease 50 per cent.

Concurrent preventive and corrective measures are necessary. A general preventive activity should be carried on for the assistance of all drivers, and at the same time corrective measures should be directed toward those involved in accidents. The latter group changes from year to year.

Other data may be helpful such as: degree of severity, miles per accident per individual employee, months of operation per vehicle per accident, accidents per hundred vehicles of each type per year, proportions of accidents by days of the week, time of day, and age groups.

The responsibility of this utility's drivers for accidents in 1934 was established as follows:

	No. of Accidents	Per Cent of Total
Wholly responsible	68	22.8%
Contributed to the cause	81	27.1%
Responsible Accidents	149	49.9%
Not at fault	150	50.1%
Total	299	100%

The frequency of responsible accidents, and the proportions that they bear to all fleet accidents, gives an indication of the care exercised by drivers, but the frequency of *all* accidents should be followed as an index of progress in accident prevention.

An operator at the time of an accident is usually in an uncomfortable position until his superiors have indicated whether he was responsible or not. A satisfactory method of establishing responsibility is by the means of accident committees which investigate accidents. Drivers meet with the committee, the facts are studied, and the committee's findings are reported to the department head for such action as he sees fit.

A routine was adopted in 1934 in our companies that is working out well. About two weeks after an accident, a form is sent by the Accident Prevention bureau to the head of the department to which a vehicle was assigned at time of occurrence. This form gives a record of the driver's previous accidents and asks the department head, with the return of the form, to indicate his opinion as to whether our driver was wholly responsible, contributed to the cause, or was not at fault. The driver's record

is charged accordingly. This places the determination of responsibility with the driver's superior and any tendency toward accident proneness is brought to the attention of department heads.

Road and code tests are usually required of employees before they are authorized to operate company owned vehicles. Drivers are tested for vision and hearing every two years. Most full time drivers submit to a complete physical examination annually. All employees are urged to have an annual physical examination by company physicians without expense.

Many plans for the recognition of safe driving are in effect. These include certificates of various kinds, buttons, badges, cards, etc. Bonus systems are used in full-time driving jobs,—but rarely in public utility operations because of the incidental nature of driving.

I should like to describe a simple and effective means of giving recognition that has been employed in our companies for the past six years. With the renewal of an employee's company license each year, Honor Operators' licenses are issued to those who have driven for one or more consecutive calendar years without a responsible accident. The card bears the notation in red, "Honor Operator. No Responsible Accidents, —— years."

Employees are proud of a safe driving record, and of any official recognition. As the number of years builds up greater care is taken to preserve a good record. Increased concern is felt as to responsibility for all accidents.

Here is a tabulation showing the number of employees in our companies who, upon being licensed for 1934, were given 1 to 5 year honor cards. Our use of these cards started in 1929.

No responsible accidents for:

5 years (1929-1933 inc.)	286,	or 18.6%
4 years (1930-1933 inc.)	138,	or 9.0%
3 years (1931-1933 inc.)	185,	or 12.1%
2 years (1932-1933 inc.)	189,	or 12.3%
1 year (1933)	230,	or 15.0%
Not entitled to honor license due to accidents in 1933, or because licensed for first time in 1934	504,	or 33.0%
Total	1532	

General Methods of Approach

None of us can produce the best results without knowing the attitude, policies, and desires of the management. A manual for motor vehicle operators that outlines company policies serves admirably. Such a manual should be helpful and informative rather than consist of do's and don'ts.

One bulletin on a bulletin board displayed for a limited time will produce the best results. If left up until crowded out it is apt not to be read. The attention of employees should be focused on a few ideas at a time. Bulletins, which show company experience are helpful. Safety posters of the National Safety Council, insurance companies and others, or especially prepared ones, keep safe driving alive in the minds of the drivers. Safety messages on vehicle dashboards, are unobtrusively emphasized by daily repetition. Letters to department heads, the circulation of currently interesting general articles or facts, articles in company magazines,—all serve a good purpose.

Conclusions

The fact has been firmly established that motor vehicle defects are responsible for only about 10 per cent of all accidents. This percentage is less in well maintained fleets. The other 85 or 90 per cent of accidents are due to human errors.

If every one drove an automobile with as much care and courtesy as is exercised when walking down the street, accidents would be few. This does not apply to all drivers. It is less applicable to fleets in which safe operation is stressed.

Employee and Public Safety on Streets and Highways

By C J. RUTLAND

Safety Engineer, Texas Power & Light Company, Dallas, Texas

When construction and maintenance work of a utility is to be done on streets and highways it cannot be assumed that the approaching motorist has a "weather eye" out for barricades, machinery and material. He is not anticipating perils. He probably uses the street regularly and drives fast along known routes. This driver cannot stop quickly enough after seeing a small warning sign, advising him that construction work is being carried on just a few feet ahead. A crash occurs! The driver may be charged with recklessness because he did not have his car under control, but in many such cases, the investigation has convinced the company adjuster that adequate barricades were not erected and sufficient signs were not placed far enough down the street to warn the motorist. Highway employees and city street workers know that it is better to let the approaching motorist run into warning signs far down the street than to run into men and equipment where the work is being performed. The responsibility for the safety of workmen at such locations rests on the foreman in charge of this work. He should make a survey of road conditions and traffic flow before the job is undertaken, and then make ample provisions for protection. Likewise, he should acquaint his employees with the laws affecting their work which deal with parking, use of flares and flags, overloads, trailers, lighting requirements and the like.

It does not seem necessary that I discuss rules for employees to follow in driving company equipment, but to be an A-1 driver, the utility employee should drive three vehicles at once: the one he is in, the one he can see, and the one he cannot see!

Over 75 per cent of motor vehicle collisions in which utility employees are involved occur with customers of the company. Thus another issue may be injected into the adjustment of a claim. If the utility employee is responsible for the accident, the claim is seldom settled on its merits. The public relations feature increases the importance of the claim. There are times, too, when the employee driver may not be at fault at all, but still a demand is made by the customer that the company pay all or part of the bill. These instances are quite embarrassing to adjust. The situation may be likened to a regular customer of a department store, who aimlessly bumps into a fixture and demands that the management pay for a torn dress.

If we assume that only 20 per cent of the automobile collisions in which our employees are involved are to be charged to their negligence, what efforts should we make to eliminate the 80 per cent in which our employees are not negligent? Why shouldn't the utilities take a community interest in public safety? For its employee suffers injury and the company must pay for compensation, medical bills and damage to its own equipment. Why shouldn't the utilities take the same interest on behalf of its off-duty employees and their families? Those factors which keep the employee on the job, which keep him from worrying about injured ones at home, and which keep him from spending money as a result of avoidable accidents, have some direct benefit to the employer.

I am firmly convinced that each utility has a definite contribution to make toward helping solve the traffic problem. It should exercise enthusiastic leadership in bringing about constructive measures. In a general way, the utility knows the ways and means of solving the problem. The method does not differ materially from the one industry is now using. It should assist to bring about the enactment of drivers' license laws, motor vehicle inspection ordinances, model traffic codes and better traffic engineering and traffic law enforcement. It should urge the establishment and operation of traffic commissions as a part of city governments and contribute to educational programs.

The utilities have a direct and selfish interest in the solution of the traffic problem. We also have a humane and social interest in our communities. The situation is a challenge to us.

THURSDAY MORNING SESSION

October 17, 1935

A Resumé of the Immediate Treatment of Extensive and Superficial Burns

By J. J. WITTMER

Medical Director, Consolidated Gas Co. of New York, New York City

The treatment of burns can be conveniently divided into two parts; treatment of the local lesion and treatment for the prevention of systemic reaction.

Shock.

Treatment must be instituted in the early stages of burns, *i. e.*, before the end of eight hours, before toxic absorption has yet occurred, when the gravity of the patient's condition is largely dependent upon the degree of shock. The condition of shock occurs especially in those burns of a more severe nature, and unless the condition is recognized and accorded successful preliminary treatment, the patient's chances of recovery may at least be jeopardized, and in extreme cases the oversight may actually prove fatal.

There is real danger that the general condition of the patient will quite escape the attention of the medical attendant in his zeal to do something locally; particularly so, if he possesses the information that the local wound is the source of toxemia and is attracted to this area by the silent or expressed entreaties of both the patient and his friends. No undue anxiety need be felt, however, in the usual case of thermal burns, to hasten in the matter of local treatment, since a number of hours of grace are allowed by nature before the beginning of the onset of the other main factor in mortality, "toxemia."

Treatment directed toward the relief of local conditions is contraindicated in the presence of shock. The truth of this is too rarely appreciated, and it is a common sight in some hospitals to observe the medical attendant laboring with the removal of clothing, and cutting away blebs, and washing away contaminating debris, while the patient's systolic blood pressure is less than 70, 60 or even 50 m.m. of mercury, and the exposure incident to the manipulation is constantly aiding in the further dissipation of heat from a body which already manifests a subnormal temperature. Therefore, the shock of hasty and unwise local treatment added to the shock already present as the result of the original burn, will undoubtedly precipitate a needless death.

The treatment of burn shock differs in no essential particulars from the treatment of shock otherwise induced, essential features being the administration of large doses of morphine, the maintenance of body warmth by the application of external heat in a light tent or by hot water bottles and internal heat in the form of warm drinks or intravenous infusion, the lowering of the head to combat cerebral anemia, and the assurance of quiet and rest under the watchful eye of a competent attendant. During this period, local treatment may be completely disregarded except for the prevention, as far as is feasible, of adventitious local contamination. For this purpose the wounds may be simply covered with a sterile sheet or towels. It is again emphasized that toxic absorption does not occur for several hours, a period of time ample both for the treatment of the shock and for the institution of suitable additional treament after the period of shock has passed.

Two important exceptions must be mentioned:

(1) In those cases in which the patient's clothing has caught fire the utmost care must be exercised immediately to make sure that no smoldering material has been overlooked in the excitement of transporting the patient to the medical advisor.

(2) In attending cases of chemical burns one peculiarity of the traumatizing agent must be remembered; a prolongation of action is maintained until neutralization of the active agent is accomplished, either by natural or artificial means. Patients burned by chemicals should be quickly treated locally to assure complete neutralization of the chemical reagent before anything else is done. The neutralizing property of alcohol in connection with phenol burns can be invoked immediately. In most other cases copious gentle washings with water is indicated, after which application of a neutralizing agent may be employed, weak acids for strong bases and vice versa.

In addition to the shock caused by an extensive burn, a condition of anhydremia also results. If a burn involves one-sixth of the surface area of the skin the loss of fluid in twenty-four hours may equal 70 per cent of the total blood volume. Rubner has shown that in starvation an animal can live after loss of nearly all its glycogen and fat, one-half of its protein and nearly one-half of its body weight, but that it dies from loss of one-fifth of its water. The fatal influence therefore, of the great loss of fluids in burns is apparent. With such depletion the blood becomes concentrated, the circulation slowed and the blood loses oxygen. Partial asphyxiation results, metabolic processes become altered, the heat regulating mechanism becomes impaired, the temperature falls, and vital activities are suspended.

Here again I must emphasize the fact that the burn itself is relatively unimportant at first. Therefore, attention to the systemic effects of the injury should embrace, besides the usual measures against pain and fall in temperature, immediate intravenous administration of 1,000 cc. of normal saline solution at a rate not greater than 25cc. a minute, and thereafter fluid, particularly normal saline solution, should be introduced by every available channel in the amount of from 4 to 8 liters in each twenty-four hours, until the capillaries have lost their abnormal permeability, fluids are retained, and the concentration of hemoglobin and of chlorides in the blood approach normal. Usually the critical period has passed in from twenty-four to forty-eight hours.

Local Therapy.

1. Debridement. Granted that chemical agents have been successfully neutralized and shock has been found absent or has been successfully combated, the attention is now focused on the local lesion. The first act is complete debridement in an effort to convert a contaminated wound into a clean one. If the contamination is superficial and does not involve a large area, the application of a paste of sodium bicarbonate made with cold water will frequently cleanse the area in addition to relieving the pain. This treatment is always applicable to a first degree burn where debridement is not necessary.

The contamination may be such, however, as to make necessary the administration of a general anesthetic, following which the burned area is either thoroughly scrubbed with a sterile scrubbing brush and sterile water or saline solution until the area is completely clean, or resort is made to instrumental removal of contaminated tissue. This form of treatment is generally applied where there is charring of the tissue or in other deep burns of limited extent.

Blebs are punctured and cut away with scissors and the entire area finally thoroughly cleansed with some non-irritating fluid like normal saline solution. After the area has been thoroughly debrided and all vesicles removed, we prepare for the next step.

Fixation Method with Tannic Acid.

The use of tannic acid was introduced by E. C. Davidson in 1925. The latest modification of Davidson's treatment is to spray the denuded area with a freshly prepared solution of five per cent tannic acid, until a coagulum of fair thickness has been established. Loose dressings are then applied and kept saturated with the tannic acid solution for twenty-four hours, or until the burned area is tanned a mahogany brown. When the burned area is sufficiently tanned all dressings are removed and the patient is placed in a tent to avoid pressure of the bed clothes.

In cold weather the inside of the tent is warmed by means of electric lamps. Sterile pads or sheets are always kept beneath the burned areas that rest on the bed.

Infection can and often does occur beneath the tanned area, but the careful cleaning of the burned area prior to the application of the tannic acid will tend to reduce the incidents of infection. Infection in these instances are treated either by

an incision through the membrance or, when there is more extensive areas involved, by excision of the entire membrane.

If the burn is superficial, epithelization, *i. e.,* formation of new skin, will proceed under the dried coagulum; and if the burn is deeper the tannic acid crust that separated, between the fourteenth and twentieth day will leave a clean granulating surface, which in time will result in epithelization.

Davidson bases his treatment on the theory that the toxin present in the red cells is due to the absorption of the products of protein autolysis at the site of the burn. *In order to limit this absorption he produces a coagulum of the devitalized only by* the application of tannic acid. The dry crust thus produced prevents the loss of tissue fluids which leads to a lowering of the sodium chloride of the blood.

In addition, the tannic acid applications produce a definite analgesia and does not affect the normal skin. Sepsis is avoided by the dry coagulum which forms an unfavorable medium for bacterial growth.

Up to this time we have dealt only with the tannic acid treatment of second and third degree burns. Some authors have employed a two per cent solution of the gentian violet, spraying it on in the same manner in which the tannic acid is applied. This solution also forms a membrane over the burned surfaces, much like tannic acid, and it is claimed that the instance of infection is lowered due to the antiseptic action of the gentian violet. Other writers have employed a mixture of tannic acid and gentian violet.

Ointments containing any form of medication are contra-indicated in the treatment of large second or third degree burned surfaces. They tend to cause maceration about the skin margins and prevent the formation of epithelium. When the wound has become cleansed it is far better to leave it exposed to the air without any covering, applying a liberal coating of sterate of zinc, which, being a mild astringent, has the property of drying up any of the areas where epithelization has begun.

When the burned areas involve the region of the joints it is well to apply traction during the process of healing. More important however, is skin grafting in the regions of the joints, employing either Thiersch, Pinch, or Reverdin grafts.

Treatment of Electric Burns.

Electric burns differ from all other types. The degree of heat is far more intense and the general aspect is radically different from the pathological picture of any other type. The intense heat observed in the electric contact burns, is not found in the so-called flash burns.

A flash burn is produced when an electric arc is formed close to the body but the current does not go through the part. The severity of the burn depends upon the proximity of the tissues to the arc and the length of time that the arc is maintained. *These superficial burns do not differ in any material way from the ordinary burn or* scald.

By contrast, in the case of an electric contact burn, the surface of the body forms one of the poles of the electric arc. The electric current passes through the body and the degree of heat attained at the point of the surface of the body when the contact is made, is the temperature of an electric arc. If a burn is produced, no matter how small, an electric arc must have been formed. If the contact is so perfect that sufficient resistance is not introduced to develop an electric arc, the body simply sustains an electric shock which might produce anything from a slight tingle to instant death.

The temperature of an electric arc varies from 5,500 to 7,000 degrees, whereas the temperature of the acetylene torch is 4,500 degrees. This intense heat presents a characteristic picture.

Examination of a victim of an electric contact burn may simply present a single small innocent appearing blister, but if the superficial blister is carefully cut away there is noted a central area of white necrosis surrounded by a narrow ring of hyperaemia or edema. The size of the central area of necrosis is naturally dependent upon the size of the contacting electrode. The area involved is usually pyramidal with the top of the pyramid at the surface of the skin.

As a rule, in from thirty-six to forty-eight hours an electric burn looses its dry, crisp, circumscribed appearance and becomes a serum saturated area with disintegrating walls and floor, progressing to profuse purulent secretion, large sloughs

bathed in pus, exurberant granulations uncontrollable to the most radical antiseptics. This disorganization may include muscle, tendon, joint capsule, even bone itself.

After a varying period of the treatment mentioned before, apparently unduly tedious and prolonged, firm granulation ultimately ensues and the final result will be the same as that ordinarily secured in other comparable burns. The period of disability will be greatly shortened and the certain extensive scar formation will be decreased by the application of the surgical principle of complete resection of the burn area before the stage of serum formation begins.

The application of the principle of complete resection and immediate closure by suture or skin graft to third degree electrical burns, produces uniformly satisfactory results. The method has its limitations: the line of demarcation may not be sufficiently clear in tendons, cartilage or bone to warrant immediate resection of the eschar. Essential structures, such as large vessels, nerves and joints, should certainly be spared, if there is any doubt in the operator's mind as to their possible viability. Welles states however, that experience has taught that the great majority of electric burn cases are far more successfully handled by complete resection and *immediate* closure by suturing and skin grafts, than by any other method.

First Aid.

I have purposely detailed and emphasized the physician's treatment of burns because in this manner the immediate treatment by the first aider should be logical and apparent. The procedure initiated by him should be such that it not only takes care of the immediate emergency but can be maintained and continued by the doctor.

The first step, of course, should be the removal or neutralization of the causative agent.

The second step is the application of a material that will exclude the wound from the oxygen, thus putting out the fire in the tissue, and abort the exudation of fluid. If tannic acid is going to be used by the surgeon, this then can be applied by the first aider. A ready five per cent solution of tannic acid can be available by having a quart jar of sterile water and 1.6 ounces tannic acid crystals each in separate containers. Adding the crystals to the water just previous to application establishes a fresh solution. I personally prefer to have a second top which has been perforated, for the jar, which is screwed on after the crystals are added to the water. The inversion and shaking of the jar forms a sprinkler. The burned parts including those areas which have parts of clothing adhered to them are thoroughly saturated even unto all bends and crevices. The part may then be covered with a sterile dressing and this dressing soaked with the solution. In the case of small burns and those in proximity to the eyes, an ointment containing five per cent of tannic acid may be applied.

Third, if the patient is conscious, insist that he drink two glasses of water immediately and another glass each half hour until he comes under the doctor's care.

Fourth, get the patient to the hospital as soon as possible so that further fluid intake measures may be instituted and shock combatted.

Many lives can be saved, prolonged invalidism can be shortened and deformities averted if burns are treated on a well planned procedure. This effort must be initiated by the first aider and carried on through the doctor, both having the same basic thought in mind—"That what I do now, immediately after the accident has occurred, and what I do throughout the entire course of the case, have *all been with* the constructive idea of saving the building from toppling, of shoring up the parts so that they can stand repair, then repairing the parts in such a manner that the splices and flows are the least evident, and the integral sections will work in harmony, and function in the same way as before the catastrophe occurred."

Public Utilities Section Safety Contest

One hundred thirty-one units competed in the Public Utilities Contest this year, 135,168 employees working a total of 281,365,620 man-hours. The average frequency was 7.510, a slight increase over the rate of 7.472 for last year. Seventy-eight

of the units had a rate below this average and fifteen had perfect records. In this contest eighteen plaques were awarded and seven certificates.

The plaques were presented to Contest winners by C. H. Dinsmore, director of safety, Wisconsin Power and Light Co., Madison, Wis., and Statistics and Contest Committee Chairman, Public Utilities Section, National Safety Council, as follows:

Combination Gas and Electric Division, Group A—Central Illinois Light Co., Peoria, Ill., 1,978,291 hours, 3 injuries.

Combination Gas and Electric Division, Group B—Three tied for first place—Panhandle Power & Light Co., Borger, Texas, 334,491 hours, no injuries; Eastern Oregon Light & Power Co., Baker, Oregon, 162,866 hours, no injuries; Moncton Electricity & Gas Co. Ltd., Moncton, N. B., Canada, 107,968 hours, no injuries.

Electric Division, Group A—Duquesne Light Co., Pittsburgh, Pa., 5,612,804 hours, 18 injuries.

Electric Division, Group B—Ten tied for first place—Savannah Electric and Power Co., Savannah, Ga., 447,900 hours, no injuries; Fall River Electric Light Co., Fall River, Mass, 419,456 hours, no injuries; Erie County Electric Co., Erie, Pa., 351,134 hours, no injuries; Maine Public Service Co., Presque Isle, Maine, 172,324 hours, no injuries; Worcester Suburban Electric Co., Uxbridge, Mass., 161,220 hours, no injuries; Gloucester Electric Co., Gloucester, Mass., 159,140 hours, no injuries; Newport Electric Corporation, Newport, R. I., 148,344 hours, no injuries; Citizens Power & Light Co., Council Bluffs, Iowa, 126,075 hours, no injuries; Canada Electric Co., Ltd., Amherst, Nova Scotia, Canada, 116,025 hours, no injuries; Kaministiquia Power Co., Ft. William, Ont., Canada, 81,324 hours, no injuries.

Gas Division, Group A—The Laclede Gas Light Co., St. Louis, Mo., 2,274,476 hours, 3 injuries.

Gas Division, Group B—Two tied for first place—Reserve Gas Company, Pittsburgh, Pa., 313,464 hours, no injuries; Peoples Gas Company, Port Arthur, Texas, 146,979 hours, no injuries.

What the Utility Executive Expects of the Safety Director

By N. M. ARGABRITE

Vice President, American Gas and Electric Company, 30 Church Street, New York, N. Y.

The safety movement is, to the most of us, a comparatively recent thing. In the earlier days of the electric industry we paid little attention to accidents. An accident was something that just happened. Those were the days of small power houses, each manned by an engineer, a fireman, and an oiler. We had three or four electricians and linemen who did all sorts of work from unloading coal to stringing wire and wiring houses.

As I look back I can recall accidents in sufficient numbers to convince me that our accident rates must have been terrifically high. On one property that I recall we had 22 employees and on our present property we have 2,200 employees, or one hundred times the number.

During 1934, there were two deaths on the present property or one for each 1,000 employees. If we applied that rate to the property with 22 men, we would have had only one fatality in fifty years. We know that the record of the small properties was much worse than that. My guess is that our accident rate in those days was terrific.

We became accident conscious as our properties grew, for as the executive began to look through a magnifying glass, so to speak, he saw the original picture magnified one hundred times.

Accidents are viewed by the executive from more than one standpoint. First and foremost, there is the humanitarian standpoint. He feels that he has no right to run a business that kills a number of men each year and leaves a trail of widows and orphans. He has no right, but also has no stomach for it. He is human. His heart aches for a faithful assistant and for the family that has been deprived of its bread-winner.

Then there is the standpoint of public opinion. People do not look kindly upon a company that is continually creating cripples and causing deaths. The local press cannot afford to let such things so unnoticed.

Then there is the financial standpoint. Liability insurance, both employee and public, is no small item. And there is the loss of trained men.

The executive, as his property grows, concludes that accidents must be stopped. He must place in his organization a man who can give his entire time to safety. Once he has come to this conclusion he has only started. Hiring a man sounds like an every day affair, but hiring the right man as safety director is a job of major importance.

What kind of a man do you want to guide and educate your organization? He must get the interest and command the confidence and respect of the organization.

First qualification the man must be mature. Seasoned linemen and power plant men will not pay as much attention to a youngster as to a mature man. I do not believe that you can get very far by taking a man without practical experience in your industry. I can hear a hard-boiled lineman remark: "What does that kid know about it; he never climbed a pole"; or, "What does that old duffer know about our business, he never was in it."

If I were selecting a man to head a safety organization I should look for a superintendent of broad experience and a two-fisted, red-blooded man. I should want him to be friendly and unafraid.

This man would be the representative of the executive head of the organization. He would speak with authority. He would be a teacher to the entire organization from the executive himself down to the laborer. And he must be courteous and give no offense. A big job to find such a man? Yet these are the qualifications for a successful safety man.

I should not expect this man to take the responsibility for the detailed task of accident prevention. I should expect him to train the organization in such a way that the "non-commissioned" officers would feel that the safety of the men working under them was in their keeping; and I should expect him to pass on the credit for all that is accomplished to those "non-commissioned" officers, and the men under them. I should expect the safety man to learn the best methods of first aid and resuscitation. I should expect him to pass on this knowledge group by group down through the non-commissioned" officers o fthe organization to the men. I should expect him to formulate, with the assistance of the engineering department, such rules as are needed and to each the "non-commissioned" officers how to study the root and the source of accidents.

I should expect the safety man to pick lieutenants for permanent or part time duty. He should study the organization and slowly take the square pegs out of the round holes and fit them in where they belong. He should do this in such a way that the suggestion seems to come from the foreman.

There are men climbing poles who have no business to because of some defect of which they, themselves, may not even be aware. There are men in boiler rooms who have no business in boiler rooms. There are many men driving cars and trucks who are not qualified. These men must be relocated.

We talk a great deal about teaching men, foremen and superintendents to guard against accidents, and yet we leave accident traps lying around our system. I believe that on a large property a safety director should have a full-time lieutenant whose job is the constant inspecting of the property looking for danger spots and accident traps, such as a place in a fence where a child can crawl through and come in contact with dangerous equipment.

When we go before a public service commission or a court to establish the value of our property for rate-making purposes pricing everything that we can lay our hands on, we say: "Your Honor, that is not all. In addition to these values we claim a GOING CONCERN value." Then we outline what we mean by this, and one of the principal things we mention (and it has been recognized by the Supreme Court) is that we have a trained, coordinated and efficient organization built up over a long period. We may claim that this one item has a value of a million dollars, and yet we may be going along letting this organization be shot to pieces by accidents. Sometimes we hesitate to hire a safety men who is big enough to do a real safety job because we don't want to pay the price for a mature, capable man.

What Does the Safety Man Expect of Management and How Does He Get It?

By J. L. VANDEGRIFT

Assistant Vice-President, The Chesapeake and Potomac Telephone Companies

The safety man may expect many things of his management. He may expect a large, well-equipped office, with push-buttons to summon messengers, clerks and secretary. He may expect a fat salary; experienced assistants to relieve him of arduous details; he may expect the dignity of an executive job and other luxurious appointments. But how a safety man is to get these things I cannot tell you, for I have tried to waggle them out of my management for years without success.

What is vastly more important is to determine how a safety man may obtain the moral support of the management in initiating an effective policy and in installing suitable practices with respect to the safety of the personnel.

Safety, to my mind, has to do with the very fundamentals of production and all of its operations. Accidents are a form of industrial waste, just like a product defective in quality, and therefore are indications of wrong methods, wrong engineering, faulty supervision or general inefficiency.

There are three principal factors to be considered and directed in guiding the accident prevention activities in any industry—the management, the men, and the machines.

By the management is meant all those who have any supervisory or management responsibilities. By the men is meant the general forces, the people who actually do the craft work. By the machines is meant the appliances and material with which the work is done. Production losses, such as accidents, arise from the failure of any one or from a combination of these factors.

It is necessary that the machines and appliances be built and operated according to approved standards which include necessary safety factors. In a public utility, for instance, it is essential that pole lines be built in accordance with recognized standards, and that they be maintained in a safe condition for the men who work on them. With respect to tools, these shall be constructed according to approved standards and maintained in satisfactory workable condition. The materials shall conform definitely to quality specifications. Perhaps there are fewer accidents that happen through the inherent fault of the machine or materials than is generally appreciated.

We must have certain standards for our workers in industry if we are to have the work efficiently performed, and, of course, it cannot be efficiently performed if there are accidents. The workers should be selected with regard to their physical and mental fitness for the job and with due regard to the potentialities of the individual for progress in the organization. After his selection, the employee should be trained in the work that he will be required to do, and adequately supervised. He should have inculcated in him the proper attitude towards the job with respect to its correct performance. While these factors affect the man, it is easily evident that they are in fact responsibilities not of the man but of the management.

We may all agree that a few of the classifications of accident causes which apply to the individual are recklessness, carelessness and ignorance. I have never seen a reckless person in the telephone business. I have heard the term careless applied to many accident causes during the last fifteen years and I have seen many accident reports which indicate ignorance of the employee, but I submit that the so-called ignorance and careless factors are management responsibilities. They indicate lack of training, or of overseeing, or of selection standards, or possibly of discipline, all of which are faults of supervision. The accident-prone employee is also a sad commentary on effective supervision.

If it is management's attitude that accidents are bound to happen, then certainly accidents will happen. If on the other hand their philosophy is that accidents are indications of inefficiency, that they interfere with production, that they cost money, that they are a waste which can be controlled and that they are a bad personnel influence, that is to say, that if the management views its accident as an indication of *management* inefficiency, then we have a correct and reasonable preamble to the safety movement. This attitude is one which the so-called safety man has a right to expect of his management.

Let us view some of the factors involved in safety activity, and please remember that these several factors are common to both safety and effective production. Their application to safety is merely incidental to efficient operation.

These factors are: Selection, which includes assignment of men; Training; and Supervision of Operations.

I. Selection

1. *Selection of Employees.* As indicated previously, it is necessary that great care be exercised in the selection of the men who are to do the work of an organization, because these are the people with whom supervision has to deal. Besides the mental and physical qualifications determined by the nature of the work to be done, it seems to me that there is to be considered another quality which is quite important not only from an accident prevention standpoint, but also from an all around performance standpoint. It may be called the *moral* quality and it includes consideration of the individual's conduct on the job, his ability to fit in with the other members of the group, his reaction to discipline and his obedience to instructions.

2. *New Men.* The reception and treatment of a new man on the job very often determines his future with the company. He should be impressed with the importance of efficient performance, including safe workmanship. He should be carefully directed and observed especially during the early period of his employment. Before assignment to any task, his foreman should see that he is thoroughly trained in the correct method of performing the task; after which he should be guided until he becomes proficient. It is important that the new employee form correct habits of work under the immediate direction of his foreman or of an assigned experienced employee.

3. *Assigning Men.* Consideration shall be given by the foreman to the employee's particular fitness for the work to which he is assigned. A difficult job calls for an experienced man. A job on which there is greater than ordinary possibility of accident should be assigned to an experienced, dependable man. Several important items are to be considered before assigning men to difficult jobs. These include physical, as well as mental, and particular ability.

II. Training

1. *Training of Men.* Probably the most important responsibility of a foreman or supervisor is that of training. Workmen should be trained in the approved methods of performing the work and should be directed in order to see that these methods and no others are used.

2. *The Supervisor's Knowledge of the Job.* The supervisor or foreman being the director and trainer of men, it is necessary that he be more familiar than anyone with the job requirements. He must know the correct work methods otherwise how can he teach them. He must be taught how to supervise and how to teach.

III. Supervision

1. *Planning the Work.* Supervisors should appreciate the necessity for planning each job so as to insure its safe and efficient accomplishment. The job should be surveyed to ascertain the conditions to be met and to determine the methods to be used. If there are dangers involved, plans should be immediately and definitely made.

2. *Definite Instructions.* In situations involving more than ordinary accident possibilities, definite and exact instructions should be given regarding things to be done and methods to be used. Statements should be concise and understandable.

3. *Personal Supervision at Danger Points.* In crew operations, if the preliminary survey discloses greater than ordinary accident possibilities, the work should be planned so that the foreman will be present to direct it.

4. *Discipline.* This means training men to act in accordance with established rules. The supervisor is concerned with having his men conform to the rules of the company. The foreman is the company as far as his employees are concerned. He should speak with authority and insist that his instructions be fully and completely carried out.

5. *Inspection of Work.* Good work welcomes critical inspection. Frequent inspection of work in progress and of completed work is necessary to insure that standards are being met.

6. *Set Good Example.* The foreman who takes chances, who violates safety rules himself, or who overlooks infractions by his men, stands a poor chance of obtaining the cooperation of his workers in safety. If he is sincere in his safety endeavors and strictly follows and enforces the rules, he earns the respect of his men. A good example is necessary to obtain discipline.

The title asks the question "What does the safety man expect of management?" My answer is that he expects the management to take unto itself the responsibility for the safe performance of the work. That it does not blame men and machines for accidents to men or for production failures. He expects management to have a reasonable and sound philosophy concerning the safety of their personnel and to treat the safety work, not as a thing apart, but as part and parcel of sound operations. He expects the management to have a plan for the training of foremen and men; and to permit him, the safety man, to direct the methods and practices to be used in production; and to direct the supervision of work in order that failures will be kept at a minimum.

How does he get these things? He gets them by going after them. First, by setting himself straight as to the real relation of safety to operations—that accidents are operating failures, then by selling his management on these principles. This, it seems to me, can be advanced by the analysis of accidents that have happened, tracing their causes to management failure. Then he must inculcate in every management person an appreciation of this viewpoint that "the successful promotion of accident prevention work is largely a matter of executive interest, and unless management takes the lead and unless the employees generally recognize that management is leading, no plan of safety can hope to function."

If the safety man does his job well he may get his reward from the management or he may get it in heaven. If he fails, he can expect to catch hell in large, unadulterated doses.

ADJOURNMENT

Quarry Section

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Poster Committee Chairman—H. F. YOTTER, The General Crushed Stone Co., Easton, Pa.
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General Chairman—ALEXANDER FOSTER, JR., Warner Co., Philadelphia, Pa.
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NORMAN G. HOUGH, The National Lime Assn., Washington, D. C.
A. L. WORTHEN, The Connecticut Quarries Co., New Haven, Conn.

THURSDAY MORNING SESSION

October 17, 1935

The sessions were called to order by General Chairman William H. Baker, of J. E. Baker Company, York, Pa., who presided. A previous session held jointly with the Cement Section had been attended by the delegates on Wednesday morning, and the minutes of that session will be found in this volume under the heading "Cement Section." Chairman Baker traced the progress of the section, particularly praising the activities of the standing committees.

Dust Hazards in the Quarry Industry

By J. WM. FEHNEL

Chemist, Industrial Hygiene Laboratory Metropolitan Life Insurance Co., New York

Quarrying is a special type of mining, the methods of working are the same in some instances. While hazards in quarrying and mining have been recognized and standards of operation adopted for their elimination, the health hazards have not received great notice. This is probably due to their slow progress in producing disability or death.

The oldest published data on the harmfulness of exposure to dust deals with the mining industry. Some of the records date back before Christ, and as early as 1556 Agricola[1], according to Mavrogordato[2], in his De Re Metallica, described the perilous occupation of miners due to inhalation of dust and pointed out that permanent injury to the lungs resulted from exposure to certain kinds of dust, but not to all kinds.

In 1780 Ackerman[3], quoted by Koelsch, described miners phthisis as the most "frequent and specific" mine workers' disease and said that physicians did not agree regarding the true definition of it.

The first investigation of health hazards in the mining industry in the United States was made in 1914-15 by the United States Bureau of Mines in cooperation with the U. S. Public Health Service in the Joplin, Mo. mining district. Of 93 men examined, 64 showed definite evidence of pulmonary disease, 3 were suffering from non-pulmonary disease, and 26 were seemingly well. A further examination of 720 miners made from May 15 to December 31, 1915 showed that 45.7 per cent had silicosis and tuberculosis and 5.3 per cent had tuberculosis. A report in 1917[5] on this study by Lanza and Childs contained the first detailed X-ray studies of silicosis made in the United States. The operations in this district are principally in shallow mines.

A recent study by the United States Public Health Service[6] of the exposure to dust in coal mining showed that 2 per cent of anthracite miners and their helpers, with less than five years exposure, showed signs of pneumoniconiosis and that the rate increased to 16 per cent among those with more than fifteen years exposure. These are records for persons under 45 years of age.

Kibbey[7] reported in 1931 that practically all miners working in the bituminous coal mines of his company in Alabama had anthracosis demonstrated by X-ray and there was a high mortality rate from tuberculosis among them. Kibbey does not associate the tuberculosis to inhaled coal dust but rather to a retarded calcium metabolism due to deprivation of sunlight.

The Industrial Health section of the Metropolitan Life Insurance Company, in cooperation with the Department of Industrial Hygiene of the College of Physicians and Surgeons of Columbia University and the New York Tuberculosis and Health Association, undertook during 1928 a study[8] of the rock dusts to which are exposed rock drillers and other hard rock workers engaged in excavation and subway construction in the Borough of Manhattan, New York City. Forty-two per cent showed early silicosis and 15 per cent well developed silicosis in the examination of 208 drillers, blasters and excavators. Evidence of tuberculosis, both active and inactive, was found in 9 per cent of the total examined. The great majority of these workers had previously worked in other mining operations, both coal and metal.

Atmospheric dust samples were taken at eight locations, six of which were building foundation excavations and two in subway construction work. The building foundation work is comparable with quarry operations as far as general methods are concerned, but the area is more confined, so that the dust concentrations may be higher.

The dust counts on dry jackhamer drilling varied from 53 million to 17.5 billion particles, less than 10 microns in greatest diameter, per cubic foot of air, and the free silica of the rock ran from 0 per cent to 84 per cent. In many instances, workmen engaged at other operations than drilling were exposed to high dust concentrations, as general air samples taken show from 16 to 200 million dust particles per cubic foot of air.

In subway tunnel work general air conditions ranged from 2 to 37 million, mucking from 4 to 270 million and water Leyners drilling at headings from 136 million to 2 billion. The tests on wet drilling were made at two different locations and were taken while 5 wet drills were operating.

So far we have only mentioned dust concentrations and free silica, so it is interesting to note the comparison of particle sizes found with dry and wet drilling. In the one tunnel there was little seepage of water, so that the workings were dry and the particles of dust generated by wet drilling showed 96 per cent less than 10 microns in size, 75 per cent less than 5 microns and 50 per cent less than 3 microns.

In the other tunnel there was an excess seepage, necessitating the wearing of boots and the constant operation of pumps. Here the dust generated at the heading by the same number of wet drills showed 99 per cent less than 10 microns, 98 per cent less than 5 microns and 50 per cent less and 1.7 microns. In comparison, the particle sizes found in the dust generated by dry drilling with a jackhamer showed 95 per cent less than 10 microns, 65 per cent less than 5 microns and 50 per cent less than 4 microns.

Later tests substantiated the conclusions that wet drilling did not allay the extremely fine dust but did substantially lower the total count. In a test conducted in October, 1931 in a tunnel in the Bronx, New York City, seven CPS type axial water feed drifters were mounted on two benches at the heading with five on the upper and two on the lower bench. A water pressure of 75 pounds was maintained and the drilling rate was 100 feet per drill in five hours. The dust concentration averaged 47.5 million particles per cubic foot over a 30-minute period of sampling.

In a study of underground iron ore mining comparisons were made of wet and dry methods of drilling and it was found that the reduction of dust was ten to one. While this appears to be a long step toward the solution of the dust problem in drilling, nevertheless when we consider that concentration as high as 5 and 6 billion particles were found, reduction to one-tenth of this concentration by wet drilling is not sufficient, especially when a considerable amount of free silica is present.

The Ministry of Health of the Welsh Board of Health published a report[9] on an Investigation Into the Alleged High Mortality Rate from Tuberculosis of the Respiratory System among Slate Quarrymen and Slate Workers in the Gwyrfar Rural District, in which a thorough investigation of working conditions in the quarries and cutting sheds was made and living conditions noted. Physical and X-ray examinations were made and the incidence of tuberculosis and mortality statistics compared for various types of occupations. Unfortunately, no determinations of dust concentrations of the atmospheres to which the workmen were exposed was made, nor were determinations of the chemical or petrographical composition of these dusts made. It was noted that the mortality curve for tuberculosis reached its maximum at a late age and it was concluded that:

1. The workers in the slate sheds are exposed to an injurious dust.
2. The dust concentrations are not very great and the workers and quarry managers, together with the local medical men, do not consider the inhalation of the slate dust to be injurious.

[1] Agricola, Georgius. De Re Metallica: Book I. Trans. from first Latin ed. of 1556 by Herbert Clark Hoover and Lou Henry Hoover, 1912, p. 6.

[2] Mavrogordato, M., The Etiology of Silicosis. Rept. 4th Meeting of Permanent Internat Commission for the Study of Occupational Diseases, Lyon, April 3-6, 1929, pp. 1-22.

[3] Koelsch, Franz. Theophrastus von Hohenheim, called Paracelsus. Of the Miners' Consumption and Other Miners' Diseases. Deut. Gesell. Gewerbehyg., N. F. 12. 1925, 69 pp.

[5] Lanza, A. J., and Higgins, Edwin, Pulmonary Disease Among Miners of the Joplin District, Mo. and Its Relation to Rock Dust in the Mines, Technical Paper 105, Bureau of Mines, 1915.

[6] Lanza, A. J. and Childs, Samuel B. Miners' Consumption: A Study of the Disease Among Zinc Miners in Southwestern Missouri, U. S. Public Health Bulletin 285, 1917.

[6] U. S. Public Health Service, Treasury Dept., Public Health Bulletin 2208, The Health of Workers in the Dusty Trades, III. Exposure to Dust in Coal Mining, 1933, pp. 7-19.

[7] Kibbey, C. H., Relative Pneumonia Fatality Among Surface Workers and Miners, American Journal of Public Health, Vol. 22, No. 4, 1932, pp. 360-366.

[8] Smith, Adelaide Ross, and Fehnel, J. Wm., Silicosis Among Rock Drillers, Blasters, and Excavators in New York City, Journal of Industrial Hygiene, Vol. XI, No. 2, Feb. 1929.

[9] H. M. Stationery Office, London, 1927, Ministry of Health, Welsh Board of Health, Reports on Public Health and Medical Subjects No. 38.

3. The living conditions are not responsible for the high death rate from tuberculosis in this district.

A report by Rogers [10] in the New England Journal of Medicine in August, 1932 indicates that slate dust may contain a higher percentage of free silica than granite, but the tuberculosis rate is not as high in the slate as in the granite district of Vermont.

While we have made many comparative studies of mining operations, in underground work and also some comparisons with open cut or typically quarrying operations, we have found that general ventilation plays a very important part in the control of the dust concentration.

For instance, we found that dust concentrations as high as 6 billion particles per cubic foot were commonly encountered in drilling underground and we encountered in comparison the following dust conditions in quarry work:

Type of Rock	Quarry Operations	Dust Concentrations
Limestone	Drilling Jackhamer	29.5 million particles, less than 10 microns, per cu. foot.
Cement rock	" (wagon type drill)	25.4 " "
Asbestos	"	(28.8
"	"	(33.6
"	"	(54.2
"	" " " "	96.4

Mucking operations in general show low dust concentrations, approximating the general air dustiness of the locality. Conditions are, of course, modified by air currents so that while the shoveling operations may not produce a heavy dust concentration, drilling operations close by may set up dust that grossly pollutes the breathing zone of workers engaged in mucking.

Normally the dust concentrations in quarry operations are dependent upon the worker. In few instances is the worker required to remain exposed to a heavy dust concentration, and then only for a short period of time. It is usually possible for him to work in a position away from the direction of the air currents carrying the dust clouds. This is especially true where the drill is of the mounted type. In case of hand jackhamer drilling, the operator is required to bear down with his full weight in order to supply the required feed to the drill. Here the rate of drilling is more or less dependent on the physical characteristics of the man and often the contractor picks only the heavier men for this work. With mounted drills, the weight applied or the feed is constant and the rate of drilling is not only more regularly progressive but also the operator is not required to be constantly exposed to the arising dust cloud.

Tests on mucking show that the dust generated is dependent upon: 1. the fineness of the material; 2. the dryness of the material; 3. the rate and method of handling.

In recent studies in the iron mines in upper Michigan with mechanical scraping of relatively wet material, the dust in the breathing zone of the tugger operator closely approximated the general air of the mine area. In quarry and building foundation work the same conditions held, but in most instances the dust concentrations of the general air were too high for safe breathing over a period of time.

A test run recently[11] of hand shoveling in a dry mine indicated that greater dust concentrations were generated when the material was thrown from the shovel into the car. Samples taken with two men shoveling showed an average dust concentration of 83 million particles, but on applying suction to the top end of the car to entrap and remove the arising dust, the dust concentration was reduced to 8 million particles.

Crushing operations are usually associated with quarry operations. These operations, together with screening or sizing of materials, are usually done on the dry material. Usually the crushing and screening plants are mechanical, requiring only

[10] Rogers, Edward J., Silicosis or Pneumoconiosis in Vermont Granite Cutters and Slate Workers, New England Journal Medicine, Aug. 4, 1932, Vol. 207, pp. 203-208.
[11] The American Institute of Mining and Metallurgical Engineers, Technical Publication No. 637, Control of Dust in Mines, Feb. 1935, N. Y. C.

a few employees at stations and more often only intermittent attention is necessary for the oiling of the machinery.

In some cases the screening operations are done wet and the resulting dust generated is greatly reduced over the same operation done on dry material and especially, as is common practice, with no covers over the screens.

In a survey of a silica grinding plant, the following dust concentrations were obtained:

Location of Sampling	Total Count in Millions of Particles, less than 10 microns, per cu. ft. air sampled
Crusher room	4.25
Grinding room	9.52
Bagging room	69.33

These tests were taken in the summer and there was good general ventilation with all doors and windows open. The crusher and grinding room operations were mechanical, requiring the attention of one oiler intermittently, but the bagging room had two men at the two bagging machines and two men trucking the bagged silica into a car for shipment. These four men were exposed to the highest dust concentration in the whole plant.

A similar study of a feldspar mill operating with open vibrator screens showed the following concentrations:

Location of Sampling	Total Count in Millions of Particles, less than 10 microns, per cu. ft. air sampled
At roughing roll	2,656
At roll crusher	1,589
At screens (feeder end)	4,652
At screens (take-off end)	8,885

Samples taken in a wet limestone screening plant showed 0.91 million particles as the general air dustiness. This limestone was burned to make caustic lime and samples taken at the kilns showed:

Charging floor	2.5 million particles
Bottom of kilns (discharge of kilns)	1.7 " "

Summing up, our experience gained over a number of years by making surveys of varied industries, we have definitely concluded that:

1. Dust is principally produced by mechanical operations and in the mining and quarrying industries, drilling operations are the chief dust producers.

2. Employees at other operations than drilling are often exposed to a high dust concentration due to pollution by dust generated by the drills.

It is, therefore, logical to conclude that the proper way to eliminate dust is to entrap and remove it at its source. While wet drilling may, in certain instances, be effective, the use of water offers other difficulties, especially in freezing weather.

The effectiveness of the Kelley Trap has been demonstrated experimentally and its adaption to drilling operations in its first commercial use on the foundation of the Metropolitan Life Insurance Company's Home Office Building at 24th Street and 4th Avenue, New York City[12] was successful.

A series of later tests conducted in the Balmat mine of the St. Joseph Lead Company[11] showed the practicability and efficiency of the Kelley system under severe mining conditions.

The dust health hazards of the quarry industry are such that they can readily be eliminated by efficient and economical measures.

[12] Hatch, Theodore, Kelley, George S., Fehnel, J. Wm., Control of the Silicosis Hazard in the Hard Rock Industries, II. An Investigation of the Kelley Dust Trap for Use with Pneumatic Rock Drills of the "Jackhamer" Type, Journal of Industrial Hygiene, Feb. 1932.

Some Phases of Accident Prevention

By H. F. YOTTER

Insurance Supervisor and Safety Engineer, The General Crushed Stone Co., New York City

Accident prevention is primarily a matter of organization and education, but existing dangerous conditions must be made safe before we can reasonably expect the cooperation of the employees.

Safeguarding must not only prevent the accident for which it is designed but it must serve its purpose without unnecessary interference with the proper performance of the work. If not practical, it is a hindrance, rather than a help, in preventing accidents.

Whenever practicable, it is advisable to enlist the aid of the man on the job in planning guards. If the workman feels that he has had an active part, even though minor, in the provision of a safeguard for his protection he takes a keener interest in its use. He comes to look upon it as *his* guard. Safety suggestions from workers should be encouraged, for in this manner their interest is increased and their initiative stimulated.

It is possible to make nearly perfect safety devices, but human frailty does not permit of perfect control of the human element. You can probably recall instances where men of long experience and with good safety records, in a moment of thoughtlessness, suffered injury through taking ridiculous chances. At one of our plants we had a man of more than usual intelligence who was assisting in rivetting a truck body. This man had been with us for twenty years and up to the time of this incident had an excellent safety record. The dolly fell out of the rivetting hammer, which was being operated by a fellow workman, and this operator laid down the machine and walked away. The helper picked up the hammer and, out of curiosity, looked into it to ascertain whether the piston also had fallen out. In doing so he touched the trigger. The injury, fortunately, was not serious but had he shut off the air at a valve located several feet away the injury would have been avoided.

The employer is morally obligated to see that his employees are taught the hazards of their occupation and to make sure that they are alert in their efforts to avoid accidents. Notwithstanding this responsibility, it is probably true that there are still many plants where accidents are caused by the neglect of the employer to properly acquaint both new and old workers with the dangers of their particular duties. In each accident prevention activity management must lead the way in a manner that will convince the workers of its sincerity.

We are reminded of the warning given to his men by an old lumberjack—"Boys, when you hear the crack of timber look out for yourselves. When one of these big trees comes down you must be somewhere else, and be there quick. Use your heads and use them fast." In our allied industries the failure of mechanical and human equipment is not usually preceded by as much warning as the cracking of timber before it falls, and our workmen must consequently foresee the dangers attendant on their work to avoid injury.

In educating the workers it is highly desirable to teach them to be habitually careful. Workers should become imbued with the safety habit. While this habit may not be so easy to acquire as some others, it is infinitely more worth while. The best safety device is a safe workman, and the safety device in a man's head is of greater value than the guard on the machine he is operating.

The best results in safety education are obtained by personal contact. Supervisors of safety who have many operating units under their direction do not have this personal contact with the rank and file. Under these circumstances the duties of teaching the men how to avoid being injured devolve all the more heavily on the foremen in direct charge of operation.

Accident prevention should be made the responsibility of the foremen, just as they are held accountable for quantity, quality and cost of production. Safety bears a close relation to each of these operating phases. When the foreman is convinced of the value of safety and is enthusiastic in preventing the men under his supervision from being hurt, considerable progress has been accomplished. Because of his close

contact with the men, the foreman is in a position to notice the hazards of the work and determine the direct and indirect causes of accidents.

A careful study of working conditions, a thorough analysis of accidents, and a searching inquiry into potential causes of accidents will give an accurate picture of the hazards to which workmen are exposed and enable us to determine the proper means of eliminating them. No remedy can be effective which is based upon a wrong diagnosis. It is manifestly of great importance that we profit by those accidents which do not involve injury, as the difference between an accident without injury and one causing injury is sometimes only a matter of a fraction of a second or a fraction of an inch. Each "narrow escape" is well worth investigating.

If the foreman is an effective leader and holds the respect of his men, he is in an excellent position to influence them to acquire the habit of working carefully.

Foremen are seldom eyewitnesses to injuries. It is therefore imperative that they should attempt to foresee an accident in the making. Too frequently they fail to see a workman doing something which their experience ought to tell them will, if repeated, eventually result in an injury, and such an unsafe practice should be stopped before, not after, an injury occurs.

Accidents cannot be effectively or appreciably reduced until every man on the job knows exactly what he is doing, why he is doing it a certain way, and the part his efforts play in the whole plan.

The average worker is inclined to follow his own judgment on matters affecting his safety. He must therefore be thoroughly educated in accident prevention so that his judgment will be sound. He must come to realize that hazards do exist, that he and his fellow workmen are exposed to them, and that it is highly important that he habitually exercise caution if he and these fellow workers are to avoid injury.

A workman must be safety conscious to the point where, if confronted with a dangerous situation, he will instantly recognize the risk involved. Some men come to believe that they are immune from injury. This attitude is very dangerous and management must recognize it as a serious problem.

The human mind generally is not freely receptive of new thoughts suggested by others and this natural resistance must be overcome. When a new idea is broached, particularly if it involves a change in a man's method of working, he challenges it in his own mind. It is therefore necessary that the merit of the suggestions be made clear to him.

Accident prevention is an essential part of good management. During recent years the standards of every phase of modern industry have been constantly rising. This change has necessitated greater efficiency in the production of our product and consequent closer attention to protecting workmen against injury. The strenuous competition in business today calls for the highest degree of efficiency, and industrial accidents so impair efficiency that they cannot be ignored.

The lowered morale of employees due to reduced wages and the uncertainty of employment during the past few years has caused them to be nervous and has taken their minds off their work. The problem of making ends meet on reduced income and other family troubles have created worries which follow the worker to his job, reduce his interest in his work and his alertness, until his mental condition is often a real accident hazard. Recent conditions of business have also resulted in greater labor turnover and any period of new hiring means at least a temporary increase in the accident rate.

In many instances this depression in business activities has resulted in a let-down in supervising. Foremen who usually did only supervisory work have been required to work as well as supervise in an effort to reduce overhead. This method of cutting costs is questionable from an accident prevention point of view.

Safety posters play an important part in teaching accident prevention. Such illustrated bulletins should contain striking suggestions which cause the men to think about their hazardous surroundings and enable them to apply the lesson to their own working conditions. Without this application to conditions with which the man actually comes in contact, the forcefulness and effectiveness of the poster is largely lost.

Since the last annual Congress, the National Safety Council has issued 756 different safety posters. In so far as possible, these posters have been designed to meet the need for bulletin board material and are aimed at the outstanding common

causes of accidents. During the year the demand for these posters has reached the highest total figure in the history of the Council; over three million posters have been used in the fight against accidents. Over 70 per cent of these posters are suitable for use by members of our Quarry Section.

What the Worker Thinks About Safety

By GLENN L. GARDINER

Assistant to the President, Forstmann Woolen Company, Passaic, N. J.

What the worker *thinks* determines what he *does*.

If we were to ask a number of people their opinion as to what the worker thinks about safety, we would get an interesting variety of replies. Some would say, "That's just the trouble—the worker doesn't think about safety!" Another reply would be, "The worker is indifferent to the whole subject." Some people believe that the worker feels that "accidents are bound to happen, so why make a fuss about it."

The reaction of some would be that the worker thinks, "My own safety is my own lookout, and no one needs to be telling me to watch my step." Others have the opinion that the attitude of the average worker is one of bravado—he thinks, "Why be chicken-hearted about the dangers of the job?" Some workers have a superstitious attitude toward safety. They say, "When it's your time to get knocked off, you just get knocked off. When your number is up, you're going to get hurt—if it's your unlucky day, nothing can prevent an accident."

Then we also know that there are many workers, particularly in those organizations where intelligent accident prevention work has been carried out, who thoroughly believe that "*it can be done*"—that accidents can be prevented. Certainly the records of successful companies prove that where an effective job has been done in correcting the thinking of workers regarding safety, accidents can be reduced to the vanishing point.

What the Worker Thinks About Safety Rules

What the worker thinks about safety rules and regulations depends a great deal upon how strictly safety rules are enforced. The reason that so many workers lose respect for safety rules, is that often safety rules are not enforced with the same degree of rigidity with which other rules of worker conduct are enforced.

Safety rules must also be sensible and practical. A fundamental principle to follow is to make no more rules than are absolutely necessary, and then enforce them without compromise. Some safety rules may unnecessarily hamper a worker's productivity and interfere with his earnings. Such rules should be carefully considered.

To be thought well of, safety rules must be properly "sold" to workers. The reasons back of the rules should be thoroughly explained. The worker should clearly understand that the purpose of such rules is to safeguard his life and health.

The attitude of the worker's supervisor, the manner in which he carries out safety rules and standard practices, will determine what the attitude of the worker will be. The foreman who enforces safety rules apologetically and says, "I'm sorry, but this is a safety rule that the company says I've got to enforce. I know it's a nuisance, but I've been given my orders and I have to carry them out," cannot expect to convince his workers that safety is essential.

The foreman must indicate that he himself is sold on safety regulations, or he cannot expect his workers to respect them.

What the Worker Thinks About Safety Committees

In my opinion a large proportion of workers think that safety committees are "a lot of eye-wash." Most workers do not want to be bothered by membership on them.

One of the reasons for this rather prevalent lack of respect is the fact that so many safety committees have been set up and then allowed to die without activity and without accomplishment. With all due respect to companies writing compensation insurance, their representatives have been responsible in many instances for the attitude of indifference on the part of workers toward safety committees. Most of us have had the experience of being called upon by the representative of such an insurance company. We have been told that "You can get a certain percentage reduction on your rate if you will set up a safety committee and hold regular meetings of the committee." And often, this statement has been made with a wink, which indicates that you can take the safety committee as seriously as you see fit, just so long as you set it up and make it appear to be functioning.

Safety committees can perform a vital and useful function in any program of accident prevention. It is one of the most difficult safety activities to keep functioning effectively, however. Real work must be given the committee to do. Safety committees should have some authority. Their suggestions should be acted upon promptly and thoroughly. No safety committee will amount to anything unless it has vital work to do, is held responsible for that work, and is given credit for its accomplishment.

Therefore, if you want safety committees to do the job they are capable of doing, do not embark upon a safety committee set-up unless you are prepared to go all the way. It is also proper to rotate frequently the membership of safety committees so that many workers will have an opportunity to participate in their activity.

What the Worker Thinks About Safety Posters

A worker thinks nothing about safety posters unless the posters *make him think*. The trouble with many safety posters is that they do not stimulate active thinking. Granted, it is not easy to make safety posters which register with equal effectiveness with every worker who looks at them. Different workers are appealed to by different types of posters.

Safety posters are safety advertising and must be judged by advertising standards and the principles of advertising psychology. There are two time-honored definitions of advertising that may well apply to safety publicity. The first is that the function of advertising is "to deliver an unbroken series of favorable impressions" for a product or an idea. The second is that "advertising is the art of causing others to KNOW, to REMEMBER and TO DO!" In short, the job is to make the worker *know* safety, *remember* safety and *do* the safe thing always.

Almost as long as the safety movement has been under way there has been argument over the "gruesome" type of poster. I am one of those who believe that the type of safety poster which makes a worker think most actively is the poster which pictures for him possible consequences of indifference, carelessness or thoughtlessness relative to the hazards of his job. One of the best proofs of the effectiveness of the "gruesome," I believe, is the recent article entitled "And Sudden Death" by J. P. Furnas in the August "Readers Digest." The article painted the gruesome side of automobile accidents; it was gruesome almost to the point of nausea. But I firmly believe that it has been more effective in awakening public opinion to the necessity of greater automobile safety than all the statistics, newspaper articles and other forms of publicity put together. I am told that the sale of reprints of this article has exceeded a million and a half copies.

To be effective, safety posters must have a clean-cut, worth-while safety message, in the form of reminder, suggestion, warning, information, or instruction that will help prevent accidents. The poster that does not capture the attention and aid in developing what we call safety-mindedness might better be consigned to the waste basket.

The worker will think little or nothing of safety posters unless they are frequently changed. They should also be posted prominently at accident-possible points, so that they strike the worker's line of vision, and so that he cannot escape the message which they hurl at him.

What the Worker Thinks About First Aid

I am quite sure that the average worker does not think enough about first aid.

Accident statistics indicate that 15 per cent of all compensation cases are infection cases. There are more than 100,000 such cases annually, causing the loss of a week or more from work, and costing more than 25 million dollars a year in compensa-

tion. The key to reducing this type of injury is the education of workers to think more seriously about the importance of getting first aid treatment of minor injuries which may lead to serious infection.

Why do workers so often neglect first aid? This question has several answers. Many workers just do not want to be bothered about having a slight scratch or cut fixed up. They have had many such slight injuries before and always recovered without serious consequences. Then, some workers do not want to lose time from their jobs to get first aid, particularly if they are working on a piece-work basis. Many regard it as being "sissy" to go to the trouble of having a scratch dressed. Some workers fear that the reporting of these slight injuries may build up a bad record for them. Others do not get first aid attention because they do not want fellow workers to make fun of them for taking seriously so slight an injury.

All this makes us realize the importance of combating such mistaken viewpoints by continuous educational effort to impress upon workers the commonsense importance of getting first aid treatment.

Rather strict rules and regulations should be in effect with reference to getting first aid treatment. Workers should be made to understand that the neglect of slight injuries places them in a much less favorable light in the eyes of the foreman and the management than a record indicating that they have called at the first aid room on frequent occasions to be treated for injuries. There is no more effective medium for the education of workers on the importance of first aid than well conceived posters showing the disastrous results of neglecting slight injuries.

What the Worker Thinks About the Safety Engineer

Probably the worker thinks little about the "safety engineer" until he happens to get hurt and the safety engineer questions him as to how it happened.

It seems to me that the real function of a safety engineer is not to attempt personally to prevent all the accidents that may happen in the organization. His real function should be that of a safety adviser and helper to get the entire supervisory organization safety-conscious to begin with, and then to help them to bring this same attitude toward accident prevention to the workers under their supervision. I should prefer to think of the safety engineer as a foremen's "safety follow-up man." The real responsibility for preventing accidents should be put squarely up to the supervisors themselves. The safety engineer should function as a helper to them. Their safety suggestions and requisitions should be made to him and then it should be his routine duty to see that these suggestions are carried through promptly and effectively. He should furnish the technical guidance, the facts and the analyses of accidents, and all of the information the supervisors should use to sell safety to their workers.

One reason why the average foreman does not take more interest in safety is that he does not have the time nor take the time for all the details that go with safety work. This is where the safety engineer can do a job, and prove his true worth.

What the Worker Thinks About His Foreman

The foreman's safety attitude determines the attitude of his workers toward accident prevention. An indifferent foreman is a positive menace to the safety of his men. If he regards safety as a function of secondary importance, then his men will think of safety only when there are no other things to think about. The foreman who does not recognize that safety is the RIGHT WAY OF DOING A JOB, has missed the target.

An accident is just a MISTAKE! Many a foreman has found it possible to transfer the spirit of cooperation from accident prevention work to the other functions of the department. A group of workers who have learned to cooperate on safety matters can more easily be led to cooperate in getting out the work and in getting out quality work.

If a foreman will take safety seriously, he can make his safety activities the foundation for the building of a great deal of worker good-will. If he approaches safety always with the idea that he is working for the welfare of his workers, it is inevitable that his workers will appreciate this spirit and return to him many times the effort he has made in their behalf.

Workers will respect a foreman much more if he takes safety seriously. The foreman who is slip-shod and apologetic about his half-hearted enforcement of safety regulations, may think that he is being "a good fellow" with his workers, but they do not so regard him. In their hearts they feel that he is an undependable fellow who is not living up to his responsibilities.

Particularly important is the impression that the foreman makes on the new worker. There is no better time for the foreman to impress a man with the importance of safety than when he is learning the job. The development of safe working habits right from the outset is a vital feature of good safety work.

What the Worker Thinks About His Company's Safety Program

A company that sponsors and keeps alive an effective accident prevention program reveals a sincere interest in the welfare of its workers. Do not let anyone tell you that workers do not appreciate such an attitude in the company they work for. This appreciation may not be shown in many tangible ways, but its value is there nevertheless.

Let us not forget either that what the worker thinks about safety is generally a direct reflection of what the top management thinks. When he sees management conscientiously endeavoring to provide safe conditions, safe equipment, and the best obtainable safety devices and protective appliances, together with competent supervision that is ever watchful to prevent accidents, he knows that management is sincere and deserves his hearty cooperation, which he then freely gives.

Today, as never before, we need to find ways and means to stimulate good will with our workers. Safety furnishes a non-controversial avenue of approach to the worker's heart. An active program of accident prevention helps to heal sores of the mind as well as the flesh. If you do not believe that workers think well about a company's safety program when conscientiously and effectively carried out, just listen to the conversation of workers employed in an organization where no attention is paid to their safety.

The good will value of active safety work stands at a higher level today than at any other time in the whole history of industry.

Thought and Action

We know that more than 80 per cent of the accidents of industry are preventable only by the workers' own safe thinking and safe habits.

Most accidents among workers happen to those who are not thinking. Many of the accidents ascribed to "carelessness" are rather due to thoughtlessness or lack of thinking.

To influence the action of people we must first influence their thinking. The key to safe thinking and safe working habits is the repetition of impressions upon the mind of the worker—impressions which bring to him a realization of his responsibility for his own safety—impressions which cause him to KNOW, to REMEMBER, and to DO!

ADJOURNMENT

Refrigeration Section

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GUY W. JACOBS, The Steubenville Ice Co., Steubenville, Ohio.
S. R. KALLINS, C. Hoffberger Co., Baltimore, Md.
H. L. LINCOLN, The Union Ice Co., San Francisco, Calif.
J. F. NICKERSON, American Institute of Refrigeration, Chicago, Ill.
W. M. O'KEEFE, American Warehousemen's Assn., Chicago, Ill.
GARDNER POOLE, American Institute of Refrigeration, Boston, Mass.
W. H. SENYARD, Louisiana Power & Light Co., Algiers, La.
HAROLD M. TOOMBS, Armour and Co., Chicago, Ill.

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W. O. HAM, Southern Ice & Utilities Co., Dallas, Texas.
HURLEY G. HUST, City Ice Co. of Kansas City, Kansas City, Mo.
GUY W. JACOBS, The Steubenville Ice Co., Steubenville, Ohio.
S. R. KALLINS, C. Hoffberger Co., Baltimore, Md.
K. D. KNOBLOCK, American Utilities Service Corp., Chicago, Ill.
J. F. NICKERSON, American Institute of Refrigeration, Chicago, Ill.
P. J. NOLAN, Libby, McNeill & Libby, Chicago, Ill.
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R. M. SEEKER, Anheuser-Busch, Inc., St. Louis, Mo.
W. H. SENYARD, Louisiana Power & Light Co., Algiers, La.

THURSDAY MORNING SESSION

October 17, 1935

The session was called to order by Acting General Chairman J. F. Nickerson, who presided. Chairman Nickerson welcomed the delegates and sketched the progress of the section during the past year.

The Use of Hand Tools in Refrigerating Industry

By A. A. RALL

Safety Supervisor, Kansas City Power & Light Co., Kansas City, Mo.

Statistics show that hand tools contribute a large portion of the accident injuries in industry. Machine accidents can usually be avoided by use of proper safety devices, but accidents from handling things and using hand tools depend largely on the control of the man himself.

For example, in hanging a heavy door a hitch occurred somewhere, and in trying to overcome it a workman pulled the door away from the hinges, entirely forgetting that his right hand gripped the outer edge of the door. His fingers were caught between the door-frame and the door, causing painful bruises.

Another cause of hand injuries is the habit of letting the hands wander about without conscious control, as when we make gestures. This is especially dangerous near electrical apparatus or where the hand can be placed against a moving gear wheel, or a hot object.

It should be remembered that we received our hands for nothing, but we can only have one pair. Do we treat them with the care we would bestow upon a watch or some other valuable piece of mechanism? We do not. We take all manner of chances with them, allowing them to become infected, bruised, and mutilated. The ways in which accidents are caused through the use of hand tools are as varied as the number and variety of tools.

Wrenches. Many an accident has been caused by the slipping of a wrench; yet the importance of this hazard is seldom appreciated. The danger is particularly grave when men are working on ladders or platforms or in other elevated positions. Numerous ways in which accidents may arise include the following: (1) The use of open-end wrenches not of the right size. (2) The corners of the nuts may have become mis-shapen through long-continued use; (if nuts are badly worn they should be removed with a pipe-wrench or an alligator wrench, and new nuts substituted). (3) Monkey wrenches are applied with the jaws pointing away from the user, instead of toward him. (4) The adjusting mechanism of the monkey wrench and pipe wrench sometimes becomes so worn that it is no longer possible to set the jaws tightly. (5) The wrench may be too large for the job; or it may be unreasonably lengthened by slipping a piece of pipe over the handle, so that the bolt twists off under the excessive leverage. In order to stop accidents, it is necessary to eliminate the causes, and the necessary methods of doing this are fairly obvious.

Pliers. Too many of us are plier mechanics. The slip joint pliers is the most commonly used, as it holds square objects as well as round ones. This tool is subjected to considerable abuse. One abuse is in helping the screw driver to remove a tight screw or slotted head bolt. This frequently results in spreading of the slot so that it becomes practically impossible to remove the part with conventional tools. While maintaining a grip on the pliers, one cannot steady the screw driver properly when additional leverage is necessary.

Cold Chisels. The cold chisel is an instrument intended to cut metal softer than the tool itself and must have the same amount of care as any other tool to do good work. The chisel head will swell or broom out from constant use. This broom should be ground off as a matter of safety. When the chisel is properly tempered the hammer will not do much damage. A chisel should not be used on an anvil. A good anvil is made of the same material as the chisel and tempered to the same degree of hardness. Contact of the two under the blow of the hammer is therefore injurious to both. Also bear in mind that the chisel should be of sufficient length to permit of holding it properly.

Hammers. The hammer, more than any other tool, can be made a tool of abuse. Two types of hammers are in general use. The claw hammer comes in for considerable abuse because the handle is of such proportions that it is amply strong for use as a claw. However, it is impossible to pull spikes with the average weight hammer; and it is also bad practice to use a pipe over the handle to secure additional leverage. A broken handle often means a bad fall. Security of the hammer head on its handle is important, as a loose head not only results in poor work but also is dangerous. The hammer head should be fitted to the handle with properly fitted wedges.

Screw Driver. The leverage applied to this tool is governed practically by the twist of the wrist in rotating the tool. Care must be taken in obtaining leverage by offsetting the screw driver since the effect on the slot is apt to be much the same as that produced by an improperly shaped point. An improperly shaped tool will mutilate the screw head, as it does not have a good bearing slot. To counteract this tendency to slip, the screw head, being of softer material, swells where the point touches on its edges. This increases with each effort, until finally the sides of the slot are so tapered that some make-shift arrangement must be used to remove the screw.

Constant use wears the tool and it must be dressed to restore its condition, but this dressing must be understood to get maximum service. The practice of holding the screw driver in one hand and the material to be worked on in the other is unsafe. A pierced hand is often the result. To reduce this hazard, screw drivers are now being manufactured with a ribbed point.

A screw driver presents several hazards when used as a make-shift tool. The shank often becomes bent from use as a punch bar. The handle becomes splintered from hammer blows when used as a chisel. Inguinal ruptures have sometimes been caused through bruises when the driving points have suddenly been released from the screw slot.

Files. Never use a file without a handle. Many men have violated this precaution and have had the sharp point driven into their hands. Never hit a file with a hammer, as pieces of hardened steel are almost sure to fly.

Tools most commonly used by the ice-delivery man are tongs, picks, and axes. All these should be kept sharp and in good condition. A suitable holder or rack should be provided for the axe on every wagon, and it should be kept in the holder when not in use. The ice man should have a suitable shield in which to carry his pick and never carry it in his pocket. Empty tongs, when carried, should be closed so that their points overlap—both handles being held in the hand. He often opens them out and carries them by hooking one point over his shoulder. This is a dangerous practice, likely to result in serious injury if he should fall. Many accidents happen through the improper sharpening of ice tongs.

More injuries in our ice plants are due to the breaking of some parts of the ice-pulling equipment than from all other causes combined. It is the duty of the ice puller, as well as the engineer in charge, to watch his ice-pulling equipment for any dangerous defects; should he detect any part of this equipment showing signs of wear or defects liable to cause injury, he must report the condition to the one in charge so that it can be remedied.

It is essential to use extreme caution in handling heavy machinery, especially when rope blocks, hand tools or chain hoists are employed. One should know approximately the weight of material to be handled, the capacity of the hoist, and the strength and condition of the supporting beam. As a rule, when a machine or part of a machine falls, it results in broken parts and injury to one or more employees.

Tool Room. The tool room has been found to be a profitable investment as it has paid a company with which I am acquainted, in three ways:

(1) Bad hand tools were practically eliminated. It was surprising to note the condition the tools were allowed to get into, and in some instances only half of the tools were returned.

(2) Longer life of tools, greater care shown, and elimination of abuse to tools.

(3) Better grade tools were purchased, consequently the maintenance of tools improved.

Refrigeration Machinery Hazards and Their Elimination

By R. M. SEEKER

Director of Personnel, Anheuser-Busch, Inc., St. Louis, Mo.

We use two types of refrigeration machinery in our plant, the old style steam driven, and the modern electric driven. On the steam driven type the exposed moving parts include fly wheels, piston rods, compressor arms, pulleys, etc. These parts are operated at about 42 R.P.M with a 140 pound pressure at 400 degrees F. with a back pressure of 27 pounds. To guard the fly whels and other moving parts, we have a hand rail and fence with bars 1½ inches apart running up to the hand rail. All vertical type compressors have a platform for the oiler as well as a hand rail and fence. The platforms and steps are kept free from oil. They are covered with non-slip covering and the steps with safety treads. Since the equipment is oiled while in operation, the oilers should be instructed to take extra care. We placed rubber non-slip runner mats on the floor around the entire equipment.

Steam pipes, valves, and joints should be covered with insulation and kept in good condition. Couplings, joints, and valves should be inspected regularly for leaks which may cause injuries to employees as well as break downs in operations. While repairs are being made to machinery, steamlines, and ammonia lines, care should be taken that all valves are closed and locked and that no one is permitted to open them except the man in charge of the repairs.

On high speed electrical driven equipment the hazards are some what the same as in steam driven compressors. You have machinery moving at about 164 R.P.M. with a back pressure of about 15 pounds and operated with a 2,200 volt high tension line. The high tension lines are to be concealed as much as possible and where they cannot be concealed the insulation should be of the best quality and free from oil.

Our compressors are equipped with push button type of control with starting switches and transformers which are the oil type and are in a special fire proof vault. Oil type switches and transformers are very dangerous when they explode for they spray burning oil.

Cooling tower fans are encased and when repairs are made the fans are locked out at the switch and only the man in charge of repairs is permitted to unlock the switch. Also fuses are pulled from the switch board.

Up to this time we have been unable to find a safety cock for gauges that will close when the gauge glass is broken. We had a gauge glass broken in our refrigeration plant and the cock refused to shut off. This was quite a problem because one had to go in and shut off the valve and an ordinary canister type mask would not give protection. We are now equipped with two blower type masks which have 150 feet of hose to take care of such situations while we use the canister type for small leaks. The canister mask will take care of only 3 per cent ammonia.

Personal Protective Equipment in the Refrigeration Industry

By HARRY HUTCHENS

Manager, Department of Safety, Kentucky Utilities Company, Lexington, Ky.

Within the past few days the curtain has been lowered on one of America's great out-door sports—baseball. I wonder if we cannot find a lesson in this professional industrial sport. Go where you will, from the sand lot to the big league game, and you will find such a uniform system of equipment that you can easily determine a player's position when you observe the protection used by him.

Unfortunately, you will not be able to find in industry any such thorough employment of equipment to protect against industry's accidents. The situation seems to be a sort of three cornered affair. The workman occupies one corner of the triangle, the employer another, and protective equipment the third. So dependent is each of these upon the other that accident prevention cannot be very successful without all three working together. But too often, like a three legged stool that has lost one of its supports, we find safety work in this plant and that doomed inevitably to failure.

Recently I wrote to a large number of refrigeration plants asking them for information about their accident experience. My replies came from California, New Jersey, Texas, Illinois, and Ohio, and gave me a fairly representative picture of the general situation.

The companies reporting had 10,000 workmen and during 1934 suffered 1,900 personal injury accidents, a rate of 19 for each one hundred. While a great many of these were trivial, I feel that entirely too many personal injuries are experienced in our industry.

In face of the fact that for years safety shoes have been on the market, the most frequent injury suffered was to the feet. There was a total of 227 of these injuries. The next class in point of frequency was injury from strains with a total of 194. Next in order were the injuries caused by falls with 152; and then those due to infections with 149. These four classes accounted for 720 accidents.

If it is true that protective equipment for the feet has been available for years, and in 1934 we still continued to suffer most from that type of injury, surely the points of this accident prevention triangle occupied by the employer and by the workman have failed in their part of the responsibility. The employer failed in that he gave too little thought on the value of accident prevention, and the workman failed either in refusing to avail himself of the protection that was offered or because he did not use intelligence in guarding himself against the dangers of his labor.

So far as I know, there is no mechanical equipment to protect men handling ice or storage products against strains that come as a result of lifting or moving such products either in delivering or storing them. But much can be done by properly instructing men in the manner of lifting.

A short time ago in one of our employee safety meetings the question came up

as to how much weight a man would lift when up-ending a 300 pound block of ice. We found that for a man to place his hooks in the end of a block of ice and stand so that he lifted straight up, he lifted in the first three inches from the floor 145 pounds. When he stood back away from the ice as he lifted, the weight was 160 pounds, an increase of 15 pounds. The lift from a point three inches to 12 inches above the floor, with the straight up-lift, was 140 pounds; and to stand away with the pull-type lift, the weight was 150 pounds. From 12 to 18 inches above the floor the weight varied from 120 to 130 pounds.

This test clearly shows that there is an added weight thrown upon a workman by the manner in which he does his work. It is highly proper therefore that he be taught the importance of relieving himself of all unnecessary lifting.

For a long time creepers have been worn on the shoes to protect men against falls while working in ice storage rooms; but there are many cases where falls do not occur in storage rooms. They occur on stairways, or on platforms, and it would be impossible to prevent such falls with the creeper. Many times the use of creepers has created a tripping hazard far greater than the slipping hazard. Protective equipment is thus only one of three means of accident prevention, and to get the maximum benefit all points of the triangle are very necessary.

It is needless to outline here the many other items of protective equipment on the market. The question is, What shall we do about it? Personally, I believe that too many of our operators are safety minded only in meetings of this kind, just like some people who are religious in prayer meetings. It is not difficult to be good in a prayer meeting, neither is it difficult for a man to be safe while in a safety meeting. The real test comes when he is away from these influences and is facing the difficulties that confront him in his daily toil.

What the refrigeration industry needs most is a more earnest, honest-to-goodness determination on the part of those responsible for the operation of our plants to operate without injury. Just as soon as that man in charge of any partic... plant becomes so determined not to have accidents that he will let it be known among his employees that any workman who has accidents cannot remain in his employ, just that soon will his men put a stop to all avoidable accidents. And that, my friends, will eliminate practically all of them.

We have too long sought excuses for accidents instead of taking a definite stand against them; too many times we have excused men guilty of gross negligence resulting in injury because they had been with the company a number of years. We have provided safeguards and protective equipment only to have workmen lay them aside and take the chance of doing their work without them. Eyes have been destroyed by workmen refusing to wear goggles; hands have been severed by saws when guards lay beneath the table. That is why I say that protective equipment is only one of the three points of the triangle.

Much good could come from a standardized method of selecting men so that undersized men would not be given the heavier classes of work. Neither would men of low intellect be selected. Countless graves are filled today with the bodies of workmen who were unable to anticipate danger sufficiently to take care of themselves. It is just as necessary for a workman to place himself, by intelligent thinking, in a safe position to do his work as it is for him to take the short route to his home when the whistle blows.

ADJOURNMENT

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R. A. BULLOCK, Corduroy Rubber Co., Grand Rapids, Mich.
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H. W. LOW, Miller Rubber Products Co., Inc., Akron, Ohio.
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CHARLES F. SMITH, U. S. Rubber Reclaiming Co., Inc., Buffalo, N. Y.

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General Chairman—A. M. DIETZ, Pennsylvania Rubber Co., Jeannette, Pa.

Vice-Chairman in Charge of Program—J. M. KERRIGAN, U. S. Rubber Reclaiming Co., Buffalo, N. Y.

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Health Committee—
DR. W. S. ASH, U. S. Rubber Products, Inc., Detroit, Mich.
DR. J. NEWTON SHIRLEY, Arrow Mutual Liability Insurance Co., Watertown, Mass.
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JOHN L. GRIDER, American Hard Rubber Co., Butler, N. J.
OLIVER HOPKINS, U. S. Rubber Products, Inc., Providence, R. I.
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M. A. QUIRK, Samson Tire and Rubber Co., Los Angeles, Calif.
W. L. SCHNEIDER, The B. F. Goodrich Co., Akron, Ohio.
CHARLES F. SMITH, U. S. Rubber Reclaiming Co., Inc., Buffalo, N. Y.
H. A. WALKER, The Goodyear Tire and Rubber Co., Akron, Ohio.

TUESDAY MORNING SESSION

October 15, 1935

The first session was called to order by Mr. J. T. Kidney, manager, Employees' Service Division, The Goodyear Tire and Rubber Company, Akron, Ohio, who presided in the absence of the General Chairman and other officers.

Fifteen Years of Safety in the Rubber Industry

By ERNEST W. BECK

Supervisor of Safety, U. S. Rubber Products, Inc., New York

The Rubber section of the National Safety Council was organized in 1919. Mr. Sidney Schott, in charge of safety at the Detroit plant, United States Rubber Company, was the first chairman.

At that time the rubber industry was regarded as a most hazardous one, but it is now listed among the least dangerous. Back in 1926 the average frequency rate was practically equal to the rate for all industries. In 1931, however, the rubber industry stood 10th best in frequency and 8th best in severity among 28 of the leading industries, while in 1934 it took 5th place on the basis of frequency and 4th on the basis of severity in a list of 30 industries. In this latter year, 48 units, employing a total of 133,880 men, reported an average frequency rate of 9.25 and an average severity rate of .80.

Our annual statistical reports show that the predominating accidents in the rubber industry are machinery accidents. The 1934 report shows that 30 per cent of the lost-time accidents were due to machinery. We have to deal with much highly powered equipment, chemicals, hazardous solvents, electric currents. Some of this machinery, such as mills, cannot be guarded at the point of operation. With this thought in mind, the executive committee of the Rubber section, in October, 1923, devoted considerable time and discussion to drawing up a standard safety code covering safety factors on mills and calenders. The Code committee was composed not only of safety engineers, but also representatives of rubber machinery manufacturers, state inspectors, insurance representatives, etc. Mr. John Condon, supervising engineer, U. S. Rubber Company, was chairman of the Committee and Mr. Ernest W. Beck, of the same company, was secretary. The code as approved by all the necessary parties, including the American Standards Association, was printed in March, 1927, and distributed as a recommended American practice.

The Rubber section was also responsible for the excellent research on the subject of benzol. The first report was drawn up under joint sponsorship of the section and the Chemical section, and received national recognition. At our several meetings we have received valuable information from outstanding authorities on such subjects as compounds used in the rubber industry; static electricity; vulcanizing; fire and dust hazards in the rubber industry; digesters; hazards of reclaiming, power windups; and occupational affections of the skin.

In developing our safety program a spirit of cooperation was created among the safety engineers in this industry. The various companies may be competitors in marketing their finished products but they most certainly are not competitors in the safety field. I believe it is this cooperative spirit that has done more than anything else to improve the accident prevention work within the industry.

During the last fifteen years our industry has seen many changes through the installation of modern machinery such as plasticators, banbury mixers and tubing machines, displacing to a great extent the more hazardous types of washing equipment and open mills and calenders. The installation of conveyor systems, unit vulcanizers and hoisting equipment has eliminated the dangerous man-power handling of heavy equipment and material.

The fact that many rubber companies carry their own compensation insurance has tended to increase the attention placed upon preventive measures.

Our accident records show that the frequency rates of the companies having 500 or more employees, have been substantially better than those of the smaller companies. The reduction in number of accidents during the past fifteen years was obtained in spite of the fact that compensation laws have been liberalized to an enormous extent. All of this has had a tendency to increase the number of cases which must be counted as lost-time accidents.

The large majority of rubber workers are employed in the states of New York, New Jersey, Ohio, Massachusetts, Connecticut, Pennsylvania, California, Michigan and Wisconsin, where the labor laws are more severe to employers than in other states. However, the accident records for the rubber industry have shown steady improvement. [illegible]re sums of money have been expended in installing modern equipment, thereby re[illegible] the accident hazards to a minimum.

The accompanying table on estimated injury rates will be found interesting:

Estimated Injury Rates, Rubber Industry, 1926-1934

(Based on 1934 rates of 48 reporting plants)

Year	Frequency Rate	Severity Rate
1926	30.13	1.66
1927	27.18	1.02
1928	22.63	1.16
1929	18.23	1.32
1930	12.28	1.01
1931	11.06	1.07
1932	10.31	.80
1933	11.45	1.14
1934	9.25	.80

During the past three years, in response to a demand from the rubber industry, the National Safety Council has conducted a safety contest among the Rubber section members. This contest, based on frequency rates, has stimulated a further interest in accident prevention and through the splendid trophies and honorable mention certificates has carried home to the man on the job recognition in a national way that has given him cause to be proud of the company and the industry for which he works.

You may be interested in the safety experience of our company during the last several years. The frequency rates each year are much lower than the rates for the rubber industry as a whole and for all industries. The U. S. Rubber Products, Inc., has about 20 factories and 30,000 employees. Mr. Francis B. Davis, Jr., president, is a staunch advocate of organized safety development. He believes that a plant which is efficient in safety is also efficient in production methods and that accidents will not happen in a well-managed plant. I believe that a survey of our industries would demonstrate that our most efficient factories are those where the greatest attention is paid to accident prevention.

Eleven years ago our company conducted a safety contest between plants, giving prizes to the factory showing the greatest percentage of improvement in its accident experience over the average of the previous three years. Each factory competed not only with the other factories within the company but also with its own previous records.

We have many different kinds of safety committees at our plants, such as Safety Advisory committees, Employees' Safety committees, Departmental Safety committees and the Health, Safety and Sanitation committee of the Factory Council. In addition, we have organized suggestion systems and all employees are encouraged to hand in suggestions for the good of the organization.

The reduction of accidents has been the result of the united efforts of the entire organization. Conditions regarding health, safety, sanitation and fire protection are under constant surveillance of each local organization and periodic inspections are made by the supervisor of safety. The National Safety Council's service material is employed throughout all plants, and safety lectures and demonstrations are given before safety committees, factory councils and foremen's meetings to develop an ever-increasing safety perception on the part of employees.

Accurate statistics covering the number of accidents, compensation paid, and medical and legal expenses are recorded for each factory, as well as for the company as a whole, so that the entire program can be intelligently directed. The proof of good safety work can be shown by statistics.

Recently, all of our plants operated for 34 consecutive months, a total of 114,000,000 man-hours, without an industrial fatality. At one of our factories, employing 1,600, the personnel worked 2,286,000 man-hours during one year without a lost-time accident. Another of our factories with approximately 750 employees, operated for 16 months, working 1,853,275 man-hours, without a lost-time accident. Another plant with 400 employees has operated 503 days to date, working approximately 1,055,242 man-hours, without a lost-time accident, and this plant has a large foundry department. Our largest tire cord mill, with 1,450 employees, has operated 335 days to date, working 2,424,603 man-hours, without a lost-time accident. Another plant with an average of 50 employees, operated for over four years without a lost-time accident, working approximately 440,000 man-hours.

The success in safety work that the rubber industry has had during the past fifteen years did not just happen, nor was it the work of any one man. It came about through everlastingly plugging away every day and the whole-hearted support of the entire organization.

According to the best records we have found, the rubber industry today is the safest large industry and the Rubber section is the safest section in the National Safety Council. Our section represents about 85 per cent of the rubber industry. It is the responsibility of everyone in this room and of everyone in the rubber industry to do everything possible to maintain this position. We have not reached perfection. But last year the industry had seven deaths or permanent disability cases, 53 permanent partial cases, 1,178 temporary disability cases, or a total of 1,238 disabling injuries. The frequency rate was 19 per cent lower than in 1933 and the decrease in severity 25 per cent. The rubber industry, as stated in the annual report of the National Safety Council, was one of the few to achieve reductions during 1934.

Keeping Management Sold on Safety

By R. W. MORSE

Director, Compensation and Safety, The Firestone Tire & Rubber Co., Akron, O.

Somewhere we have read that salesmanship might be defined as the ability of one man to change the thinking of another to coincide with his own; it is simply a transfer of a mental image from one mind to another, and acceptance by the second mind.

Since the employer must necessarily surround himself with an atmosphere of sales resistance, the transfer of a mental image of the value of safety from the mind of the safety director to his mind is more than an ordinary task. Certain promises of results, in the mental and physical attitudes of workers and in economic returns, are necessary to clinch the original sale. Keeping him sold means a redemption of those pledges.

The more specious and glittering the promises we make, the harder it is to live up to our predictions. Many a well-intended safety movement has been wrecked by painting too bright a picture of future accident prevention benefits; safety, to be effective, must be a permanent policy and there is always an irreducible minimum beyond which we cannot hope to go.

In all well-regulated plants, safety has been recognized as a policy equal in importance with production and marketing, and it is becoming easier to sell safety to management; but industrial conditions are changing and in the months ahead it may be more difficult to convince management that it has made a good buy.

The past few years have wrought great changes in the relations of employers and employees and there has been a decided shift in the mental attitudes of each. These conditions have not made it easier to put safety across to either management or the worker. Also, we must recognize that we are now being confronted by many new industrial hazards which come to us as a legacy of the depression. These may have a tendency to cause a sharp rise in accident frequency and severity, and a logical presentation now of these abnormal influences to management may prevent a lot of difficult explanation in the future.

Modern industry is credited by the preachers of discontent with being utterly lacking in conscience and with having a purely mercenary interest in safety This is entirely erroneous. Cutting down the cost of accidents is of course a matter of economic wisdom, viewed in the same light as the prevention of any other form of waste; but in modern industry, certainly in our particular branch of industry, safety now is more generally recognized as a venture in human welfare than ever before. Management's primary interest is in protecting the physical and economic standards of its employees. Returns to management in the successful exercise of that policy are inevitable, but they are none the less incidental.

The only class of salesmanship that gets favorable recognition is that which delivers the goods. The safety salesman who sets up an organization in his plant and then sits down and points with pride, instead of keeping eternally at the business of cutting down accident costs, is destined to reach that point where management will view with alarm his failure to redeem his pledges.

To keep management sold on safety it is necessary to keep your supervisory forces and your rank and file sold on the proposition. Any one who is charged with that responsibility, realizes that it is a man's size job and one that will become increasingly difficult. Especially is this true of the organization which has had long experience in safety. In the days when safety was just being accepted as a policy of industrial management, it was comparatively easy to make heavy percentage gains in accident reduction. With each succeeding year, the pace becomes more difficult and a point may be reached where accident frequency levels are apt to show only

slight fluctuations, either upward or downward. There is certain to be increasing difficulty in keeping management satisfied that the efficiency of the safety setup cannot be gauged entirely by statistical gains.

Of one thing we may rest assured. The status of safety in industrial relations is permanent. It cannot and will not be abandoned. We may never attain perfection in the work but necessity demands that we keep eternally at it, confident in the thought that industrial management has keen foresight and will recognize the limitations in the path of safety progress. If we all work persistently, conscientiously and intelligently to reduce accidents to a reasonable minimum, industrial management will continue sold and satisfied.

Conveyor Hazards in the Rubber Industry

By W. L. SCHNEIDER

Safety Engineer, The B. F. Goodrich Co., Akron, Ohio

Conveyors were introduced in the rubber industry many years ago, but were not in general use until about 1910. Previous to this time manual handling of rubber products, cores, molds, crates and cartons was common and many serious accidents were sustained, especially from cores and molds. The most common types of conveyors may be enumerated as follows:

1. The conventional rubber belt conveyor, composed of head and tail pulleys and intermediate idlers, the belt running either horizontally or inclined, and in some instances made to concave slightly in order to keep material from falling off.

2. Conveyers employing the use of chain to which cross flights of angle or channel iron are fixed, also running in a horizontal or inclined plane; bucket conveyors also come under this class.

3. Overhead chain to which there is attached various types of hooks or hangers on which the articles to be conveyed are hung. This type may run horizontally, inclined or vertically.

4. Conveyors known as scraper type, employing the use of steel cables or chain to which scraper bars or discs are fastened and these running in troughs or through pipes. Also the associated screw conveyor in which a screw and shaft runs in a trough or sleeve.

5. Gravity type, of which the conventional design has ball bearing rollers spaced fairly close together and usually inclined so the boxes or material to be conveyed flow at a uniform rate along the conveyor. Another type of gravity conveyor is made of sheet iron and may be either straight inclined or circular. Also gravity chutes.

6. Monorail track, which sometimes is merely a long length of eyebeam on which trolleys with hangers are propelled manually and in some cases by power.

It is assumed that in all these types adequate guards have been provided over gears and pulleys at the drive and tail ends, so that in case of type No. 1 the hazards attendant on the maintenance of such equipment would be largely confined to slipping or falling while oiling and greasing it, which may in most cases be accomplished while conveyor is in operation. Frequent adjustments of the idlers and tail pulleys must be made while belt is running in order to get it into proper alignment. Overloading this type of inclined conveyor may cause material to slide back with possible injury if operator is obliged to shift material by hand.

In the second type, hazards are a little more definite; operators or mechanics may be caught on buckets, angle iron and channel iron flights. Also workmen try to climb over this type of conveyor while it is in operation, which is extremely dangerous.

Hazards of the third type consist largely of materials or objects falling off of hangers or hooks, if improperly loaded. Hangers or hooks should be so designed that the loading may be accomplished without throwing hangers out of line or tilting to such an angle that the load might easily slip off. In case of a vertical run of this type of conveyor, provision should be made to keep the chain from piling up at the bottom of the run in case the chain breaks. This may be accomplished by providing ratchets or dogs to engage the links of the chain.

No. 4 type of conveyor is sometimes used in rubber reclaiming plants and troughs must be well shielded or guarded and shearing points adequately protected.

On the gravity type conveyor, accidents frequently occur when workmen try to stand on the conveyors or cross from one side to the other and lose their footing. If it is at all necessary, because of the length of this type of conveyor, for workmen to get from one side to the other, a crossover bridge with steps and handrails should be provided. Plain gravity chutes and sheet iron conveyors provide no particular danger if the opening at the floor above is protected by railings and toeboards and the lower end protected by guards or checks to slow up material being conveyed.

In the 6th type, care should be taken that the fastenings between the rail and ceiling are ample to carry the loads and frequent inspection should be made. The joints between the various sections should be smooth, which is accomplished sometimes by welding so that the trolleys will operate easily. Overloading of this type of conveyor seems to be the usual fault.

Periodic and thorough inspection should be made of all conveyors. Worn and missing parts should be replaced as quickly as defects are found.

No matter what type of conveyor is in use, adequate and accessible starting and stopping equipment should be provided. Where possible, disconnect switches with locking arrangement are not only desirable but necessary to prevent their accidental starting, as well as stopping them in emergency. The most serious conveyor accidents arise from lack of such devices or from their failure to operate when an emergency arises. A good rule for such equipment is to apply but one starting switch and plenty of stopping switches. On long conveyors with several people included in the operation, cables or wire center cord attached to stop switches is an excellent emergency device. In any case all switches should be of the "re-set" type so that the conveyor cannot be started accidentally or without warning, the operator being required to see that everything is clear before starting the conveyor from the main switch.

Where objects are apt to drop through or under conveyors, the openings should be shielded, especially where all moving parts cannot be otherwise protected.

Safety Inspection—Who—When—How

By H. W. LOW

Safety Engineer, Miller Rubber Co., Akron, O.

The title assigned was, I believe, intended to cover the whole subject of safety inspection. It seems to me, however, that the first and most important question has been left out, and I am going to take a few moments to discuss "why." There is only one reason for making a safety inspection—to prevent accidents. Likewise, there is only one reason for not making an inspection—the cost of inspecting.

Therefore, the desirability of making any particular inspection resolves itself into a matter of judgment after balancing the potential hazards which may be overcome by the inspection against the cost of the inspection.

We will all agree that it is better to spend a hundred dollars in preventing an accident than to spend the same amount in compensation to an injured employee. In fact, if the generally accepted ratio—indirect cost being four times the direct cost—is used, it would be good business to spend five hundred dollars to prevent a one-hundred dollar accident. This fact should be borne in mind by the safety engineer in selling the management on inspections against the advice of some hard boiled budget director.

Now let's go on to the "who." There are two general types of safety inspections: First, the general inspection of departments for such hazards as poor housekeeping, unsafe layout of machines or operations, hazardous handling of solvents or cements, and unsafe hand tools and auxiliary equipment, etc. Second, the inspection of specific equipment to be sure it is not likely to fail under any operating condition.

The general inspection can be entrusted to any intelligent, alert person who has been instructed in the purpose of the inspection and given a list of common hazards for which to be on the lookout. It is a good plan to have a group of

about three persons make inspections of this type, preferably some one in a supervisory capacity in the department being inspected and one or two of about equal rating from another department. So far these general inspections in our plant have been made by the supervisory force only, but we are contemplating including some workers with the idea that this may help increase safety consciousness.

The inspection of specific equipment logically comes under the engineering department. I don't think any of us question the ability of trained mechanics to inspect a piece of equipment properly. However, since there is always the possibility of a mechanic's forgetting to make the inspection, the safety department should receive written reports of inspections to serve as a check. These reports also serve as a basis for follow-up if the inspection shows the need for repairs.

On some items such as testing mill line safeties we require the signature of the production department foreman as well as the electrician on the inspection report before the mill line may be put in operation. This is done so that the production department may have the assurance that the equipment is O. K. without any loss of time in waiting for reports to clear through the safety department.

Now the "when." Inspections whether general or specific must be regular to be effective, and practically all of the inspections in our plant are scheduled.

The frequency with which a machine or a department should be inspected is again a matter of judgment based on the potential hazard compared with the cost of inspecting. This frequency varies greatly in our plant from mill line safeties which are inspected at the start of every shift, to the guy wires on a metal smoke stack which are inspected twice a year.

The following are some of the items on our inspection list with the frequency of inspections:

Mill line safeties, every shift; brakes on Oswego cutters, every shift; safety valves on boilers, daily; elevators, daily—Insurance Co. 3 Mo.; steam hose mills and calenders, weekly; ladders, monthly; chain blocks and hoists, quarterly; safety valves on heaters, quarterly; machinists hammers and chisels, quarterly; pressure vessels (internal), semi-annually; and guy wires on stack, semi-annually.

I do not contend that our particular schedule is any better than those in your plants but in our judgment it strikes a fair balance and gives us a good return on the expense.

"How"—To go into the details of the various inspection procedures would require more space than is available but I will run over the methods we use briefly:

Mill line safeties. The safety is pulled by the operator while the line is running empty. The electrician and usually the production department foreman visually check the travel of the rolls before they stop. Electrically operated devices have been designed to measure the roll travel accurately but we feel that a visual check is sufficient.

Brakes on Oswego cutters. Mechanic operates the machine and adjusts the brake until there is no visible sign of the knife's drifting down at the end of the stroke.

Safety Valves on Boilers. Operator pulls safety valves daily to prevent sticking. Once a week the pressure on the boilers is increased until the safety valves pop.

Elevators. Electrican checks operating mechanism, brakes, etc., daily. Every three months the insurance company inspector gives each elevator a thorough inspection including cables, side rails and operating mechanism.

Steam Hose—Mills and Cal. Mechanic inspects hose weekly for leaks and worn places, tightness of clamps, etc.

Ladders. Inspected monthly for cracked or worn treads or side rails. Braces tightened etc.

Chain Blocks. Visually inspected for wear of chain links and operating parts. Elongation of links in load chain checked with gauge.

Safety Valves on Heaters. Valves removed from heater and replaced with another which has been shop tested to pop at the required pressure. In locations where corrosion makes seats stick the valve is pulled manually each shift to keep the seat free.

Mechanics Hammers and Chisels. Employers required to produce hammers and chisels which are inspected for bevel and mushroomed heads.

Pressure Vessels (Internal). Thoroughly inspected internally for weakness which may have developed due to corrosion. Valves and fittings also included in the inspection.

Guy wires on stack. Tying and general condition of wires given visual inspection. Surveyors transit is used to inspect inaccessible parts.

In addition to these specific inspections the plant protection department reports daily on unsafe conditions or practices noticed by the patrolmen in making their rounds. Our men are trained to be observant and turn in a great many valuable items.

It is a responsibility of management to provide a safe place in which to work and there are certain hazardous pieces of equipment which must be inspected if failures are to be prevented. However, the inspection program cannot be left there. If accidents are to be eliminated the whole organization must become safety inspectors. No one knows more about the machines and equipment in a department than the foreman, unless it is the operator. These men, the foreman and the worker, by reporting machines and equipment which are in need of repair, can do more than anyone else to keep our plants safe. It is the safety engineer's job to arouse their interest to the point where they will take the initiative in making these reports.

The Use of Ammonia and Lacquer in the Rubber Industry

By DR. J. NEWTON SHIRLEY

Medical Advisor, Arrow Mutual Liability Insurance Co., Watertown, Mass.

Ammonia has long been a substance looked upon with fear and in European countries the employment of boys under 18 years and girls under 21 years in the manufacturing of ammonia is prohibited. Yet this should not materially worry the safety men in the rubber industry because it is used only in weak solutions. Let us consider the chemistry and then the uses of ammonia.

Ammonia, NH_3, is a colorless gas with a particularly pungent odor. Its boiling point is —33.7 degrees C and its freezing point is —75 degrees C. It is readily soluble in water and is used largely in solution in water. The solution is alkaline and mildly caustic. Evaporation is rapid and accompanied by great absorption of heat.

Its toxicity in strong concentrations is dependent upon its marked action on the mucous membranes. Kober and Hayhurst cite acute transient conditions resulting from temporary exposure to concentrations—intense irritation of the respiratory organs, violent sneezing, lachrymation, redness of the eyes, increased secretion of saliva, burning sensation of the nasopharynx, constriction of the larynx, paroxismal cough with tenacious stringy mucous (spit) which may even be blood tinged, suffocation, vomiting and suppression of urine with possible fatal ending. Such a condition could only occur in the rubber industry in the receiving room, stock room or mixing departments, when spilling of strong ammonia solution happened as the result of an accident, such as the breaking of a pipe line or upsetting a drum of ammonia water or solution.

In smaller concentrations, irritation of the mucous membranes is noted. Kober and Hayhurst report 1500 parts in 1,000,000 parts of air cause irritation of the mucous membranes. Lehmann reports 100 parts per million parts of air is the maximum exposure permissible for constant exposure. He claims that exposure to 300-500 parts per million cannot be endured for more than a moderate time without symptoms. Men working in ammonia fumes note this less than others. Bronchial catarrh is said to result from long continued exposure to small quantities of ammonia gas. Tradition has it, that menstruation in women is made more profuse if obliged to work in ammonia fumes. No confirmation of this claim can be located. Cushny reports the action of ammonia as local in nature only, claiming that the fumes are not absorbed by the lungs under normal conditions. He states that reflex stimulation of the vasomotor center from irritation of the throat may slow the heart and increase the blood pressure temporarily.

Present day use of ammonia in the rubber industry is largely in latex solutions, where it keeps latex in suspension. In dip tanks with such a solution, ammonia fumes are quite apparent. In some processes fixed alkalies are replacing ammonia

in this work. While no reliable information can be located to give the concentration of ammonia fumes in work rooms of this nature, I believe it to be less than 300 parts per million.

Ammonia is also used in certain vulcanizing processes. Under such conditions, there should be no hazard save that of leakage, as the vulcanizers are vented or blown before they are opened and very little ammonia could be left.

There have been numerous claims of ammonia causing arrested cases of tuberculosis to become active. I can see no reason to believe that such could happen in the rubber industry under present conditions of work. In fact, men who are working in the dip rooms state that they have been free from colds since entering that department.

Lacquers

As used in the rubber industry, a lacquer is a preparation applied to a rubber product, either before or after vulcanization, to give it a dull or glossy surface to improve the wearing qualities and appearance or to give it a different color from that obtained by the compounding method necessary. It is primarily a covering layer, firmly bonded to the rubber product, which has an elasticity and flexibility equal to that of the rubber compound.

The formation of the lacquer is of course quite variable but I believe the notation in Thomas H. Durrans "Solvents" covers the general description. He states that cellulose lacquer is composed of: 1. a cellulose ester; 2. a resin; 3. a solvent of high vapor pressure; 4. a solvent of medium vapor pressure; 5. a diluent or thinner; 6. a plasticizer; 7. a dye or pigment. In looking over this formula, I believe that we need only consider the solvent and thinner seriously when talking about health hazards. Cellulose esters are *harmless*. Most *resins require little* consideration because of toxicity. The plasticizers are fairly safely handled, and the dyes and pigments are used in small quantities and any toxic action is known to the chemist.

When we get into the list of solvents and thinners, we are dealing with a group of hydrocarbons, some of which are definitely toxic. We have already dealt with some of these in previous meetings. A list of solvents and thinners contains a great many materials which are not generally known to the ordinary layman and have come into use industrially with the development of synthetic organic chemicals. A partial list is noted below:

Hydrocarbons: benzol, toluol, xylol, tetralin, decalin.

Alcohol: methyl (methanol), ethyl, propyl, iso-propyl, butyl, benzyl.

Glycols: ethylene glycol, di-ethylene glycol, ethylene glycol mono-methyl ether (methyl cellosolve), ethylene glyco mono-ethyl ether (ethyl cellosolve), di-ethylene glycol mono-ethyl ether (carbitol), ethylene glycol mono-butyl ether (butyl cellosolve), di-ethylene glycol mono-butyl ether (butyl carbitol).

Ethers: ethyl ether, iso-propyl ether, butyl ether.

Ketones: acetone (di-methyl ketone), methyl acetone (methyl-ethyl-ketone).

Esters: methyl acetate, ethyl acetate, propyl acetate, iso-propyl acetate, butyl acetate, amyl acetate, butyl propionate, ethyl lactate, amyl lactate, di-ethyl carbonate.

Chloro compounds: epi-chlorhydrine, chloroform, carbon tetrachloride, beta-tetrachlorethane.

Now, some of these solvents are toxic and others are decidedly objectionable to the workman because of the odor or temporary local effect on the mucous membranes. For this reason, certain precautions should be taken to insure as low a vapor concentration in the air as is possible, or practical.

The present day procedure is to exhaust ventilate the process and the type of procedure would depend upon the manner in which the lacquer is being used. Let us note how lacquer may be used.

1. Small quantities of lacquer may be applied by brush in such work as coloring medalions. Here the process requires a very small amount of material and general room ventilation may be all that is necessary. Under such conditions, known highly toxic solvents and thinners should not be used. Where the brushing process is extensive, local exhaust ventilation should be used, usually hooding the operation.

2. Large amounts of lacquer are being used today in spraying processes. This work should be done in exhaust hoods or spray booths. The amount of exhaust ventilation and the angle at which the spraying is done should be adjusted so that the breathing space will be as free as possible of the vapors. In rare cases, it may be necessary to have the operator wear gloves to prevent constant contact of his hands with the solvent spray.

3. Spreading machines are used in applying lacquer to such products as artificial leather, a line of work frequently carried on in rubber factories. Such processes should be adequately locally exhaust ventilated. The successful plant today using this process incorporates a solvent recovery plant with the exhaust system. The efficiency of the exhaust system and the recovery process will determine how long the company can continue to operate.

This covers briefly the use of lacquers but we must not forget that these lacquers must be mixed. Certain attention to mixing methods and the handling of solvents must be noted. In so far as possible, this work should be carried on in a closed system whenever toxic vapors are used.

In a resume of lacquers, solvents and thinners, certain toxic substances may be found. These may be highly toxic—as benzol, methanol or chloroform; or objectionable to the worker because of penetrating odor—as amyl acetate. Any one of the above features requires control of the vapors for efficient production.

Health Hazards and Their Relation to Safety

By DR. W. S. ASH

U. S. Rubber Products, Inc., Detroit, Mich.

All absence on account of illness cannot be attributed to *health* hazards in industry. It may sound paradoxical, but I believe that a job may be without any health hazard whatever and yet be terribly dangerous; on the other hand, danger to life and limb may be negligible and the health hazard be marked. Even so, what constitutes a health hazard is open to a wide and varied interpretation. I may consider some job, or operation, very hazardous on account of some unfortunate expereince, while you may look upon the same job as comparatively harmless because you have had better luck—if we may use that term. Again the old adage of "What is one man's meat is another man's poison." This applies to both the job and the individual who performs the job.

Determining just what features of a given job contribute to the health hazards of that particular job is a rather complicated matter because of our old friend, the human equation. Individual response on the part of the worker *determines* largely whether we say the job is hazardous. Nor must we lose sight of influences outside the factory which have a very positive bearing on any working condition, regardless of hazard. I have said at other times, and I repeat it, that an employee of regular habits is preferable to a night owl; an employee with a harmonious home life is preferable to one whose hours away from the shop are filled with domestic discord; an employee who realizes that a good physique is something to be prized and maintained is preferable to the chap with the bottle of soda tablets or aspirin in his pocket.

Speaking of the individual influence on job hazard, I believe we all agree that dark skinned persons are less susceptible to skin lesions than light skinned ones; some races seem more inclined to tuberculosis than others; some are mentally equipped to follow along certain lines better than others, etc. However, no matter what working conditions we place in the health hazard class, there are only two angles from which the safety picture is affected; (1) Physical, and (2) Psychological, and I am inclined sometimes to place the psychological first because of the easy way we human beings are influenced by extraneous circumstances. The worker on the job is affected, and we who are supposed to view things from a kind of detached viewpoint are also affected, most of the time unconsciously, I'll admit. We hear over the radio, for instance, that a certain salts from a certain distant state is just what we need to put pep back in the old human machine, so we dash down to the nearest drug store, invest our dollar, follow the directions on the package, and feel that we are getting just what the doctor ordered without paying his fee.

No matter that the package contains only a few cents worth of Glauber's salts or Epsom salts, didn't the printed matter say it was what we needed? Our mental set-up convinces us that all is well in the health world.

And so the man on the job in the shop hears that some chap who worked there previously died of tuberculosis, cancer, heart disease, or what not, and he makes up his mind that a decided health hazard exists. And he doesn't hesitate to tell all and sundry listeners about it. He never gives a thought to any outside influences to which the deceased may have been exposed. The man died; therefore the job had something to do with it.

Many Errors in Diagnosis

Last spring the local papers ran a large headline about the State Industrial Board demanding that all cases of lead poisoning be reported, even though they are not compensable. In less than two weeks we had six employees come in with statements from their family physicians that they were suffering with lead poisoning. Not one of these men was exposed to lead in their work, but we had them all checked and lead was ruled out in all cases. At another time there was an explosion in a refrigerating plant and ammonia fumes did a great deal of damage. The following week we had three employees whose physicians thought they were "poisoned by ammonia" merely on the statement that ammonia was used in our plant.

Take our most consistent trouble breeder, dermatitis, and what do we find? In spite of all our educational efforts to set the worker right on skin lesions, he, and unfortunately sometimes his supervisors, still cling to the old idea that *any* skin eruption in a rubber factory is rubber rash. Dusty occupations are usually associated with pulmonary diseases, yet many present day investigators have shown conclusively that dust is not such a taker of life as was once thought. Aside from the quartz family the problem is not so great, nevertheless that is no justification for permitting dusty and dirty jobs to continue if they can be cleaned up.

In the state of Michigan we would naturally suppose that the highest death rate from pulmonary disease would be in the urban centers, of which Detroit is the largest by far, having a cosmopolitan population including about 100,000 Negroes, and where almost the entire wage earning group is employed in factories and exposed to the so-called health hazards. Yet, there are 16 counties in the state which have a higher death rate, some over twice that of Detroit. Insurance people, also, are very impersonal beings and base their findings on careful analyses. Our premium rate has been reduced 15 per cent in the last year.

We might go right on down the line of most of our manufacturing processes and find something which would seem to put them in a class of health hazards. Ventilation, lighting, heating, temperatures, etc., all might be saddled with some kind of health hazard. Poor ventilating may produce a headache, take a man's mind off his work, and cause an accident, but there are other causes of headache. Exposure to extreme heat may cause collapse, but not half so easily if the worker has had his rest the night before instead of being in the neighborhood beer garden until the wee small hours. In our hot departments we do not place thermometers on every pillar and post. The foreman in one particular department never goes out among his men without snugging up his collar and tie, and sometimes even putting on his coat. We haven't had a single heat prostration in this department this year; we never have an employee asking for a transfer on account of working conditions; and the accident rating is among the lowest in the plant despite what we might call the natural hazards of working in such a department.

Without entering into specific cases, we will simply say that anything which affects an employee's physical well being, his poise, his balance, his mental alertness, will play havoc with any safety record. But before we pin a definite hazard tag on any job let us consider it from all angles. Let the engineering and medical departments make occasional joint surveys, giving due thought to all outside influences as well as to those which seem inherent to the job. Then, when a really positive conclusion can be reached, it should be presented to management promptly, and management will usually be governed accordingly.

TUESDAY LUNCHEON SESSION

October 15, 1935

Rubber Section Safety Contest

Thirty-six units were registered in the fourth annual contest of the Rubber Section. Sixty-seven thousand, seven hundred sixty-eight persons worked 60,090,000 man-hours on an average frequency rate of 6.291, which is a two per cent decrease from the 1934 rate of 6.430. Eighteen units completed the contest with a frequency rate below the average and five units completed the contest with perfect records. Six plaques were awarded in the contest and four certificates.

The plaques were presented by Thomas P. Kearns, superintendent, Division of Safety and Hygiene, Industrial Commission of Ohio, and member of the Executive Committee, National Safety Council, as follows:

Group A—U. S. Rubber Products Inc., Naugatuck Footwear Div., Naugatuck, Conn., 5,045,246 hours, 9 injuries.

Group B—The B. F. Goodrich Co., Pacific Div., Los Angeles, Calif., 756,268 hours, no injuries.

Groups C and D—Four tied for first place—Samson Tire & Rubber Corp., Los Angeles, Calif., 657,436 hours, no injuries; The Goodyear Tire & Rubber Co., Bowmanville, Canada, 393,711 hours, no injuries; Van Cleef Brothers, Chicago, Ill., 127,068 hours, no injuries; The Richardson Co., New Brunswick, N. J., 88,653 hours, no injuries.

Compounding Materials Used in the Rubber Industry, Their Classification and Health Hazards. Groups II, III and IV

LEON J. D. HEALY

Consulting Chemist and Engineer, Milwaukee, Wis.

At the sixteenth annual Safety Congress, the writer gave his first paper on materials used in the rubber industry. That paper was the outgrowth of an effort on the part of the Health Hazards committee of your section to provide authentic data on the hazards existing through the handling of compounding materials used in the industry.

That first paper was revised in 1931 and used as the basis for a safe practices pamphlet on rubber compounding ingredients issued by the National Safety Council. The paper gave a general summary of the usual ingredients used for compounding rubber, divided into four groups:

Group I—Organic Accelerators and Dry Organic Compounds.
Group II—Dry Inorganic substances.
Group III—Gums, Oils, Resinous Materials and Waxes.
Group IV—Liquids and Gases.

The first group was a comparatively new line of ingredients, developed largely since the war by our new chemical industries. Some of them had given no small amount of worry to our safety departments in the matter of toxic poisonings, skin irritations, and other discomfitures to many rubber workers. Their chemistry and physiological effects were not well understood. For these reasons my paper was confined to this Group I and was made the basis of a safe practices pamphlet.

On account of the upset conditions prevailing in industry during the past few years, the other three groups were never completed. Early last spring, your section urged the writer to continue with work on the remaining groups as originally out-

lined. I have now, therefore, completed the classification of the other groups along the lines presented herewith. I have included practically all of the usual compounding ingredients used for rubber. It must be realized, however, that new materials are constantly being developed and in some cases new and unusual uses are being made of old ones. These can be added from time to time.

It has been the writer's object to limit the description of materials to those facts most pertinent to the safety engineer. This classification is a sort of ready reference or dictionary of compounding materials used in the rubber industry. Each ingredient is listed alphabetically, together with a brief description of its properties, its use in the industry, its relative health hazards and its safe handling. I believe that this is all that the safety department requires in the majority of cases. Where more information is necessary, recourse may be had to such works as Hamilton and other sources of information.

GROUP II—Dry Inorganic Compounds

Most of the compounds in this group are of a soft mineral powder type of a particular size less than 200 mesh and many of them less than 300 mesh or even finer. Very few of them contain hard or abrasive particles such as silica, corundum, etc. Likewise only a very few are toxic, so on the whole this group is comparatively free from health hazards. However, they are all more or less dusty when handled carelessly and there is always the ordinary dust hazard present. Good storage bins, conveyors, hooded mills, and efficient exhaust fans can readily eliminate all dust hazards and in most cases also prevent harm from the toxic or silica-bearing compounds.

There are several compounds whose handling should receive special consideration, such for instance as lead or silica bearing compounds. These are so designated in the following conspectus of materials in this group.

Aluminum Flake. A fine cream colored powder consisting primarily of aluminum silicate. Used as a filled in rubber. It is non-gritty and non-toxic.

Ammonium Carbonate. A white crystaline or lumpy powder having a strong, pungent odor of ammonia. Readily decomposes and gives off irritating odor during mixing. Used in sponge rubbers. Slightly toxic but very little hazard in connection with its handling.

Antimony Sulphides. There are two types, the golden and the red antimony sulphides. They are used for coloring rubber articles. Some grades contain a considerable percentage of free sulphur and calcium sulphate. They are slightly toxic and also are irritating to skin and mucous membrane. No hazard with careful handling.

Asbestine. A fibrous variety of talc used in rubber as a filler, especially in packings and gaskets. Is a magnesium silicate. In appearance, it is a white powder, non-gritty and non-toxic. It should be borne in mind that many of these silicates, when not pure, may contain traces of silica. No hazard if dust is kept down.

Asbestos. A fibrous magnesium silicate used in many types of rubber goods, especially of the packing and gasket type, and where the rubber must withstand considerable heat. It may be obtained in many different lengths of fiber, varying from an inch long down to almost a powder. Grayish white usually, in appearance. There is no hazard connected with handling this material in compounding.

Barium Dust. A trade name for barium sulphate (which see).

Barium Sulphate. A heavy white powder used for reinforcing rubber and also as a filler. Insoluble in most solvents. It is non-absorbable and non-toxic. No hazard in handling.

Barytes. Commercial name for natural deposit of barium sulphate.

Beckton White. A trade name for lithopone.

Blanc Fixe. A trade name for barium sulphate.

Blue Lead. A grayish-blue powder used as a mild accelerator and for compounding. A mixture of active lead compounds and very toxic. (See lead compounds.)

Cadmium Yellow. A fine light yellow powder of cadmium sulphide, used for coloring rubber. Slightly toxic. It can cause irritation of mucous membranes and also gastritis. No hazard with careful handling to keep hands clean and dust down.

Calcined Magnesia. (See magnesium oxide.)

Calcium Chloride. White to brownish deliquescent crystals or lumps. Very soluble in water. This material is not added to the rubber but dissolved in water and used as a bath for vulcanizing rubber articles. It is irritating to skin but non-toxic.

Carbon Black. An exceedingly fine dusty black powder. Used in tremendous quantities for tires and many lines of rubber goods as a reinforcing ingredient. The dust is difficult to cope with, but is non-absorbing and non-toxic.

Carbonate of Ammonia. (See ammonium carbonate.)

Carbonate of Magnesia. (See magnesium carbonate.)

Caustic Soda. Same as sodium hydroxide. A white deliquescent substance usually in the form of sticks, flakes, or lumps. Very soluble in water. It is dissolved in water and used as a bath or wash for rubber articles to cleanse, remove bloom, grease, etc. It is very caustic, disintegrates organic tissue and should be handled with great care to keep from the flesh. Otherwise not toxic, in the ordinary sense of the word. Also used in reclaiming.

Chalk. (See whiting.)

China Clay. (See clays.)

Chrome Green. A green mineral powder pigment used for coloring rubber. Slightly toxic and causes irritation of mucous membranes and possibly slight ulcers. No hazard with reasonable care.

Chrome Yellow. A deep yellow powder used for coloring rubber. This is a chromate of lead, although there are also chromates of zinc and barium. But the lead salt is the one usually used for rubber. While the chromate is relatively insoluble and inert, it is always wise to handle lead compounds with extreme care, due to the presence of very active lead impurities which might be present. (See lead compounds.)

Clays. There are an innumerable number of different kinds of clays ranging in colors from white to black. The ones used for rubber compounding are usually the white variety ranging in color from exceedingly white to cream or buff. Most of the clays are very fine smooth powders varying greatly in both their chemical and physical properties. They are of natural origin and chemically a hydrous aluminum silicate. The clays are usually non-gritty and are non-toxic. They are used as fillers and for reinforcing.

Crimson Antimony. Another name for red antimony sulphide.

Diatomaceous Earth. A very soft earthy rock composed of the silicious skeletons of small aquatic plants called diatoms. It grinds to an impalpable powder and is extremely light and fluffy. It is used for filler in rubber compounds. It is non-toxic but care should be taken to keep down excessive dust.

Emery. A fine abrasive powder used with rubber for making erasers and emery wheels. Basically it is an aluminum oxide. It is non-toxic but very sharp and dangerous to inhale. Take same precautions as for silica. Also called corundum.

Fossil Flour. (See diatomaceous earth.)

French Chalk. (See talc.)

Fuller's Earth. A clay relatively high in magnesia. Used as a filler in rubber goods. Non-gritty and non-toxic. (Also see clays.)

Golden Antimony. (See antimony sulphides.)

Graphite. A grayish-black soft greasy powder. Used for lubricating rubber moulds and as a filling material for such compounds as gaskets, packings, etc. It is an impure form of native carbon. It is non-toxic.

Ground Glass. A very fine powdered glass used for compounding rubber to make erasers and other rubber abrasive utensils. It is very sharp and same precautions should be observed as for silica. It is harsh on the hands but non-toxic.

Gypsum. A grayish-white powder used for compounding rubber. It consists of a pulverized natural hydrous calcium sulphate. It is non-gritty and non-toxic.

Hard Rubber Dust. A very fine ground hard rubber, grayish to black in color. It is very light and fluffy and sticks to whatever it touches. Ordinarily it consists mostly of vulcanized hard rubber which is rubber and sulphur but may also contain other mineral or organic substances used in compounding rubber. Dust should be kept down, but otherwise the material is not hazardous or toxic.

Heavy Magnesia. Heavy calcined magnesia, or magnesium oxide. (See magnesium oxide.)

Hypo. Lead hypo sulphite. (See lead compounds.)

Iron Oxide. The red oxide of iron. (See red oxide.)

Infusorial Earth. (See diatomaceous earth.)

Kaolin. A white china clay. (See clays.)

Kisselguhr. (See diatomaceous earth.)

Light Magnesia. The light calcined magnesium oxide. (See magnesium oxide.)

Note:—Magnesium carbonate is often spoken of as light magnesia.

Lamp Black. A black carbon pigment obtained by burning oils and oily residues. Carbon black is often miscalled "lamp-black." Its characteristics are similar to carbon black, (which see). It is not used to any great extent. It is not toxic.

Lead Compounds. Before the advent of organic accelerators, the lead compounds were the most widely used accelerators of vulcanization. Some of these lead compounds are still used in large quantities. The usual lead compounds used in rubber compounding are:—blue lead, lead thiosulphate, hyposulphite, or hypo, lead oleate, lead oxide or litharge, sublimed white lead, and basic white lead. Blue lead, lead thiosulphate, and hypo lead are no longer used to any extent. These are active compounds of lead which reacted readily with sulphur at vulcanizing temperatures to speed up vulcanization. They are more or less active compounds and readily assimilated if taken into the system either through breathing or through food contaminated by contact with dirty hands or clothing.

Lead oleate is still used to a considerable extent both as an accelerator and for extruded and moulded goods. It gives a good finish and elimiates bloom in certain types of stocks. It is an active poison and should be treated with care. It is a soft, waxy substance, so there is no danger of dust, the real danger being of sticking to hands and clothing. It can be handled with perfect safety if cleanliness is observed.

Lead oxide or litharge is probably the most extensively used lead compound and the one to be most feared. It is a heavy, fine orange to brown colored powder. The dust is very fine but being of a very heavy gravity, settles quickly. Those handling this material should wear a dust mask if there is the slightest danger of inhaling any dust or getting it in the mouth or saliva. It is dangerous to handle tobacco, gum, fruit or any food until after a thorough clean-up. Mixing mills should be hooded and every precaution taken to keep down dust. Lead oxide is a very active material and consequently very toxic. There is no need to enlarge on Lead Poisoning as the subject has been very thoroughly covered and I am sure all rubber factory safety heads are familiar with the symptoms and treatment of lead poisoning cases. Litharge can be safely handled if reasonable care is exercised in its use. The worker should be instructed as to its serious toxic properties and pains taken to instruct him how to safely handle it.

Sublimed white lead is largely lead sulphate with about 15 per cent of active lead oxide present. It is the free lead oxide which is the active accelerating ingredient and also the real toxic substance. While much less toxic than the litharge, it should, however, be handled with the same care as the latter substance.

Basic white lead is a white powder consisting of a basic carbonate of lead. It is not now used to any great extent for rubber compounding. But it is a very active and toxic substance and should be handled with as much care as litharge where used.

Anyone using the above lead compounds to any extent should post themselves on the symptoms of lead poisoning, its treatment and avoidance of trouble from poisoning.

Lime. A fine dry white powder used quite extensively in rubber compounding as a secondary accelerator and drying ingredient. This compound is the so-called hydrated calcium oxide or slaked lime. It is slightly caustic and irritating to mucuous membranes but non-toxic. No hazard is involved in its use.

Litharge. Lead oxide. (See lead compounds.)

Lithopone. A very fine white powder consisting of barium sulphate and zinc sulphide of high coloring powder. It is one of the most widely used pigments for producing white rubber goods. Being rather inert, there is no hazard connected with its use other than the general dust hazard. The zinc present in the material might be dissolved if considerable quantities of dust were taken into the system, but zinc in such quantities would not be considered as a toxic material.

Magnesium Carbonate. Also called magnesia carbonate and light carbonate. This is a very fluffy white powder. It is, next to carbon black, one of the lightest powders we have and therefore causes considerable dust. It is, however, non-toxic and very soluble if taken internally. But it has no poisonous effects. It is an ingredient often used for baby and toilet powders and also used in many medical preparations as an anti-acid and mild laxative. No hazard connected with its use other than nuisance of dust.

Magnesium Oxide. Also called magnesia oxide and calcined magnesia. It is obtained by heating the magnesium carbonate. There are two grades used extensively in the rubber industry, one called heavy calcined magnesia and the other light calcined magnesia. The heavy calcined product is more dense and slightly darker in color than the light calcined material. They are both used as auxiliary accelerators and to neutralize acid reactions. The percentage used is relatively small in most cases. The dust is slightly irritating to mucuous membrane but non-toxic. No hazard connected with its use.

Magnesia Usta. Same as magnesium oxide.

Mica. A form of aluminum silicate which when ground fine is a soft glistening powder. The particles are flat in shape and slide over each other giving the slippery properties noted in graphite. The color runs from a cream white to gray, but the grade usually used for rubber is a fairly good white. It is used for dusting raw rubber to keep the slabs from sticking together and also for dusting finishing goods, especially spread and coated goods to give a smooth glistening and pleasing finish. Mica is also used in packings and mechanical goods as a filler where goods are to resist heat and acid. The material is non-toxic and there is no hazard other than the dust hazard. Cheap grades might contain traces of silica.

Oxide of Magnesia. (See magnesium oxide.)

Oxide of Iron. (See red oxide.)

Paris White. (See whiting.)

Plaster of Paris. (Seee gypsum.)

Plumbago. (See graphite.)

Pumice. A grayish powder consisting of ground lava. It is a complex silicate of aluminum, potassium and sodium. It is used as a soft abrasive for producing a smooth, polished surface on rubber goods such as mechanicals and rolls. Also it is used as a filler in acid and heat-resisting rubber goods. It is non-toxic but reasonable care should be exercised in keeping down dust.

Prussian Blue. There are a number of so-called prussian blues with varying shades and solubilities, all belonging to the iron blues. They are fero-feri-cyanide compositions. The blues used for rubber are the insoluble type and prepared to withstand the temperatures of vulcanization. They are used in comparatively small quantities and there is no hazard connected with their handling.

Red Oxide. A fine red pigment very dense and heavy, and consisting of the red oxide of iron. It is also called iron red. It is one of the most widely used red pigments for coloring rubber. It is non-toxic and no danger involved in its handling. Advisable to keep dust down as it flies readily.

Red Ochre. A dull brownish red powder used for coloring rubber goods. It does not give the brilliancy of red oxide. It cousists of a ground natural impure form of iron oxide. It is more gritty as a rule than the regular red oxide and often contains silica. It is non-toxic, but care should be exercised in keeping down dust due to possibility of silica being present.

Rotten Stone. (See tripoli.)

Sand. (See silicon dioxide.)

Silica. (See silicon dioxide.)

Silicon Dioxide. Also called silica and quartz, sand, etc. A very hard abrasive powder varying in particle size from a very fine powder to large, sharp particles which we know as sand. The color may vary from almost pure white to yellow or brown or grayish. This is the material which has been so widely discussed in cases of silicosis. It occurs as an impurity in many dusts and powders and is usually present in common road dust. In rubber compounding, its use is confined to such special rubber articles as erasers and abrasive wheels. A very fine grade is also used as a special filler for certain rubber goods. However, its use is not general throughout

the rubber manufacturing trade. Wherever used, the workers weighing and mixing should be protected from inhaling the dust, being supplied with suitable masks where necessary. Many cases of silicosis have been unjustly laid to rubber compounds, where the workers have been subjected to silica dusts previous to their employment in the rubber factory. There is an abundance of available data on Silicosis which should be studied by anyone using or contemplating its use.

Slate Flour. A fine bluish-gray powder consisting of ground slate. In composition it is similar to clays. It is non-toxic, but it may contain silica, so reasonable precaution should be taken to prevent inhaliation of the dust. It is used as a cheap filler and for certain heat-resisting and acid-resisting rubber goods.

Soapstone. (See talc.)

Sulphur. A pure natural deposit ground to an impalpable powder. It is light yellow in color and is the principal vulcanizing ingredient used in all rubber manufacture. With very few exceptions, all rubber goods are cured or vulcanized with sulphur or in a few cases with sulphur compounds. It is non-toxic and no hazard is encountered in its use. There are several varieties of sulphur, such as flowers of sulphur and precipated sulphur, but chemically they are the same as the natural product.

Talc. A fine white to gray powder, characterized by an extreme softness of touch and having a peculiar greasy or soapy feel. It is very generally used throughout the rubber industry as a lubricant or dusting powder. It is a hydrous magnesium silicate and very inert. It is non-toxic and there is no danger in its handling other than the usual dust hazard.

Tripoli. Also called rotten stone. It is a porous silicious rock resulting from the natural decomposition of sandstone. It is used as an inert filler and as a mild polishing compound for rubber. It is non-toxic but reasonable care should be exercised to prevent excessive dust, and especially inhalation of same.

Tripolite. (See diatomaceous earth.)

Ultramarine Blue. A very common blue powder used for coloring rubber goods. Its composition is variable but consists essentially of a double silicate of sodium and aluminum, and sodium sulphide. It is a dark blue powder fast to heat and sulphur. It is non-toxic and no hazard with its use.

Umber. An iron oxide with varying amounts of clay and silicon compounds. There are two common varieties, the raw and the burnt umber. The raw is the natural deposit ground and levigated whereas the burnt umber is calcined at low heat. The former is a yellowish buff to brown color and the latter a reddish brown color. They are low cost colors used quite extensively in rubber floorings and mechanical goods. There is no hazard in their handling other than the dust hazard.

Venetian Red. (See red oxide.)

Vermilion. A fine, very brilliant scarlet to orange colored powder consisting of mercuric sulphide. It is used in a limited way for coloring certain types of rubber but is too costly for general use. It is a very inert compound and no hazard involved in its use.

Whiting. A soft white powder consisting of over 98 per cent calcium carbonate. It is one of the most widely used filling compounds for rubber manufacture. It varies in color from a good white to gray. The poorer grades may contain some traces of silica. It is non-toxic and there is no hazard connected with its use unless it contains free silica which can be determined by laboratory analysis.

White Lead. (See lead compounds.)

Yellow Ochre. An earthy mineral deposit which when ground produces a cheap coloring pigment used in coloring rubber goods. Used principally for floorings and mechanical goods. It consists of hydrated ferric oxide admixed with clay and other silicious materials in varying amounts. There is no hazard in its use for coloring rubber.

Zinc Oxide. Next to sulphur, this is probably the most widely used rubber ingredient. It is used both as an activator of acceleration in vulcanizing the rubber and as a white reinforcing ingredient. It is a very fine white amorphous powder. Taken internally, it is slightly toxic, but with proper precautions for keeping down the dust there is no serious hazard in its handling.

Zinc Sulphide. A fine white powder with yellowish tinge used for coloring rubber. It has great tinctorial strength but is not as good a reinforcing ingredient as zinc oxide. There is no especial hazard involved in its use. (See also zinc oxide.)

GROUP III—Gums, Oils, Resinous Materials and Waxes

This group contains materials which are either liquid or semi-solids and therefore there is no dust hazard. Also all members of this group are practically non-volatile at temperatures encountered in rubber processing. None of the substances mentioned are known to be toxic with the possible exception of some of the tars or pitches. But there is practically no hazard here because of the relatively small amounts used and the fact that it is neither in fine particles nor sufficiently hot to give off fumes. (See Shirley on Tars. National Safety Council Trans. 1927.)

The oils are usually added directly to the rubber on the mills and worked in whereas the solid resins and waxes are either melted or ground to coarse flakes before adding so as to distribute and work into the rubber more readily. With reasonable care and cleanliness there is no hazard in their use.

Oils and Resins known as organic accelerators, are not included with this group but are classed in Group I under Organic Accelerators and Compounds.

The members of this group are largely used as softeners and plasticizers.

Asphalt. Also called bitumen and mineral pitch. It is a natural deposit of bituminous mixtures either solid or semi-solid readily softened by heat. The color of the natural material is brown or brownish black. Many treated or blown asphaltic compounds are also used in rubber compounding and the latter may be obtained in almost any degree of hardness. They are usually black and have a bright fracture when broken. Used as a softener and cheap filler, especially for extruding and covering stocks.

Balsam. (See Canada balsam.)

Beeswax. A yellowish to white colored wax obtained from the honey comb of bees. It is a tough fairly high melting wax used to render rubber impervious, as a softener in extruding and as a mild preservative against action of light.

Bitumen. (See asphalt.)

Brown Substitute. (See factice, brown.)

Black Substitute. (See factice, black.)

Burgundy Pitch. An opaque yellowish to reddish-brown resin obtained from Norway spruce. Softens under heat and used in conjunction with other oils to give tack to rubber, especially unvulcanized frictions, tapes, etc. Also used in tacky cements.

Canada Balsam. A resinous exudation from spruce used to give tack in rubber frictions and cements. (See also Burgundy pitch.)

Carnauba Wax. Used quite extensively in rubber compounding to produce a dense, impervious product for rubber coatings, floorings, etc. It is very hard yellowish to buff colored wax of high melting point. Usually melted before adding to the rubber batch. Carnauba wax is obtained as an exudation from leaves of the Brazilian wax palm.

Castor Oil. A thick, yellowish oil obtained from the castor bean. Used as a softener in rubber and in the production of certain rubber substitutes or factice.

Ceresin. A purified mineral earth wax having a melting point of approximately 74 deg. C. It comes in white cakes. Used in rubber to render it more impervious to water and air, as a softener and for extruded articles and coverings, electrical insulations and for acid-resisting rubbers.

Coal Tar Pitch. A brown to black amorphous body consisting of the residue remaining in the retorts after the coal tar has been distilled. It varies from a soft sticky to a hard brittle mass according to the degree to which the distillation has been carried out. Coal-tar pitch is used as a softener, tack producer, and for extruded goods. It might contain residues of coal tar products which are toxic, but the high temperatures of distillation should remove most of these, and the small amounts used for most rubber work preclude there being any serious hazard in its use.

Colophony. Common pine rosin which is obtained as a residue after the distillation of turpentine oil from crude turpentine. Varies in color from light amber to very dark reddish brown. Used in many rubber compounds for producing tack and

in rubber cements. It usually comes in lumps and is readily pulverized or melts down when added to the rubber batch on the mill.

Corn Oil. A pale yellow oil obtained from the germ of the common corn. It is used in rubber as a softener, in reclaiming old rubber and in the manufacture of factice or rubber substitute.

Cottonseed Oil. A pale yellow to reddish brown oil obtained from the seeds of the cotton plant. It is used in rubber as a softener, for reclaiming old rubber, and in conjunction with resins to produce tack.

Cumar. A synthetic resin consisting of polymers of coumarone, indene, and homologous compounds. It can be obtained in several states, varying from a liquid to hard, high-melting resins. The color varies from light buff to brown. They are used quite extensively in various rubber compounds, such as soles, flooring, friction tapes and cements. Cumar is also used in acid and alkali resisting stocks.

Degras. Also known as sod oil and wool grease. It is a dark brown grease obtained from the washings of sheep's wool. It is used in rubber as a softener and for aiding processing of the raw rubber such for instance as calendering and extruding.

Factice, Black. A black, gummy cake resembling rubber in some respects, but easily disintegrated, by crushing. It is made by vulcanizing vegetable oils with sulphur and adding mineral rubber. Black factice is added directly to the rubber on the mill and is used as a soft filler. It has the property of absorbing other fillers and thus bulking up the rubber. Besides its use as a filler and bulking material, it is used for producing smooth finish on calendered and extruded goods. No hazard in the use of factice.

Factice, Brown. Also called brown sub. It is a vulcanized oil usually made from corn or similar oil by heating with sulphur until the vulcanization has proceeded to proper stage. In appearance it is a dark brown cake, easily crumbled. It is added directly to the rubber on the mill. It is used as a soft filling material in molded goods, druggist's sundries, proofing and tubing.

Factice, White. A white granular powder prepared by vulcanizing vegetable oils with sulphur chloride. Rapeseed and soya bean oils are often used for making white factice. The factice is added directly to the rubber batch on the mill. It is used in druggist's sundries, tubing, extruded articles, rolls, pads and molded articles. It gives a smooth velvety finish and facilitates calendering, tubing, and other processing operations. No hazard.

Gilsonite. A very pure natural bitumen found in the United States only. It is a black mass breaking with conchoidal fracture and showing bright lustre. It is used in floorings, mechanical goods, coatings, varnishes, insulation, gaskets and cements.

Glucose. A thick viscous syrupy liquid made from corn. It is used in a few rubber compounds, cements and for latex compounding.

Glue, and Gelatin. A nitrogenous colloidal substance of the protein class which is derived from animal connective tissues and bones, obtained from slaughter house and tannery waste. It comes in sheets, chips or ground granules, usually of a light amber color. Always contains some water. Added directly to the rubber on the mill or dispersed in water. Glue is used in rubber as a reinforcing ingredient of low gravity. It gives strength, stiffness, and good processing qualities. Used in tubing, rollers, coatings and latex compounding.

Guayule. A resinous rubber native to Mexico and southern U. S. having about 25 per cent of resin. It is used largely for soft rubbers such as friction stocks. Being of a soft resinous nature it does not require as much breaking down as smoked sheets and small amounts are often added to the harder rubbers to speed up the breaking down time.

Gumkaraya. Gumkaraya is a bassora type of gum similar to gum tragacanth. It is used for thickening latex solutions.

Gum-Tragacanth. Dull white translucent plates or yellowish powder. It is a vegetable gum used for cements and as a thickener for latex solutions.

Gutta Percha. The coagulated milk juice of various tropical trees. It comes in yellowish or grayish hard leathery sticks. It is used with rubber to impart certain leathery properties. Also used in golf-ball manufacture and cements. One large use has been in the coating and impregnation of fabric for driving belts, clutch linings, wire coverings, etc.

Hardwood Pitch. A brown bituminous material consisting of the residue from the distillation of hard wood. Used as accelerator activator, and for giving tackiness to rubber stocks. Added directly to the rubber on the mill. Only comparatively small percentages are used and no hazard involved.

Hydrolene. A black bituminous mass resembling asphalt obtained from the residue remaining after the destructive distillation of petroleums. Used as a filler and softener in much the same manner as asphalt, which see.

Linseed Oil. An amber colored drying oil obtained from the seeds of the flax plant. Used in rollers and cements. Also used in preparing rubber substitutes in the form of factice by vulcanizing the oil with sulphur chloride.

Mineral Oils. There are numerous grades of mineral oil ranging from the light paraffin oils to petrolatums, which are used for softening rubber compounds and preventing scorching. The most common oils are the light paraffin oils which find a use in many types of rubber compounds. The oils are added directly on the rubber mill and they are quite rapidly absorbed by the rubber. No hazard.

Mineral Rubber. A term applied to natural asphaltic deposits such as gilsonite and also to blown asphalts. Blown asphalts may be obtained in varying degrees of hardness and are sold according to their respective melting points. They are often called M.R. by rubber compounders. Mineral rubber is used very extensively in many lines of rubber manufacture as a cheap bulking filler and to aid in processing raw rubber. It is used in frictions, spread goods, cements, and many types of mechanical rubber goods. Mineral rubber comes as a solid mass in sheet metal drums or it may be obtained in a granular form. It is added directly to the rubber on the mill. There is no hazard whatever involved with its use.

Montan Wax. A mineral wax extracted from lignites. In the crude state it is dark brown. When refined, it is a white semi-soft wax. The crude wax is used to a considerable extent for soling, flooring, special mechanical stocks, insulating compounds, extruded stocks, etc. This wax imparts excellent processing qualities without the softening effect resulting from the use of softer waxes, such as paraffin. No hazard in its use.

Naphthalene. White crystaline flaky compound, used to a limited extent in certain rubber goods as a reodorant and processing aid. The material has a camphor odor characteristic of moth balls. It may contain, as impurities, coal tar products which are slightly toxic. But used in such small amounts, there is no hazard involved in its customary use for rubber compounding.

Oil Substitutes. (See factice.)

Ozokerite. A mineral fossil wax occuring native and yellowish brown to black or green in color. Used as a rubber filler and softener, especially in such goods as electrical insulations, frictions, extruded and mechanical stocks. Usually added directly to the rubber on the mill, either as broken lumps or in molten state. (See also ceresin which is prepared from ozokerite.) No hazard.

Palm Oil. An orange yellow fatty oil or grease of butter consistency. It is obtained by expression from the fruit of a tropical palm. It consists chiefly of palmitic acid and the glycerides of palmitic, oleic and stearic acids. It is used quite extensively in rubber to aid processing, especially for producing a smooth finish on calendered and extruded goods. Also used to reduce the tack in very sticky compounds. No hazard in its use.

Paraffin Oils. (See mineral oils.)

Paraffin Wax. A white translucent waxy, tasteless and odorless solid obtained from petroleum. It consists of a mixture of hydrocarbons chiefly of the methane series. It varies in color from the light yellow crude to a hard white refined wax. Wax is used in rubber as a softener, as an aid to processing, as an anti-scorch material, and as an anti-oxidant and light resistor. It is also used for rendering rubber less permeable to water solutions.

Petrolatum. Also called vaseline and mineral fat. A light yellow to amber colored oily, semi-solid material consisting chiefly of hydrocarbons of the methane and olefine series. It is obtained by distillation of the still residues obtained in steam distillation of paraffin base petroleum. It is used in rubber as a softener, in reclaiming old rubber, as an anti-scorch material for active accelerators, and to aid in smooth calendering and extruding operations. No hazard.

Pine Tar. A very viscid, blackish brown liquid with a characteristic odor and taste. It is obtained from the destructive distillation of pine wood. Used in large number of rubber goods as a softener, tack producer, dispersing agent, and accelerator for synthetic rubber. It finds a large use in tread stocks, frictions, tape, reclaiming of rubber and cements. It contains phenolic bodies, but as used in rubber should not be hazardous. It is usually added directly to the rubber batch on the mill.

Pine Tar Oil. A reddish brown oily substance obtained by the destructive distillation of pine wood. It is a lighter distillate than the pine tar mentioned above. It has a strong tarry odor and taste. The material is somewhat toxic and should be handled carefully. Used for the same purposes as pine tar in rubber, but where the lighter oil is preferable for certain compounds.

Rape-seed Oil. A dark-brown to pale yellow oil, color depending upon degree of refinement. It is a viscous oil and is obtained by the expression of rape seed. It is used for making factice or so-called rubber substitute. (See factice.)

Rosin. (See colophony.)

Rosin Oil. An amber colored oily liquid pleasant odor but strong peculiar taste. It is obtained by fractional distillation of rosin. Used in rubber for producing tack. Used in rubber adhesives, tapes, mechanicals, and in reclaiming rubber. No hazard.

Shellac. A resinous exudation from the twigs of a species of East Indian tree caused by the bite of an insect. Obtained as orange to light buff brittle flakes, or as a ground powder. Used to a limited extent in rubber as a stiffener and in hard rubber to give firmness and finish. Non-toxic.

Sod-Oil. (See degras.)

Stearic Acid. A colorless, odorless wax-like material obtainable in form of block or flakes. It is obtained from high grade beef tallows by saponification or distillation and pressure and also by hydrogenation of oleic acid. It is used quite generally in most types of rubber goods as a stabilizer of vulcanization, as an activator of certain accelerators, and as a dispersing agent and softener. It is used up to several per cent on the rubber and added directly to the rubber in which it readily disperses. Non-toxic.

GROUP IV—Liquids and Gases

In this group are included the usual liquid solvents and gases used in rubber manufacture with the exception of the liquid accelerators, which are listed in Group I under organic accelerators, and softening oils which are listed under Group III.

This group contains some of the most hazardous chemicals used in the industry and should be given careful study by the safety engineer to see that they are properly handled.

Liquids

Acetic Acid. Acetic acid is not used generally throughout the rubber industry, but only in special parts of the industry. It is, however, used in large quantities for certain purposes. It is used for coagulating rubber latex, in certain latex preparations, and in sponge rubber production. In coagulating and latex work, the temperatures are low or normal, comparatively small proportions on the batch are used and handling is simple. When used for sponge rubber, the temperatures are higher and considerable disagreeable fumes is given off which should be conducted away by proper ventilation.

Acetic acid is a clear, colorless solution at ordinary temperatures. It comes in a number of different strengths, varying from the pure concentrated acid, known as galacial acetic acid, down to dilutions as low as twenty-five per cent. It has a strong, pungent odor, characteristic of vinegar, and is very corrosive especially in the higher concentrations. It is very irritating to hands and nasal passages. In small amounts it is not toxic, but care should be taken to keep away from the bare flesh and any fumes should be conducted away from the workers.

Alcohol. Alcohol is usually used in the denatured state. Its use is not extensive in the rubber industry, being confined to certain types of cements, as a means of introducing certain resinous compounds into rubber, and as a cleaning solution for raw and finished rubber where it is necessary to eliminate solvent action on the rubber. The characteristics of alcohol are well known and it is not necessary to dwell here upon its relative toxicity. Various denatured types of alcohol are available and all are toxic if taken internally, but as used for rubber work there should be no hazard if not actually taken internally.

Ammonia. Ammonia is a colorless gas, but as usually used is dissolved in water and known as ammonia water or ammonium hydroxide. It is sold on ammonia content designated by degrees Be'. The usual grade used is 26 Be' or a saturated solution. It is a clear water-like liquid with an extremely strong irritating odor well known to most persons. In the concentrated form it is strongly caustic and should be kept away from the flesh. Use rubber gloves in handling. It gives off powerful pungent fumes when exposed to the air causing bronchial disorders if inhaled in any amounts. The fumes are toxic, but usually do not leave any serious lasting effects. Where used, good ventilating system should be installed, if concentrations of ammonia are great. In the more dilute forms of ammonia liquid, the water retains the gas in solution and only slight fumes are given off.

Dilute ammonia is used very generally to preserve raw latex, in manufacturing latex compounds and throughout the liquid latex industry. Here, the concentrations seldom run higher than a few per cent and there is practically no hazard other than where the ammonia solutions are prepared. Ammonia is also used in the spread goods industry where sulphur chloride cures are used as a neutralizer for acid released during the vulcanization operation. The hazard here is also small since most of the cold curing chambers are of necessity, equipped with adequate venting systems.

Benzole. Benzole is one of the most widely used solvents in the rubber industry and also one of the most dangerous. It has probably caused more serious poisoning cases and deaths than any other one solvent. We are still encountering benzole poisoning cases and there have been a number of deaths even within recent years, in spite of all the available literature on the subject. There is no need to go into the details of its toxicity here, as it is only necessary to obtain Safe Practices Pamphlets on the subject or consult such works as "Hamilton" for complete details.

Benzole or benzene, as it is chemically defined, is a clear water white liquid of characteristic odor. It is very volatile at room temperatures and should never be allowed to stand in open containers. The vapors are very flammable and very toxic. There is the double hazard of fire as well as poisoning. Benzole is used largely for making cements and adhesives for assembling rubber parts during process of manufacture. It was formerly used in large amounts as a wash for raw rubber, being applied by hand swabs. It was here where many of the most severe poisoning cases were experienced. Within recent years, less toxic solvents have almost entirely replaced benzole as a washing or cleaning solvent and to some extent also in cements. Wherever used, BENZOLE MUST BE HANDLED WITH CARE, the vapors spread rapidly and must be removed to prevent both fire hazard and health hazard. The workers must not be allowed to breathe any considerable quantity of benzole vapors nor must they be permitted to get the solvent on their hands, clothing or other parts of their body. The solvent can be absorbed through the flesh as well as through inhalation, producing lasting serious complications.

Benzene. Same as benzole. Must not be confused with benzine which is a petroleum product and not a coal tar product.

Benzine. A distillation product from petroleum, being a clear solvent similar in properties to ordinary cleaner's naphtha but very light and volatile. Also called petroleum ether. Used as a cleaning solvent for swabbing raw rubber. Much safer to use than benzene from toxic standpoint, but is also very flammable. Should be used in safety dispensers to eliminate fire hazard. Danger from toxicity is practically nil.

Carbon Bisulphide. A clear, colorless, very flammable liquid. When pure it is almost odorless, but the commercial grade, usually used, has a strong disagreeable odor. It is exceedingly volatile at room temperatures, having a flash point at minus 25 deg. C and is one of the most dangerous fire hazards which we have. It will often ignite from a spark or flame many feet away. It is also toxic and very poisonous to breathe. For further details as to its toxicity, see Hamilton, or other similar sources of information on carbon bisulphide.

Carbon bisulphide is used for removing sulphur bloom on rubber goods, in rubber adhesives, and as a diluent for sulphur chloride in cold vulcanization and

vapor cure. Departments using this solvent should be adequately equipped with fire extinguishers and exhaust system. Keep off the hands.

Within recent years the use of carbon bisulphide has been very limited as in the majority of cases, a less dangerous material such as gasoline or carbon tetrachloride has been substituted. There are, however, a few places where it finds a use in rubber manufacture and where used, the safety engineer should study the situation and see that the material is handled in a safe manner.

Carbon Tetra Chloride. A light colorless liquid with a peculiar characteristic odor. It has a low boiling point and is very volatile at room temperature giving off heavy vapors. The vapors are not flammable but are moderately toxic. They are heavy and sink to low parts of the room, often collecting in corners and poorly ventilated places, making a real hazard to workers unless removed by proper ventilation. This solvent finds an extensive use in rubber manufacturing on account of its freedom from fire hazard and its excellent solvent properties for rubber. It has replaced many more dangerous solvents such as the highly volatile gasolines, benzole, carbon bisulphide, and other coal tar products.

Considerable data may be found on its toxic properties and use. (See Transactions of N.S.C., 1933). While it is toxic where concentration of vapors is high, it does not produce the permanent effects as does benzole and it can be handled absolutely safely if ventilation system is satisfactory. Since the vapors are heavy, suction ducts are located near the floor.

Chloroform. A clear colorless highly volatile liquid with peculiar characteristic odor. It is non-flammable, but toxic. It is an excellent solvent for rubber and used for cements and cleansing solvent. However, it has been almost entirely replaced by the cheaper and safer carbon tetrachloride which has very similar properties to the chloroform where used in rubber manufacturing. It should be handled with the same care and in like manner to carbon tetrachloride, noted above.

Coal Tar Naphtha. Refined coal tar naphtha is a clear water-white liquid having a heavy gassy odor. It is flammable and considered a fire hazard. Should be kept in approved dispensers. There is also a crude material used which is straw colored, but this grade is not used to the same extent as the refined grade. Coal-tar-naphtha is obtained by fractional distillation of coal tar and consists of a mixture of benzene, toluene, xylene and other higher homologs. It is toxic but less dangerous than benzole, due largely to its lesser volatility. It is used to a considerable extent for rubber cements, rubber doughs, and as a cleansing solvent. The same precautions should be taken as for benzole, which see.

Ethylene Dichloride. A colorless liquid having a strong chloroform-like odor. It is an excellent solvent for rubber and does not support combustion. It is used for rubber cements and doughs on account of its low fire hazard. It is toxic and in many respects acts like a carbon tetrachloride. It should be handled in similiar manner to carbon tetrachloride. Its vapors are very heavy.

Gasoline. The name given to a series of solvent distillates derived from petroleum and having a range in gravity from 50 deg. to 90 deg. Be'. The range from 56 deg. to 70 deg. is the usual range of rubber solvents. They are clear water-white oily liquids of characteristic not unpleasant odor. The gasolines are the most universally used solvents in rubber manufacture, partly due to their low cost and also to their comparative freedom from toxicity. They are all flammable which necessitates careful handling from the fire hazard, but there is practically no hazard from toxicity. Where workers have their hands in contact with gasoline, such for instance where using swabs, the solvent dissolves the natural oils and fiats of the skin causing dry and chapped skin. This can be prevented to a great extent by first coating the hands with a neutral glycerine soap preparation which repels the gasoline.

Gasoline is used as a cleaning and swabbing solution in the manufacture of many rubber articles, in all types of rubber cements, in preparing coating and spreading doughs, and as a diluent for other solvents. Fumes should be removed on account of fire and explosion hazard.

Glycerine. Also called glycerol, is a clear, colorless or pale yellow, heavy, syrupy and odorless liquid having a sweet taste. It is non-flammable and non-toxic, and is no hazard from the health standpoint. It is used in rubber manufacturing, as a preservative coating or dressing on finished rubber goods, to prevent rubber from

sticking together while in the raw state and in liquid latex preparations. When used as a dressing, it is either swabbed, sprayed or painted on. No hazard.

Kerosene. A clear water white to straw colored oily liquid familiar to most people. It is obtained as a distillate from petroleum and refined to remove low flash constituents. It is perfectly safe to use although the skin of some workers is sensitive to kerosene oil. Used to only a limited extent in rubber manufacture, but used very extensively as a wash for rubber machinery, rubber rolls, etc. In rubber manufacturing it is used for softening and blowing sponge goods.

Naphtha. A name given to both petroleum and tar solvents. The type of naphtha should be specified, otherwise it is very misleading. For petroleum naphtha, see benzine, petroleum ether, and gasoline. (For coal naphtha, see coal-tar naphtha.)

Petroleum Ether. (See benzine.)

Solvent Naphtha. (See coal-tar naphtha.)

Sulphur Chloride. The subchloride of sulphur. It is an amber to yellowish-red oily, fuming liquid with very penetrating odor. It is used in vulcanizing rubber by the so-called cold process and vapor process. Its use as such is confined largely to sheet, spread and dipped goods. It is also used in the manufacture of rubber substitutes and oil factice. When used for sheet and spread goods the sulphur chloride may be applied in liquid form by distributer roll or the goods may be hung in chambers where the sulphur chloride is vaporized by heat. The sulphur chloride is extremely active chemically and is usually diluted with some solvent such as carbon bisulphide, benzole, etc. In vulcanizing dipped goods, the latter are usually immersed for a very short time in a diluted solution of the sulphur chloride.

The sulphur chloride is very readily decomposed in a damp atmosphere and should be kept well bottled when not in use. It is extremely corrosive due to liberation of hydrochloric acid in presence of moisture. It is extremely irritating to the eyes, lungs, and mucous membranes. Workers should be protected from its fumes by adequate ventilation and warned to keep it away from their hands. It has not been found dangerously toxic to rubber workers.

Sulphuric Acid. A strongly corrosive dense oily liquid, colorless to dark brown in color, depending upon its purity. Used for removing cotton fiber in reclaiming old rubber. In a diluted form it is used as a coagulant for latex mixtures. It is also used in attaching rubber to metals and in producing sulphonated rubber resin products. The acid is practically odorless and non-volatile, but it is dangerous to get on the flesh. It causes very severe burns and will char almost any organic matter. Workers using the concentrated acid should be protected from having the material fly into their eyes or onto their flesh or even their clothing. The acid will rapidly eat its way through clothing to the flesh. There is no danger from the toxic standpoint.

Toluol or Toluene. A colorless flammable liquid obtained by fractional distillation of coal tar oil. It resembles benzene in odor and many of its properties although it is less volatile at room temperatures. It is an excellent rubber solvent and used for rubber cements, doughs and as a cleansing solution. It is toxic and should be treated in same manner as benzol. Poisoning effects can be very serious. Workers should be protected from its vapors and keep it from their hands. Its vapors are heavy and cling to the floor and in poorly ventilated corners. (See benzole for handling.)

Turpentine. Also called spirits of turpentine. A clear, colorless liquid with a characteristic rosin-line odor. It is obtained by distillation from turpentine resin. Turpentine is a powerful solvent for rubber and was formerly used in making rubber cements. But its use in rubber work has become very limited and it is no longer a factor in rubber manufacturing. There is no hazard as used for rubber work, other than fire.

Xylene or Xylol. Xylene is a clear, colorless flammable liquid with a characteristic penetrating odor. It is one of the constituents of coal tar naphtha, and, in fact, is obtained from the latter source by distillation. It is a good solvent for rubber and is used in rubber cements, doughs for the spreading trade, and as a swabbing solution in the manufacture of rubber goods. It is toxic, but not to as great an extent as benzole and toluene probably due to its less volatility. It is a fire hazard and the same precautions should be taken both for fire and toxicity as noted for benzole.

Gases

There are comparatively few gases used in rubber manufacture and in nearly every case they are used for vulcanization in some form or another. On account of being in the gaseous form, they are handled in closed chambers. Consequently, leakage or inadequate suction systems are the usual cause of trouble or discomfort to the workers.

Ammonia Gas. A colorless gas with powerful penetrating and irritating odor. Affects the eyes and respiratory organs. It is used for neutralizing any acid after sulphur chloride vapor cures. It is produced by heating concentrated liquid ammonia water in the curing chamber and finally exhausted by suction or forced air. No danger if the gas is kept confined and properly exhausted. In quantities used there is very little danger as toxicity is low and non-permanent.

Chlorine Gas. A heavy greenish-yellow gas, highly irritating and toxic. It is used only in specialized industries such for instance as for producing chlorinated rubber. It must be confined in suitable chambers and kept away from workers. It is extremely corrosive, especially in presence of moisture. (For further data on chlorine see Hamilton.)

Hydrogen Chloride. Also known as hydrochloric acid gas, is a colorless and exceedingly pungent gas. Highly poisonous and produces quick death if inhaled even in comparatively small amounts. It has a strong affinity for water. Must be kept in closed systems. It is used only in specialized industries where rubber is converted into certain resinous products. *Requires special handling.* (See data on hydrochloric acid gas.)

Hydrogen Sulphide. A colorless, flammable gas, with very offensive odor and a sweetish taste. It is used to only a limited extent for specialized work in vulcanization of sheet or spread goods in conjunction with other reactive gases. It is highly toxic and flammable and must be handled with care. The goods are exposed in closed chambers and the gas blown in and later expelled.

Sulphur Chloride. See sulphur chloride under liquids Where the gas is used it is merely the liquid sulphur chloride vaporized by heat in the hot curing chambers for vapor curing of sheet and spread goods. Usually the goods are festooned in large rooms or chambers and a quantity of liquid sulphur chloride evaporated on a hot plate, circulation being accomplished by fan if necessary. Concentrations are usually small and no serious hazard is involved with adequate ventilation.

Sulfur Dioxide. A colorless gas with suffocating odor and poisonous. It is used only in special industries for producing special types of vulcanized products. The vulcanization must be carried out in closed chambers and operatives protected from the gas. It is not used to any great extent in this country to the writer's knowledge.

WEDNESDAY MORNING SESSION

October 16, 1935

Making Safety an Intergral Part of Plant Operation

By T. E. PITTINGER

Factory Manager, The Firestone Tire and Rubber Company, Akron, Ohio

The Firestone Tire and Rubber company employs approximately 10,000 clock employees in the Akron factories, and it has subsidiaries in California, Canada and several of the foreign countries.

In my earlier experiences in industry, it was my observation that executives employed safety engineers to prevent accidents and they held these men responsible for results without giving them sufficient backing and support. Managers felt that they had done their share when they provided a safe working place. Thus it was up to the men to take care of themselves. This was not on account of any lack of sympathy for injured employees but it seemed to be an unnecessary task to caution employees to be careful and to educate them in accident prevention when it seemed that the law of self preservation was sufficient.

Unfortunately proximity breeds contempt: workers must be taught to protect their own lives; every person considers himself more or less immune to accidents; and it requires positive initiative rather than mere passive hope if workers are to avoid injury.

While we have men specializing in safety, it is now our policy to place the responsibility of operating safely in the hands of our foremen. We believe the foreman is the key to successful factory operation. Our greatest problem is to get our policies down to the foreman so that he can interpret them to the employees.

We have never made it a practice to get groups together to discuss safety, or, in fact, to discuss any other problems, but have always felt that the greatest progress could be made by instructing the individual foreman. It is our experience that in too many of these group meetings we find too many of the people inattentive, half asleep, and not knowing what it is all about. The foreman who is accustomed to an active life finds it trying to sit in meetings and keep his attention upon the subject under discussion.

When new machinery is installed, and where the machinery is complicated at all, we have what is known as the "Safe Practice Method," which we post on the machine and which we insist upon the employee following. If he does not follow this method, we hold the foreman responsible and he must take whatever steps are necessary to correct these practices. For example, we have punch presses which we have equipped with Possuns safety devices. When our foremen find employees operating these presses without having the devices hooked up, something must be done about it. When we find our employees operating these presses, even though they are hooked up correctly to the employees' hands, but have not been correctly adjusted, then *we* do something about it.

Another item we have followed closely is the handling of safety shoes. We sell through our employees' store, hundreds of pairs of safety shoes. We permit our employees to buy these shoes at cost on an easy payment plan.

In our mold engraving, where there is considerable exposure to chips and small particles in the air, we furnish goggles and insist that the employees wear them. You will always find some employee who wants to bring in a different pair or who just knows he doesn't need to wear goggles. If his foreman lets him get away with this he will find out he is wrong when it is too late.

It is useless to have a lot of safety devices and safety rules for the foreman if he is going to mix them all up and not know which one belongs to which machine.

The problem today, more I believe than at any other time, is that the foreman and supervision must show an interest in the individual employee. He must be receptive to questions and suggestions from the employee, and when the question is raised by the employee, he must get him an answer and within a reasonable length of time.

We all realize that the foreman has a multittude of problems. They include specific production problems, of which safety is one, and on these special problems, he must, at certain times, consult an expert. We insist that our safety man work back through the foreman and not independently.

It is my opinion that great good is accomplished by using safety contests. They should not, however, be held continually or too often. When you do this they become a routine matter.

We have found it extremely helpful to have boards in our departments whereon we post the number of days that the department has operated without a lost-time accident, and we have given publicity in our plant paper to the success of different departments. When a record of this kind is broken it is of concern not only to the management but to every employee.

A number of our departments have established enviable records for continuous operation without accidents. Our Gum Stores department, employing 17 people has operated 2,901 days without a lost-time accident. Our Tube department, employing 246 people has operated 1,207 days without a lost-time accident, one of our Stock Preparation departments, employing 118 people, has a record of 1,150 days, our

Sidewall Assembly department, with 46 people employed, has a record of 1,158 days, and one of our Mechanical divisions, employing 28 people, a record of 1,229 days.

You may be interested in the progress that Firestone has made in the past 6 years in reducing the number of accidents:

	1929	1930	1931	1932	1933	1934
Number of lost time accidents	1051	296	179	45	17	18
Number of compensable accidents	402	163	125	59	66	93
Total	1453	459	304	104	83	111
% Improvement		69	34	66	20	—34

The increase in 1934 is accounted for by the NRA causing an abnormal increase in new and inexperienced workers.

Government Regulations and Their Relation to Safety

By C. S. CHING

Director of Industrial & Public Relations, United States Rubber Products, Inc., New York City

I assume that when I was asked to speak on the subject of "Government Regulations and Their Relation to Safety," the Program committee had in mind the project which was then on foot to have safe practices *incorporated into* the fair trade practice codes of the various industries. Up to the time that the Supreme Court declared the N. I. R. A. unconstitutional, very little progress had been made along this line and of course since the codes have been discontinued, there has been no federal activity. There is a grave question as to whether a safe practice code covering all industry would be any more *effective when promulgated by the* federal government than were the codes regulating hours, wages, and other trade practices. The variation in the size of plants and local conditions surrounding an industry such as ours makes it practically impossible to regiment a whole industry under strict rules.

When attempts are made to establish standards of any kind on a national basis, you will find that certain companies in an industry, due to a process of development over a period of years, have established very high standards along certain lines, one company in one way and another in some other way. These high standards are attained only as a result of an evolutionary process. It is obvious that a government agency entering any one of the fields where standards of this kind are set up is bound to attempt to force the general adoption of the high standards which are found in any one company. Let us take for instance this matter of accident prevention. Some of the companies which have expanded fairly rapidly within the last ten years and which have purchased new equipment and have had a volume production which justified capital investment in labor saving machinery, have their plants so far as their equipment is concerned on as high standards of safety as could possibly be demanded by any government agency. Such plants usually are also large enough to have experts who are thinking along these lines and are convinced that it is good business to prevent accidents. On the other hand, there are many smaller companies who may of necessity be operating with semi-obsolete equipment, whose production methods are entirely different, but who nevertheless may be just as keenly alive to the necessity for accident *prevention and may be compensating to some extent* for their differences in equipment by greater vigilance in accident prevention, to whom it would mean bankruptcy for machinery codes to be set up by the government.

I believe the attitude taken by many of our state industrial commissions in working in co-operation with industry is the surest approach to this problem. We have outstanding instances in this country to-day of the progress which state agencies and industries have made through co-operation in accident prevention. Ohio, New Jersey, and New York are outstanding examples.

Americans as a rule are inclined to take the attitude that we must do everything that we want to do in the shortest possible space of time. We take an idea like the establishment of fair trade practices with minimum wages and maximum hours in

industry, and rush in and overnight attempt to put every activity of our American life under codes and set up code authorities inexperienced in judicial procedure and in co-operative effort. They are bound to take the attitude that if some fellow does not do what they want him to, he ought to be put in jail. The result is as we have seen in N. R. A., a complete collapse. The Supreme Court decision of May 27 was merely the funeral services over an already dead body because it was found long before the decision was made that enforcement of N. R. A. was impossible. On the other hand, had we been content to proceed along the evolutionary rather than the revolutionary path we probably would have had to-day in many of our large industries codes of fair trade practice working successfully, *with continuous additions to the groups*. Any attempts on the part of either the federal government or states to set up very rigid and very high standards for accident prevention covering the country as a whole are bound to result the same way.

At the time when Workmen's Compensation laws were first being introduced, industry fought these laws and with very good reason. They feared that there would be more and more state regulations. In many instances their fears were justified both as to factory inspection procedure as well as to the administration of the laws. The positions were filled by broken-down, deserving members of the political party in power who had no conception of the problems of industry and no idea at all in regard to co-opration between state government and industry, and whose sole method of getting results was to wave the baton of authority. Many times in those days the representatives of the state were perfectly willing to be approached with proposals for fixing things which state inspectors had found. Gradually it began to dawn both on state and industry that there was a problem to be solved, and by an evolutionary process we have reached a place to-day where we have very much higher standards in factory regulations and also very much higher standards in the type of people who are enforcing these regulations.

I believe there is still much to be done. Far be it from me to outline the duties of a factory inspector. There are many units in every industry which as a matter of pride and good management will always have the highest standards for cleanliness, fire prevention and accident prevention. Factory inspectors will readily know who these companies are and instead of harassing them on picayune things, will concentrate their efforts on other units where the management either through lack of information or through inexperience is not paying the attention it should to such matters. No industrial manager is so cold-blooded that he doesn't care whether accidents happen, but many times you will find that management is not conscious of the keg of dynamite it is sitting on. A friendly word by the state authorities in these cases would be extremely beneficial.

There is no unit in an industry carrying on safety work which is not pleased to pass along information to anyone regarding methods in preventing accidents. This is a subject of such a non-controversial nature and which arouses so much enthusiasm among those engaged in it that I find everybody anxious to help the other fellow. If the factory inspectors will in a co-operative way attempt to transplant some of these methods to those not having such standards, a great deal of good can be accomplished.

ADJOURNMENT

Safety Section, AAR–Steam Railroad Section, NSC

Officers 1934-1935

General Chairman—T. H. CARROW, Pennsylvania Railroad, Philadelphia.
First Vice Chairman—W. H. FAILING, Central Railroad Company of New Jersey Reading Company, Philadelphia.
Second Vice Chairman—C. F. LARSON, Missouri Pacific Lines, St. Louis.
Members of the Committee of Direction:
Eastern Territory—H. R. COLE, Erie Railroad, Cleveland, Ohio; CHARLES E. HILL, New York Central Lines, New York City.
Western Territory—L. F. SHEDD, Chicago, Rock Island and Pacific Railway, Chicago.
Southern Territory—D. H. BEATTY, Southern Railway, Washington, D. C.
Secretary—J. C. CAVISTON, Association of American Railroads, New York City.

Officers Elected for 1935-1936

General Chairman—C. F. LARSON, Missouri Pacific Lines, St. Louis, Mo.
First Vice Chairman—E. A. MEYER, Chicago, Milwaukee, St. Paul and Pacific Railroad, Chicago.
Second Vice Chairman—E. G. EVANS, Louisville and Nashville Railroad, Louisville.
Members of Committee of Direction:
Eastern Territory—A. O. BECK, Canadian National Railways, Montreal; H. A. ROWE, Lackawanna and Western Railroad, New York City.
Western Territory—F. W. CURTIS, Denver and Rio Grande Western Railroad, Denver.
Southern Territory—L. G. BENTLEY, Chesapeake and Ohio Railway, Richmond, Va.
Secretary—J. C. CAVISTON, Association of American Railroads, New York City.

A complete report of these sessions is published by the American Railway Association in a booklet entitled, "Proceedings of the Fifteenth Annual Meeting of the Safety Section, Louisville, Ky., Oct. 15 to 17, 1935." Copies of the booklet are available from the Association of American Railroads, N. Y. C. The following is a condensed record.

TUESDAY MORNING SESSION

October 15, 1935

The opening session of the Safety Section, Association of American Railroads—Steam Railroad Section, National Safety Council, was called to order by General Chairman T. H. Carrow, Supt. of Safety, Pennsylvania Railroad, who presided.

The invocation was delivered by Mr. L. F. Sheld, Chicago, Rock Island and Gulf Railway. The report of the secretary, J. C. Caviston, New York City, was presented, outlining the activities of the section during the past year. The chairman then introduced the first speaker.

Address

By M. J. GORMLEY

Executive Assistant to the President, Association of American Railroads

It is a remarkable thing to me today, in spite of all that has been said about it, how few people know the record that has been made on our railroads in safety. We have one fatality for every 20,000,000 passenger miles on the highways, one for every 24,000,000 miles on the airways, and one for every 400,000,000 miles on the railroads. That is an easy thing to remember, but apparently they take a look at the paper and see that the railroads are safe, take it for granted and let it go at that.

For the first six months of this year there were no fatalities to passengers in train accidents. That is another remarkable record.

The records show that highway-grade crossing fatalities and fatalities to trespassers account for 85 per cent of the total fatalities on railroads. I suppose the depression and the fact that so many people have the wanderlust for traveling from one place to another are responsible for that condition.

We have had a considerable decrease in highway crossing accidents since 1928, but we are still confronted with the fact that 40 per cent of those accidents are caused by automobiles driven into the sides of trains.

In connection with grade crossing elimination, as you all know, $200,000,000 has recently been appropriated by the Federal Government for the elimination and protection of grade crossings. I think that someone ought to be just as active in preventing the opening of new crossings as they are in the elimination of old ones. We have eliminated something like 12,370 crossings from 1926 to 1933, and added approximately 12,514 new crossings. Probably we have eliminated more dangerous ones and opened some not so dangerous, but nevertheless, the number of crossings has something to do with the number of accidents, and in the above period we have added more than we have eliminated.

You do not hear much about the progress the railroads have made in reducing their operating costs, but it is a fact that if we had had the same unit costs of operation in 1933 (mind you, '33, a year of low traffic) as we had in 1920, it would have cost a billion dollars more to have moved the same business. How did it come about? It came about largely by the amount of money spent for improvements and everything of that kind, plus the very fine work that you have done in connection with safety and eliminating that waste, because every dollar that you save is a real dollar. Every dollar saved in operating expenses is not sometimes a real dollar. It may be delayed or deferred maintenance of equipment on tracks, to some extent, particularly on branch lines, and things of that kind. But whenever you save a dollar, you have a hundred cents. And not only that, but it does seem that as you increase your safety you increase your efficiency and economy of operation in every direction.

There is another thing that is entirely outside of the question of safety, but has some relation to it again. It is pretty hard to talk about anything without coming into the safety question. The railroads now own in excess of 500,000 cars less than they did in 1925. I think that, due to their increased efficiency in movement, 350,000 of those cars are permanently out of the picture. They will never be required for the handling of any business that anybody can forecast we are likely to have in the future. One hundred fifty thousand of those cars will have to come back into the picture. The railroads have put into service about 900,000 new cars in the last few years, and when you add 900,000 to 500,000 you have 1,400,000 cars retired account of obsolescence and that adds to the safety of operation in every way.

Report of the Committee on Education

By L. G. BENTLEY

General Safety Agent, Chesapeake & Ohio Railway

The more I study the safety problem the more I am convinced that "Education for safety" means about 99 per cent of the job. This appears particularly true if we will admit that education means not only knowing, but *doing*.

With this admission on my part, I have prepared a poster. No picture is shown, only a hand with finger pointing at you and a simple statement of eleven words, arranged in modernistic fashion thus:

"EDUCATION FOR SAFETY MEANS KNOWING THE JOB AND DOING IT RIGHT."

Before one can acquire an education in any line of activity, he must have a desire for that education, and I therefore present for your consideration that "Desire" is one of the primary factors necessary to an education.

I am not expressing a new theory, but a time proven truth, when I say that to have uniform education for safety, the desire for that education must first find active place in the mind and heart of the highest executive on your railroad.

It is not sufficient that he may have an attitude of passive approval, for the mere mental acceptance of a truth does not bring any real help. The enthusiastic push of some one mortal must be back of your safety program. That one mortal is your president.

I know of no single feature just now that is inspiring the interest of high railroad officers more than the monthly statement distributed by Mr. Caviston, in which the railroads of the country are grouped in brackets with comparable roads, and shown currently as they progress or retrogress in their safety efficiency.

If you are not participating in this educational feature, you are missing an opportunity to get information before your president that must inspire his desire to have an educated personnel for safety.

Your president is too busy to read but little of the safety material produced by the Safety Section and by you locally, but you can occasionally place before him certain clear, concise data on the subject that will hit him between the eyes, such as—

1. Improvement or the reverse in your safety performance.
2. The cost of personal injuries.
3. Comparisons with some competing railroad which he is averse to acknowledging as superior to his own.

An effective means of inspiring the president's desire for safety education is to get him on the program for a safety conference such as this.

He may require you to write his speech. If he does, he is inviting you to place your views before him in words that will become his own.

If he writes his own speech, so much the better. In either case, he gets the desire you want him to have.

I know of one general manager who requires each employee injured to the extent of as much as 24 hours disability, to write him a personal letter before returning to work, explaining the manner in which he was injured, the nature of his injury and offering suggestions as to how the injury might have been prevented.

If suggestions are offered, they are acted upon immediately, and the injured man is advised of the result.

This feature is of special value, because the general manager requires the officer under whom the injured man was employed, to contact him and secure the letter in question.

As to the individual employee, of course his desire for a safety education must be transmitted to him primarily and nurtured thereafter by his immediately superior officer, but as an aid, the Committee on Education has from time to time sought to plant the germ of this desire in his bosom and that of his family, in the issuance of a number of inspirational posters such as the one showing the Christmas Dinner, turkey and all, with Dad, home from work, Mother and the Children gathered 'round and topped with the caption, "Safety has Kept us Together."

Or, the engineman, leaving home with dinner bucket and three lovely children gathered round, loath to see him go, and the admonition, "For Their Sakes, form Safe Habits."

Safety *rules* and *instructions* must mean the same thing to all men at all times. In applying this principle to education for safety, we have found that there is nothing an employee learns more quickly, nothing behind which he hides more readily, than the unexpressed permission of supervision to violate safety rules or instructions for expediency's sake so long as nothing happens. This being the case, he knows that you have no right to discipline him when he finally gets in trouble.

A serious and extremely distressing accident came to my attention recently, which brought to my mind an impressive appeal by Isaiah Hale a few years ago.

Mr. Hale said, "Unless you spend sufficient time with your new men, to properly instruct them, and then follow them up to know that they not only understand your instructions but that they are inviolate, you will miss an opportunity that will never return. When the man is new, he wants to do as you want him to do, because he wants a job. If you fail to start him off right and create lasting impressions immediately when he goes to work, you may be sure that later and selfish interests will come into play and will dominate him so that he will be forever removed from those supervisory influences which you might have made permanent in the early days of your association with him."

Application of this fine principle represents one of the highest types of education for safety.

Thousands of accidents occur every year, not because the victim intended doing anything unsafe, not because another wilfully violated a rule or instructions, but because of some impulsive movement, some act indulged in without forethought. These accidents we charge to the impulsive acts of men.

For quite a while now, our committee, through posters and circulars widely distributed, has been trying to set impulses in motion which will cause a man to glance in both directions before crossing any track, even a dead track.

Impulses, either good or bad, are great builders of habit, and it is of habit that I wish to speak here, as the widest, most fertile breeding ground for accidents, or as that field which by cultivation can be brought under the positive influence of safety education with curative results.

Since safety depends upon strength of habit, we must select and enforce those methods that tend toward the greatest habit building and strengthening processes for safety.

Absolute control of the accident situation will come to that man or group of men most strongly fortified by safe habits. This is education for safety.

Report of Committee on Trespassing

By ROBERT SCOTT

Director, Department of Insurance and Safety, Atlantic Coast Line Railroad

As a preamble, we quote from a report made by the Railway Business Association in their Bulletin No. 16 published twenty years ago:

> "While deaths to trespassers upon railway property were held down to almost nothing in Europe and Canada and greatly reduced in certain of our states, 14 times as many persons who had no business to be in danger were killed by the cars in the United States in 1913 as the number of passengers killed. Fatalities reached 5,558—more than at the Battle of Bull Run.
>
> "England has since 1868 prohibited any unauthorized person to be upon railroad property under penalty of $10 fine. THE LAW IS ENFORCED. American travellers abroad, accustomed to free and easy habits, stray upon rights of way and are surprised as well as grieved to be grabbed instanter and hustled before a magistrate, who relieves them of a part of their surplus and sends them on chastened and wondering at the 'beautiful system.'
>
> "The difference between England and the United States in this respect is shown by the results. From 1901 to 1910, inclusive, in the United States 50,025 trespassers were killed, and in the United Kingdom 4,434, in the United States 53,427 injured, and in the United Kingdom 1,315.
>
> "Canada fines trespassers up to $50 or imprisons them up to two months. The Wabash Railway operates a part of its mileage through Canada. In the year ending June 30, 1914, 94 trespassers were killed and 135 injured on the lines of that road, of whom only 3 were killed and 3 injured in Canada."

From the following it will be gleaned the situation on our railroads has improved perceptibly with regard to the trespassing evil, particularly when consideration is given to the fact that our population has increased and operation accelerated.

Years	Killed	Injured	Totals
1901 to 1910	50,025	53,427	103,452
1925 to 1934	24,951	30,200	55,151
Decrease	25,074 (50%)	23,227 (43%)	48,301 (46%)

Seeking an answer to these decreases, the following comes as the result of investigations:

(a)—Safety education in the schools, promoted to a great extent through activities of the railroad safety departments.
(b)—Protective measures adopted by railroad police departments.
(c)—Introduction of other modes of transportation brought about by improved highways and the practice of hitch-hiking.

Persons entering upon property occupied by another, in the absence of any contractural relationship between them, necessarily come under one of three distinct classifications or categories. (1) Invitees; (2) Licensees; (3) Trespassers; and the duty the occupier owes to any such person is graduated in strict accordance with the category to which such person belongs.

Toward trespassers the occupier owes no duty. The trespasser goes on the premises at his own risk and the occupier is liable only for acts done with the deliberate intention of doing harm to the trespasser or with reckless disregard of the presence of the trespasser.

The very nature of our business and the vast amount of territory covered by tracks, terminals, yards and stations renders the problem of trespassing unusually difficult. The impossibility of policing all these properties every hour of the day and night, is apparent. The best we can hope to do in that direction is to extend the services of our special officers, guards and watchmen as far as they will go, and rely upon these men to inculcate the spirit of watchfulness into all officers and employees so that trespassing will be held to a minimum.

Trespassing by our better class of citizens who sometimes do it unwittingly is capable of being controlled by active interest on the part of our agents or representatives.

Trespassing by school children can be partially cured by appealing to parents and school authorities. This plan has been tried out on many railroads with success.

As to what might be termed "general trespassing" on railroad premises, it is conceded that an appeal through the press, and by continually reminding the public that hazards exist wherever there are moving engines and cars, is by far the best method known for correcting this evil.

The use of bulletins and posters should commend themselves to all railroads interested in breaking up the practice of trespassing.

TUESDAY AFTERNOON SESSION

October 15, 1935

Value of Accident Prevention

By FRANK WENTER, JR.

General Claims Agent, Chicago & North Western Railroad

In the early days accident prevention activities on the American Railroads were confined to the safe delivery of the trains over the road, and these activities in time were consolidated in our present Book of Rules. This apparently was the only safety

activity worthy of the name. It was assumed, as far as injuries and deaths were concerned, that such happenstances were unavoidable and a natural by-product of the business.

In 1910 Mr. Ralph C. Richards, my predecessor, while general claim agent of the Chicago & North Western Railway, reached the conclusion that management and employees could do something about lessening our injuries and fatalities, and in that year he originated the so-called "Safety First Movement" on our railroads. It was an uphill fight but in due time the railroads became interested. We then entered a second era of activity which involved a general clean-up of the equipment and premises to bring about safe conditions for employees, and thus eliminate injuries and deaths due to that cause. After extensive and efficient work along this line it was noted that of the accidents being reported, approximately 90 per cent were due to man failures, and not to so-called company equipment or premise failures. This opened up another era of activity; intensive programs were instituted to educate and interest the employee in safe practices and in working carefully so as not to bring about injury and death to himself or his fellow workers. We progressed a step further when we realized it was essential the supervisor or foreman be made a key man in safety activities.

I personally believe our greatest stride in the advancement of accident prevention was made when we realized that the foreman or supervisor must, of necessity, be 100 per cent educated in safety and also sincerely committed to the turning out of his job without injury and fatality resulting therefrom.

In the five-year period ending with 1904, for each 384 employees in the service, one employee was killed. In the five-year period ending with 1934, for each 1,821 employees in the service one employee was killed. Our comparative figures on the Chicago & North Western Railway indicate in 1910 for each 435 employees there was one employee killed, and in 1935 for nine months, for each 2,872 employees one employee was killed.

Passing now to results achieved in accident prevention in reference to our traveling public, we find in 1904 the railroads carried 1,987,000 passengers for each one passenger killed, while in 1934 we carried 12,582,000 passengers for each one passenger killed. The above figures are a colossal monument to the safety of railroad travel.

We are all familiar with the enormous casualty figures growing out of automobile accidents, and the American railroads in that regard can, with great pride, point to the records made in reducing fatalities and injuries at grade crossings over our railroad tracks. A comparison of such injuries and deaths not involving railroad grade crossings with those at railroad grade crossings indicates that our railroads have brought to a standstill such casualties.

While the railroads and public bodies are making heavy expenditures for grade separation, the fact remains that only a very small proportion of grade crossings are eliminated by this means, and the gains brought about are offset by new crossings opened over the tracks. May I suggest in furtherance of safety that in addition to separation of grades, we consider a program calling for (1) a survey to locate unnecessary grade crossings, to be followed by efforts to bring about their abandonment, and (2) an insistence on actual necessity before opening new crossings over the tracks?

We are all agreed that the first object of accident prevention is the saving of human life and limb, and we must steadily carry on in this humane work. However, this should not stop us from evaluating accident prevention achievements from an economic point of view. I believe we have not sufficiently stressed the economic costs of claim payments chargeable to our casualties, nor have we utilized them as an accident prevention stimulator with our supervisory forces. Certainly the cost of any job or operation which omits from it the cost of the casualties arising from the job, is not a true cost. Emphasis on this fact to our supervisors should have weight with them and leave with them the thought that efficient operation has no room for accidents and casualties.

I know of no one yardstick which, taken alone, will measure the value of accident prevention activities. However, the trend of claim expenditures taken over a reasonable term of years, should indicate progress fairly well. Not having available figures embracing all the railroads in our country, I give you the figures of my railroad.

1920	$1,987,151.26	Per cent cost to gross revenue..... 1.41
1925	1,110,217.51	Per cent cost to gross revenue..... .75
1930	794,465.34	Per cent cost to gross revenue..... .43
1934	333,187.05	Per cent cost to gross revenue..... .43

Looking into our figures further, as portraying savings the accident prevention activities have brought about in the matter of cost of clearing wrecks, and cost of damage to property, and I find the following figures:

	1920	1934
Clearing Wrecks	$515,758.72	$24,904.00
Damage to Property	230,536.94	21,717.00

A study of the type of accidents occurring in the past and present also indicates the value of accident prevention activities. Please recall for a moment in the years gone by, the only too frequent maiming and loss of feet and legs which resulted out of the practice of kicking drawbars. This practice has virtually ceased on the railroads and we find our last case occurred about seven years ago. Another practice that took its toll which has almost passed out of the picture, is that of running down, injuring and killing car repairers while making repairs under cars. We can also mention the almost complete elimination of accidents due to stepping on nails. Another old practice which has virtually disappeared is that of employees getting off engines and cabooses facing outwards to their subsequent injury.

While the above statistical information presents some cross sections of our safety activities and the values growing out of them, they illustrate only a portion of the value of these activities to our railroads. There is no element of good advertising in the publicity given to accidents; on the contrary, accidents invariably bring down upon the railroads criticism, requests and demands which often are not based on a true understanding of the actual facts. Our accident statistics will continue to be a defensive bar against many inequitable and unjustified demands of this kind, and we can not stress enough the importance and value of the results of our accident prevention activities in placing the railroads in a position to defend themselves against unfair demands. In the absence of our safety activities and the splendid results achieved, we would be left high and dry for a defense against many unfair demands which now can successfully be controverted by our safety records.

After all, the business of railroading is a business of safety, beginning in the job where the equipment is constructed and then on through to the final dispatch of the passengers and freight off the premises of the railroad. There is no step in this whole process which is not involved 100 per cent with safety, and the reaction of good safety education goes down deep into the organization and increases the efficiency of the personnel in many directions.

Safety has its two sides. (1) The humane side, and (2) the economic side, and both are important, and it would seem that management in recognizing the human and economic values arising out of accident prevention, must see to it that the safety departments are properly equipped to carry on.

Continuing our survey of factors that may enhance the value of accident prevention, I would say the safety man is entitled to the whole-hearted co-operation of the claim department of his railroad. The claim department is a storehouse of much information of vital importance to the safety man and an efficient handling of accident prevention activities should call for close and sincere co-operation between these two departments.

We should not confine ourselves to the records made with the Interstate Commerce Commission of reportable accidents, as pointing out opportunities for the furtherance of safety values, and disregard the bulk of accident reports which are not reportable. It is in this bulk of minor accidents that the safety man can find his greatest field for further activity. Every accident has its loading, whether it is a no-lost-time case or a fatal case, and there is no accident that does not carry potentialities of dire consequences.

Another matter worthy of attention is what happens to the injured person in the interim between the actual moment of the accident and the moment the doctor takes charge, and this particularly pertains to our fracture cases. Unfortunately in many of these cases more damage is done in the unskillful handling of the patient, than by the actual fracture. I am not suggesting organized first aid activities, but do feel that the necessary knowledge to properly handle such cases before the doctor takes charge, particularly as to what not to do, should be present in any nucleus

of employees where such injuries are liable to occur. I feel that accident prevention men should be as much interested in curtailing the disability of accidents as they are in the occurrence of accidents.

On many American railroads physical examinations of employees entering the service and periodical examinations thereafter are a matter of routine. On some of the railroads these examinations have reached a practical stage of perfection. The physical condition of employees is, of course, of the highest importance to the safety man, and much progress is being made in manning our railroads with men who are physically competent. We may assume that the bulk of our accidents, however, involve mental capacity and moral reactions, and if this is true is it not timely that we consider what further values can be given accident prevention by augmenting our physical examinations with reasonable and workable examinations to disclose the mental and moral fitness of the new man? In a survey of available means to increase the values of accident prevention, I know of none I would rank higher than a movement to bring about a raising of the standard of mental and moral attributes of railroad men. Teamwork between management and employees is essential. Differences are frequently based on misunderstanding of ultimate values. Raising the standard of mentality of our employees would bring to the safety man and management a more intelligent reaction in solving our mutual problems.

Train Accidents

By C. H. LONGMAN.

Assistant to General Manager, Chicago & North Western Railway, Chicago

A "Train Accident" is one that arises in connection with the operation or movement of trains, locomotives or cars, either with or without casualties, which results in damage to equipment or other railroad property in excess of $150, including the cost of clearing the wreck.

During the year 1934 there were 6,023 train accidents, resulting in 256 persons being killed and 1,000 injured; while during 1933 there were but 5,623 train accidents, resulting in 218 persons killed and 1,365 injured. You will therefore note that there were 365 fewer injured in 1934, but there was an increase of 38 fatalities, and we find that 30 of these were fatalities to employees; in 1934 there were 96 employees killed and 352 injured in comparison with 1933's record of 65 killed and 351 injured.

One gratifying thing is that in 1934 there were but 12 passengers killed on trains, while in 1933 there were 23, a decrease of 11. Further, there were only 394 passengers injured on trains in 1934, as compared with 657 during 1933.

Any accident which involves serious property damage, delays to regular trains, fatalities among employees, or casualties of any kind among passengers, is bound to attract public attention and thus reflect more seriously on the safety reputation of a railroad than a considerable number of train service or non-train service accidents.

In checking over the Interstate Commerce Commission reports we find that the improper handling and fulfilling of train orders continues to be a prominent factor in collisions, and I direct your attention to some of these accidents:

1. There was a head-on collision involving two freight trains, which resulted in the injury of four persons, caused by failure to obey a "wait" order. All members of the superior train read and understood the train order which required their train to wait at a certain point until 4:30 a. m. for an extra. The engineman on the superior train had the order in mind and looked at his watch about four miles from the waiting point. He erroneously read the time to be 4:29 a. m. and remarked to the fireman and head brakeman that the "Wait" would expire by the time they reached the waiting point. Both the fireman and head brakeman heard the remark, but did not look at their own watches to see if the engineman had noted his time correctly. The conductor made no attempt to stop the train until the flagman called his attention to the matter, when the caboose had passed the outer switch of the passing track, at which time the conductor applied the air brakes from the caboose. They were on a curve and about the time the train was brought to a stop the collision occurred. This indicates the importance of educating employees to think clearly,

and all members of every crew to assist at all times in the proper fulfillment of train orders.

2. A head-on collision between two passenger trains resulted in the death of five and injury to 58 passengers and employees. This accident was due to the crew on one of the trains overlooking a train order meeting point. The investigation developed that of the six men comprising the crew, only three knew that their train had received a train order to meet another train. Here again it is impossible to over-emphasize the importance of all members of the crew familiarizing themselves with all orders received and assist in their fulfillment.

3. An operator failed to deliver a train order, resulting in a head-on collision and loss of life. The train order was on the operator's table covered up with papers. Check should be made at every opportunity to see that no papers or books are permitted to lie on the operator's table that might result in train orders being covered up.

4. Head-on collision between two freight trains resulted in injury to two employees, due to failure of operator to display train order signal, and as a result failed to make delivery of a "31" train order to one of the trains involved in the collision. Periodical checks should be made to see that operators display train order signals in all cases before giving "X" response or repeating orders.

Another predominating cause of train accidents is the failure of engineers to observe and comply with signal indications and stop signals from flagmen. Judging from the number of I. C. C. reports, we are having a large increase in train accidents due to this cause. Continued surprise checks should be made to insure compliance with the rule which provides that enginemen must communicate to each other, by its name, the indication of all signals affecting the movement of their train.

Excessive speed has also taken its toll. When we speak of a train accident caused by excessive speed, we should not always feel that the engineer is responsible until we know all of the facts, as many investigations of derailments have developed that the condition of the track was not such as to permit of the authorized speed. In other words, there was irregularity of alignment and surface, and the proper super-elevation on the curve was not provided. Again this calls for checking engineers to see that they comply with speed restrictions, and checking of the track to know that it is properly maintained for the authorized speed; if you are unable to keep your track up, as it should be, then the speed restrictions should be lowered.

Leaving switches set wrong also takes its toll. While it is true that we have some cases of malicious tampering with switches, many accidents are caused by failure of trainmen to properly set switches.

While it is true we had a few accidents last year due to washouts, and some this year, I believe that the railroads, as a whole, have worked up necessary instructions and have made an effort to see that such instructions have been complied with, and that this has gone a long way toward preventing derailments due to that cause. However, I recall one where a train dispatcher slipped up and it resulted in a derailment although, fortunately, no one was killed. About two hours before a train was to leave a point 14 miles from where the washout occurred, the operator told the train dispatcher that it had been raining hard for the past two hours, and that it was raining harder than it had in a great many years. Four times, from the time he first notified the train dispatcher and the time the train left its initial terminal, he advised the chief train dispatcher that it was still raining hard. The section gangs were at a point on the railroad where it had not rained a drop, and were at a point of communication, but the train dispatcher, instead of having one or more of these gangs patrol the track ahead of the train, merely put out a train order to look out for high water between two certain points. Had the train dispatcher, in this case, complied with the rules of the railroad, this serious derailment would not have occurred.

Striking automobiles and trucks at crossings is increasing our train accidents, and I think that one way to reduce accidents of this kind is by having strongly built pilots on our engines; this together with the education of the driving public to stop, look and listen at railroad crossings.

We all have rules and instructions on our railroads which, if complied with, would practically eliminate all of the train accidents mentioned, and it is part of the safety man's business to see that these rules and special instructions are complied with. If you will make observations and checks you will find that there are im-

structive safety work upon the American railroads. Yes, every 26 hours, throughout the year, some employee on some railroad throughout this nation is struck by a locomotive or car and either killed or seriously injured, due to the fact that he does not look carefully before he attempts to pass over a track, or attempts to cross over a track too near a standing locomotive or car. This is indeed a challenge to human intelligence, for the rules designed to prevent these tragedies are among the simplest and easiest to understand. The progress has not been great as compared with the progress under other causes, 1934, as compared with 1930, showing a decrease in the casualty rate of only 8 per cent.

The second cause is: getting on or off locomotives or cars, either moving or standing. During this five-year period, there has been an average of 28 employees killed and 1,784 injured each year. Yes, five times a week, with clock-like regularity, some employee on your railroad or mine is injured, every sixty-fifth injury resulting in death, due to the fact that he does not have a proper foothold, he does not have a secure hand-hold, he fails to use the sense of vision that God gave him to determine whether or not there are any obstructions on the ground before he attempts to get off the car. However, the progress in the reduction of accidents due to this cause has been some better than in the previous one, there being a decrease in the casualty rate in this four-year period of 26 per cent.

The third cause occurs while operating locomotives. During this five-year period, there has been an average of 8 employees killed and 1,224 injured each year. Every seven hours of the day, on some railroad throughout this nation, an employee, while operating a locomotive, is injured, due either to his failure or the failure of some co-worker to obey the rules. There has been a decrease in the casualty rate of 26 per cent, under this cause.

The fourth cause is made up of operating hand brakes. During this five-year period there has been an annual average of 17 employees killed and 720 injured each year. Twice a day, every 12 hours, on some railroad throughout the United States an employee is injured, every forty-third injury resulting in death, and in 90 per cent of those injuries you can attribute it to his failure to adhere strictly to a proper method of brake operation.

It is true that in the analyses that flow from the Interstate Commerce Commission reports we perhaps do not get the data in a refined manner, but I assume that on your respective properties you maintain your records so that that can be done. We do it on the New York Central, and I can truthfully say that out of the total number of hand brake accidents not more than 3 per cent can be charged to defective equipment. There has been a decrease in 1934 under 1930 of 29 per cent in the casualty rate due to operating hand brakes.

The fifth cause occurs while coupling and uncoupling cars or locomotives. During this five-year period there has been an annual average of 18 employees killed and 361 injured. Every 23 hours some employee on some railroad throughout this nation is injured, every twenty-first injury resulting in death, due to violating safety rules, going in between moving cars, having a misunderstanding about signals, and practically every one of those is preventable. I want you to note that the more inherent the hazard, the greater the decrease. The decrease in the casualty rate during this four-year period is 32 per cent. An employee, when he goes between moving cars, knows he is going into the jaws of death; therefore, the accidents have substantially decreased.

The next cause is coming in contact with fixed structure. During this five-year period, there has been an average of 18 employees killed and 194 injured each year due to this cause. Four times a week, year in and year out, some employee on some railroad is injured in this manner, every twelfth injury resulting in death, due to his failure either to know of the location of these close clearances, overhead or at the side, or having the knowledge he fails to heed the warning. However, there has been a decrease during this four-year period of 32 per cent in the casualty rate.

Coupling or uncoupling air or steam hose produces 9 deaths and 158 injuries every year, due in nearly every case to the violation of safety rules. Every twelfth employee thus injured is killed, all of which could be avoided if the rules were obeyed.

The next cause occurs while operating switches, and, strange as it may seem, we have an employee killed and 240 injured every year. One every 36 hours, some place throughout the nation, is injured due to the fact that he does not have a secure foothold or he does not know how to operate the switch. Occasionally the switch will be inoperative, but very seldom does that occur. The majority of these injuries result in strained backs or sprained ankles.

The ninth cause is due to being struck at grade crossings. Those, as you know, involve outside agencies. During this five-year period there was an average of 11 killed and 43 injured each year. Here again you will note the high proportion of deaths; one out of every five injured in this manner dies. We have only a part of this problem under our control, but to that extent we should improve the record, for the reason that during this five-year period there has been an increase in the casualty rate of 33 per cent. This is the only cause of the ten where there has been an increase during this five-year period.

The tenth cause comes under the classification of miscellaneous accidents. During this five-year period there have been an average of 148 killed and 3,325 injured each year. Thirty-five per cent of the deaths and 40 per cent of the injuries occurring in train service accidents come under this miscellaneous heading. As you doubtless know, the published reports of the Interstate Commerce Commission, under the classification of miscellaneous accidents, place them under 89 causes. We have selected 11 of these 89 causes that go to make up 85 per cent of those accidents occurring under the miscellaneous heading, and we give you the benefit of that. They are made up largely of sudden stopping of train, improper handling of the air, bursting air hose, stepping on rails or ties, stepping on boards, becoming entangled in signal wires, and so forth, handling freight or materials, stepping from one car to another.

Aside from the humane and economic aspect of the accident prevention problem, train service and train accidents combined also present another very important feature. From the public viewpoint, very little if anything is known as to shop operation, station operation or maintenance operation. The opinion of the public as to the safety of the railroads of this country is made up largely of their knowledge of the safety of transportation. Therefore, it involves the obligation of every railroad officer in this country to see to it that trains, both passenger and freight, are operated with the minimum number of accidents, and as a consequence a minimum impairment of service.

Struck and Run Over by Locomotives or Cars

By D. G. PHILLIPS

Superintendent of Safety, Wabash Railroad, St. Louis, Mo.

I am not going to talk about facts and figures, because Mr. Hill covered that thoroughly in his report. We have all the facts. But what are we going to do with these facts?

We have these men killed, struck and run over. What were they doing when they were killed? The analysis is simple. They were doing one of four things. They were attempting to cross the railroad track without first looking in both directions. They were walking on the railroad track or afoul of the railroad track, when it was possible to walk some place else. They were crossing too close in the front of a car, in what I call a live yard. A live yard should mean any track that is not under flag protection. And the fourth is getting off an engine or a car without looking in both directions before getting off.

Then the remedy becomes apparent: anyone can tell what it is. Look both ways before you cross the railroad track. Look both ways before you get off the side of a locomotive or car. Don't walk on the railroad track or afoul of the track, when you can walk some place else. Don't go too close to the end of a car.

What are we going to do? You say, enforce rules, and all that sort of stuff. But we have to get down a little more explicitly. There are two schools of safety superintendents. There is one that says, the way to do is to arm the superintendent, or the operating official, with all kinds of authority, and every time he sees a rule violation to sidetrack the fellow, put him on the bench. That is one class. The other class says, "Get down on your knees and pray to the fellow, talk to him about his wife and family, and all that sort of stuff."

I have in mind two superintendents who in 1934 had eight reportable injuries on the two territories, no fatalities, 7,000,000 man hours worked, a ratio of just a little over one. In that year, on those two divisions, there was not a single case of discipline or punishment inflicted. Would I go to those two superintendents and say, "Your methods are all wrong; get a club and get busy."

On the other hand, I know superintendents who believe strictly in enforcement of rules and who do assess discipline frequently, and they have records just as good as that record. I am not going to that superintendent with that excellent record and say to him, "You are going the wrong way. Quit using that club and do more praying."

No, the thing we have to do, when a superintendent's devision is better than any other division, is to send him that bronze race horse, indicating that we are watching what he is doing, and if he is the poorest, send him that white elephant. I will tell you, that superintendent won't need to be told whether to use discipline, or whether to use other educational methods. He will see his job is cut out for him, and he will get busy.

I was watching a gang of men tear up an old platform. One of the men had never worked on the railroad before. We have a rule that you are not supposed to step on the rail when you cross the track. This poor fellow had never heard of that rule, and every time he crossed the track, and he was doing it frequently, he was managing to step on every rail.

The foreman was watching them, and not saying a word. Finally I went up to him and said, "You have a man here who is violating safety rules all the time, stepping on a rail, and you never say a word to him."

The foreman said, "Come over here, young fellow," and he used some railroad language that I am not going to use. "The next time you step on a rail I am going to discharge you." The fellow looked at him in amazement, and the foreman said, "I mean it, the next time you step on a rail I am going to discharge you."

The fellow walked away, and I said, "Say, you did not tell that fellow whether you were afraid he would get the rail dirty or break it. He doesn't know what you gave him those instructions for."

Fellows, that is not the right kind of supervision. I said to the foreman, "There is only one occasion for ever bawling out a man like you did there, and that is after you have done and said everything you can and he has continued to break the rules. If you fully explained to him the reason for the rule, which you can see by his looks he doesn't know, then if you want to talk to him like you did today, all right, but ninety-nine times out of a hundred if you would explain to a man why you did not want him to step on the rail, you would not have to say what you said to him a while ago."

I have heard that a great railroad man said three or four years ago that in seventy-five cases out of a hundred, where an official discharged a man, a really honest investigation would have shown that if anybody should have been discharged it was the official himself, because he had not attempted to teach that man. Don't understand me to say that I do not believe in discipline when the right time comes; but I do have enough faith in the railroad men of America to believe that as smart and intelligent as they are, if you put these safety lessons before them in the right light, it is never going to be necessary to put them on the bench.

The other day, I stood in a watchman's tower at the yardmaster's office, where I could watch the operation of seven switch engines. There were five leads there, with switch engines working on all those leads, and I watched them for three hours and did not see a single rule violation. I was talking to the superintendent about it afterwards and I congratulated him on the fact that I had not seen a rule violation in three hours. He said, "After what I have done and after what I have said, they had better not let me catch them doing it."

He had done all he could. I happen to know that he had gone to the trainmen's lodge, attended the open sessions, talked to them about safety, and whenever the grievance committee or other representatives came before him, when the other business was through, he tried to put over the great idea of safety. That is what we have to do.

There is one other thought. Charles Kingsley was once asked the secret of his success, and his answer was, "I had a friend." The secret of the one hundred per cent safety record that we hope to make lies in that word "friendship." If the supervising official is the kind of a friend that he ought to be to the men who work under him, I am not worried about the results he is going to get. If the supervising official is a friend of a man that works with him, it does not mean that he is not going to punish him at all. The best friend that Duff Phillips ever had was his dad, but, oh, my, when dad saw fit, in spite of that friendship, I was subjected to treatment that I remember to this day. But he was my friend, and he was doing what he did on account of his friendship for me. If a supervising official is a friend of the men under him, every time he sees a man doing something that may result in that man's injury or death, his friendship will cause him to take whatever steps are necessary. It may be a word, it may be more than a word, it may be punishment later on, but friendship will impel him to take the steps that will save that man's life and save his wife from being a widow and those little children from being fatherless.

But this friendship should go farther and will go farther than that. I say that whenever we can get the railroad employee himself to feel that it is an act of friendship, every time he sees a fellow workman indulge in an unsafe practice, to say something to him, then we are going to get rid of these unsafe practices which would soon become habits and which take effort to overcome.

I was in Chicago the other day. We had a switchman who in the old days was in the habit of doing about everything that a switchman should not do. I went up to him and said, "Bill, how are you getting along with these unsafe practices?"

"Well," he said, "I am getting along fine. I have myself about broke of them. But you know sometimes in making up a string of cars here, the yardmaster is on one end of the yard hollering at me and the trainmaster is on the other and the superintendent is walking up and down the yard, and I am in a hurry, and I forget. It has got so every time I do something unsafe some other roughneck switchman hollers at me, and they keep it up until they have about got me broke of those habits."

Getting On or Off Locomotives or Cars and Operating Locomotives

By C. L. LA FOUNTAINE

General Safety Superintendent, Great Northern Railway, St. Paul, Minn.

I have looked over the records and I find that, under the heading of operating locomotives, according to the six months' statement that we just received from the Interstate Commerce Commission, there were six employees killed coming under that classification for that period of this year. In 1931 there were 6 killed; 1932, 6 killed; 1933, 5; 1934, 6. So we have our quota for this year, already, unless we are going to have a poorer record that we had last year.

I find in checking over the six fatalities that two men fell from the tanks of engines, two from the gangways, one from the running board, and in the other case evidently he had his body exposed on the outside of the cab or in the gangway.

I am going to talk about those falling off the tanks first. It is necessary to go back on the tank of an engine for two reasons—to take coal or water. The first thing any railroad officer and supervisor should decide upon is the proper method of getting back there. It is my opinion, with the advent of the newer type tenders and vestibule cabs and winter curtains, nearly universal now on all the railroads, that the method of getting from the engine cab back over the tank is less inviting each year. The safe way is to get down out of the gangway, on the ground, go to the rear of the tank and get to the top from a ladder, one of which we should have on each corner at the rear of the tank. That gives the fireman a chance to swing his standpipe, in case it is a standpipe. If not, he will have to pull the spout down, of course, when he gets on top of the tank.

In one of these cases the fireman was apparently reaching over to pull the pipe around. The report says he had a hook. All engines should be equipped with a hook, one properly designed, of sufficient length that the man can reach over, when he is standing back on the tank, and get his standpipe and pull it around, not one so short that you have to get on the edge and pull it around.

There are no details in connection with this accident. The safety officer on the railroad said the engineer got down to oil around, and the fireman was up there going to take water. The engineer missed him and went to look for him and found him lying on the westbound track dead. We do not know anything more about the particulars. The top of the tank was clean. It follows that it should be kept clean. If it is an oil-burning engine, I want to impress you with the need of keeping oil off the top of the cisterns. We try to put a light coat of sand on them, because the oil when you have rubbers or overshoes on, is mighty slippery.

The other case was that of taking coal; the report says he was pulling down on the chain and his hand slipped off and he fell to the ground. Anyone who has ever been up on one of those tanks, especially if the tank is empty, knows there is no boardwalk there to stand on. It is not the safest place to stand or work. But if he uses ordinary care, I believe he can stand there, assuming, in all cases, that the chute is working properly and you have a properly designed chain or rope on the coal pocket. I did not ask the safety officer why his hand slipped off, but I am inclined to believe that the rope or chain did not have a knot or ring on the end, in which case it would be very possible for something like that to happen, because in order to lower the pocket you have to put all of your 175 pounds of weight on it.

In the vestibule type of tank on our railroad we have placed a step on the inside of the tank. I think that is of material aid to the fireman in getting his coal pocket down, when the tank is practically empty. If you have a half a tank of coal, you can get back and stand on the coal at the rear.

A lot has been said about co-operation between the fireman and engineer, and I did not suppose that we would ever have the misfortune to have an accident where a fireman was injured at this day and age, account of being caught between the coal pocket and the cab of the engine. But we did, and the boy was badly injured. One leg had to be amputated below the hip. We were able to save the other limb. It happened very innocently. The man ran by the coal pocket, slacked the train back, set his automatic air, and when he had the train bunched failed to set up his independent brake. The fireman pulled the pocket down, standing between the pocket and the cab of the engine, to get away from the coal dust. No one likes to eat that coal dust, but it is much better to take the coal dust than to allow yourself to get in a position where an oversight on the part of one of your fellow workers may cause a serious injury. That, of course, gets back to a matter of supervision.

As to the two falling out of the gangways of engines, one was getting a 19 train order. I do not know how many railroads receive their orders from the gangway. It is not the safest place to receive train orders. It took a long time to break up the habit after we decided to do so, but by obtaining train order hoops of sufficient length that the operator can stand on the platform well back so he is not afraid, he can reach up there and deliver the order to the engineman or the fireman in the cab window. We had a man getting a train order, and he failed to get back in the clear quickly enough and struck a coal shed about a block up from the station and was killed. Since then we have delivered the train orders to the cab window, and I should like to recommend it as a safety movement.

In the other case, the safety officer tells me that this man came in the night before on his regular run and was called out the next day. After the accident happened they checked up and found that it was pay day, and this man, instead of getting his regular rest, which is very essential, got everything else but rest, apparently, and they feel that that was the cause of his perhaps being careless or letting himself get in a position where he fell out and was hurt.

There are several of these classifications that are interwoven. You have accidents due to obstructions on the right-of-way. We had a case recently of an engineer, fifty years in the service the day he was killed. He went out on the running board to clean off the window after coming through the snow sheds in the Rocky Mountains, and he was knocked off at Tunnel No. 1. He knew the location of it. It was just a case of going out there, unthinkingly, and he was struck and instantly killed. If we can bar men from going out on the running boards of engines, I am satisfied we are going to stop a lot of these accidents.

We had another case that could have been fatal and was a serious injury. The employees were going back from the St. Paul Union Depot, in daylight. A passenger train was coming in and he tried to turn on the injector on the fireman's side, and it was disconnected. The man stood on the little ledge and put his hand on the arm rest to see what was happening, and his head hit the block signal and he was knocked off. In not to exceed ten minutes' more time he would have been back at the roundhouse, where he could have got off on the ground and found out why the injector was disconnected. The injector on the engineer's side would have supplied all the water that was needed.

We are going to continue to have mishaps like that unless we have rules prohibiting those things, unless we have officers that realize those rules are necessary and will see that they are enforced and see that the men understand them.

Operating Hand Brakes and Coupling Cars or Locomotives

By A. O. BECK

System Supervisor, First Aid and Accident Prevention, Canadian National Railways, Montreal, Canada

As figures for the United States railroads are outlined in the report presented by our chairman, I propose presenting the lost time accident statistics for the years 1931 and 1934 covering these two operations on the Canadian National Railways, which includes the Grand Trunk Western Lines in the United States.

Under the heading of "Operating Hand Brakes" we had four killed and 49 injured in 1931, as against no fatalities and only 20 injured in 1934. In the other classification of "Coupling and Uncoupling Locomotives or Cars," there were 21 injuries recorded in 1931, and no deaths. Unfortunately, the record for 1934 shows 22 injured and two deaths. The analysis of the accidents shows that in operating hand brakes, 7 resulted in injuries to hands and feet, chiefly due from slipping when operating brakes; 4 due to defective equipment; 1 due to brake club breaking; 8 due to unsafe practices, carelessness and inattention, making a total of 20. In coupling and uncoupling locomotives or cars, 7 were due to slipping when manipulating levers, and so forth; 1 due to defective equipment; 3 due to violence of switching operations; 8 due to rule violation; 5 due to unsafe practices, carelessness or inattention, making a total of 24.

It might be well to explain that our statistics on the Canadian National Railways are based on the interpretation that a reportable injury is one sustained by an employee arising out of or in the course of the performance of regularly assigned duties and resulting in death or permanent disability, or any loss of time from work other than the balance of the day, shift or turn in which the injury was incurred.

With the exception of climatic conditions in some sections, the physical and operating characteristics of railroading in Canada and the United States are identical. Thus the causes and remedies relating to accidents are likewise identical. We in Canada are faced with the same conditions, and much greater progress in accident prevention will be apparent in the future, provided that the necessary co-operation is obtained, first, with the mechanical department in the improvement of designs, material and adequate maintenance of equipment; secondly, the operating employees, in adhering to the rules, safe and common sense practices; thirdly, the preventive department in detecting unsafe conditions and practices and the development of engineering reforms, and, last but most important, the acceptance and enforcement of the new measures by all.

You will readily appreciate the absolute necessity of complete and permanent co-ordination of effort of the three departments mentioned.

To further emphasize the necessity of co-operative effort, I would like to mention a case which came before one of our Provincial Compensation Boards. The employee concerned sustained injury while riding on leading footboard in order to couple the engine to the cars, a direct violation of our safety rules and instructions. Our claims department endeavored to controvert the claim on the grounds of violation, but investigation developed the fact that the employee and several other witnessing employees admitted the unsafe practice and rule violation. Nevertheless, the Compensation Board rules that they could not refuse compensation on the grounds that the accident was brought about by the violation of a rule when it was shown that such rule was never enforced and that the company's officials had tolerated such violations.

Then there was another case of an employee wearing a suit of overalls with very

full trouser legs. In making a coupling he caught the toe of a boot in the cuff of his trousers, tripped while between cars, lost his balance, fell under the wheels and was killed. I quote this case as an illustration of the necessity of employees adhering to rules made for their protection.

National Safety

By JOHN E. LONG

President, National Safety Council; Superintendent of Safety, The Delaware & Hudson Railroad, Albany, N. Y.

This annual meeting of the National Safety Council in Louisville is equivalent to its twenty-fourth birthday, and I for one welcome it as an opportunity to do at least two things: First, to sit back for just a moment to review briefly the progress that we in the safety movement have made thus far; and second, to listen and talk about charting our course for the future.

In doing this, however, we should not lose sight of the statement made at the Congress two years ago by Wallace B. Phillips, Vice-Chairman of the National Safety First Association of Great Britain, who said that "Civilization is very old, and the safety movement is a mere child."

Twenty-four years constitute a very short time in which any movement such as ours can really gain a foothold in the minds of the millions of people of America.

Nevertheless, in spite of our youth, we have gained such a foothold—and thanks to the initiative, enthusiasm and active support of just such men as are gathered here today, there are more than 198,000 persons alive this minute who would have been killed by accidents had the 1913 accidental death rate continued unabated.

In this connection, I need hardly remind you of the statements already made by some of our distinguished speakers to the effect that we of the steam railway industry have just cause for pride in achieving since 1913 a 55 per cent reduction in all types of steam railway accidental deaths. It is a great satisfaction to know that passengers are still safer in steam railway trains than when using any other vehicle of transportation.

But lest we become apathetic and relax our efforts, let us remaind ourselves that our job is not, and perhaps never will be, completed. There is still so much that remains to be done.

Our national accident death rate is still entirely too high; higher, in fact, than the rates for 22 of the 23 foreign countries for which we have comparable records. The South American republic of Chile is the only one of these 23 countries which has a worse record than ours.

Safety means the saving of human life from accidents But in approaching the question of accident prevention, we must realize that accidents constitute a universal problem: one that involves every activity in which we participate.

This problem confronts every individual. It is everybody's business to see that another Morro Castle disaster shall not take place. But everybody's business must be brought down to someone's responsibility if we are to secure real and lasting results. Accidents will stop only when each individual accepts his personal responsibility for our accident toll.

Accidents continue to occur because many of us evade this responsibility. We do things unthinkingly, but we continue to start fires with kerosene, to shoot off guns that were not loaded; we still try to beat the train to the railroad crossing, we do many other equally foolish things that frequently end in tragedy.

True, we must never abandon our efforts to eliminate hazards, nor to enact and enforce reasonable laws, rules and regulations, but more than all other things combined, do we need to bring our millions of associates, friends and fellow citizens to an appreciation of their own responsibility for the avoidance of accidents.

And to do this, we must utilize every possible contact. We much reach every human activity and strive to influence every habit and custom. We must secure the assistance of our employers and workers; fathers, mothers, and children; teachers, doctors and law-makers, as well as those selected to enforce our laws.

Accident prevention is a problem that will be solved primarily by individual action. We will never have adequate protection for human life until the manufacturer insists on safeguarding every machine before it is offered for sale; until the employer insists on safe equipment and safe methods of performing every job; until the worker makes safe practices a part of his sub-conscious habit; until the motor car driver becomes as courteous as he is in his home or office.

Permit me to cite just one illustration. Not long ago in a large gas plant, an executive of the company attempted to enter the plant while smoking a cigar. The gateman, not aware that this individual was the vice-president, flatly refused him admission until he had deposited his cigar in a metal refuse container provided for that purpose. This gateman fully understood his personal responsibility and lived up to the confidence reposed in him by his employer.

But, you might ask, can we bring about such a change in the habits and customs of 130,000,000 people? Can we get each person voluntarily to assume his share of the responsibility for the prevention of accidents? The answer to these questions, in my mind, is unqualifiedly "yes."

How? By continuing the same methods and procedures which have been employed so successfully during the past decade or more by our leading railroads and industrial organizations. In each location, in each industry, the work was started by one or two far-thinking individuals sometimes called safety men.

WEDNESDAY AFTERNOON SESSION

October 16, 1935

Transportation By Rail—Speed With Comfort and Safety

By ROY V. WRIGHT

Managing Editor, "Railway Age"

We are in the midst of a speed age. Records of travel—in the air, and on the rail, highway and water—are being broken with such frequency that announcements of new records have lost much of their old force in challenging our attention.

With the introduction of the private automobile on a large scale and the increasing use of the motor bus and the airplane with high speeds, the railroads have steadily lost passenger business for many years, although the trend started to turn back upward slightly in 1934. In that year, however, it was less than 18 billion passenger-miles, as compared to an average of 31¾ billions for the five years 1926-1930. A further increase will be registered in 1935. Railroad managements realize that they face serious difficulties in attempting to build up their passenger business, and that only by unusual and spectacular efforts, based on high standards of service, can they stage a comeback.

The public demands fast transportation, both passenger and freight. The demand for speed, as a matter of fact, has predominated over the demand for safety. Air traffic has continued to grow, and the speed of highway traffic has increased tremendously. However, the cost in human lives of this speed is startling.

An increasing proportion of the public, it would appear, is going to demand safety in travel, along with speed, comfort and convenience, and reasonable price. What are the railways doing to meet this demand?

The answer, in a broad way, is the provision of facilities over which modern and specially designed equipment can be operated successfully at high speeds with a maximum degree of safety. This may appear difficult, but a study of developments indicates that the foundations have been well laid for a more intensive development of rail transportation at this time.

The rapid extension of the railroads, in the effort to open up and develop the interior and far parts of the country, slowed up in the early part of the present

century and attention was concentrated upon improving the facilities and equipment to meet the demands for handling heavier traffic with faster and more reliable service.

Roadbed and track have been vastly improved. A better understanding of drainage problems; deeper ballast; treated ties of large dimensions; heavier rail sections of improved design and composition; improved and more substantial rail fastenings; the rail flaw detector which discloses internal defects in an almost uncanny manner; more efficient methods of maintenance of way operations; greater refinement in track line and surface; the use of rail motor cars by maintenance and supervisory forces, the widespread installation of labor-saving machinery and devices—these are some of the things which have combined to provide a track over which heavy trains may be operated safely and comfortably at high speeds.

Powerful locomotives designed to operate with high sustained capacity have begun to replace the older types. Safety steel passenger cars have replaced the wooden equipment. Freight cars have been designed to reduce the expense of maintenance and increase safety in long trains at higher speeds, improvements have also been made to eliminate loss and damage to contents.

These improvements have tended to increase the weight of the equipment and the costs of operation, but this has been offset by refinements which in various ways have cut down the unit costs of operation. The problem has been made more difficult in the case of passenger cars because of the necessity of making them more comfortable and luxurious.

Signals have been improved. Originally conceived as safety devices, they have become a most important factor in expediting train movements and increasing the efficiency of operation.

From the beginning of the century an effort has been made to design self-propelled rail motor cars for use on light traffic and branch lines. It was a long, difficult task to develop sufficiently powerful internal combustion engines for this purpose, particularly since special materials have not been available to make any considerable reductions in the weight of the equipment.

Roughly, this was the situation when the railroads were staggered by the falling off of business in 1930. Both railroad managements and the railway supply interests did a lot of hard thinking and development work when business was at a low ebb. The results are now becoming evident in a most decided fashion.

I need but remind you that air-conditioning of passenger cars was started in the very heart of the depression. The first announcement of high-speed streamlined trains came in the summer of 1933, and since that time a considerable number of these trains has been built and placed in successful operation. There has also followed a speeding up of all passenger train service.

The startling development of special materials and improvements in the construction of internal combustion engines, which made it possible to build articulated trains so light that relatively small built-in power plants provide much more horsepower per ton than is available for heavy main line passenger trains, proved the combination which set off the race of the railroads to speed up their passenger operations.

While the streamlined articulated trains have had the center of the stage in the public eye, there have been other important developments which, while less spectacular, are of great significance.

The high-speed streamlined, Diesel-electric articulated trains of very light materials have been supplemented by a variety of combinations of high-speed equipment, including standard passenger cars drawn by rebuilt steam locomotives; specially designed cars drawn by specially designed light, high-speed steam locomotives, and other combinations.

It must be emphasized that they are operated over lines which have been built and are used for heavy high-class traffic.

The problem of the amount of super-elevation of the outer rail on curves is greatly complicated by the spread between the speeds of the passenger and freight trains. Freight trains, however, have been considerably speeded up in recent years, and this, coupled with the lower center of gravity of some of the new high-speed trains, make the problem less serious than might have been anticipated.

Another consideration is that while maximum running speeds have been increased, this increase is not nearly as great as the shortening of schedules between terminals would indicate. Generally speaking, the high-speed trains make fewer stops and do very little work at the stations; moreover, these trains have been so designed that

most of them can be accelerated and stopped much more quickly than the standard equipment. Also, steady and continual improvement has been made in main line track over the years, to insure better and smoother operation.

Before introducing the high-speed trains it has been the practice to check critically every detail of the track construction. As a result, super-elevation of the outer rail on curves has been adjusted; curvature at critical points has been reduced wherever it could be done at reasonable expense; and the approaches to and run-offs from curves have been spiraled for easement. When this has been done the train is operated over the road at high speed, observers watching and critically checking every detail. Further modifications are then made in the track, or the speed of the train is adjusted at critical spots to insure better riding. Slight irregularities in line and track surface, which would not be noticed at ordinary speeds, affect the operation at higher speeds. It is therefore necessary to maintain the track in prime condition always.

The problem of adjusting the signals to suit the high-speed trains is dependent upon the equipment used. The light, high-speed trains, with highly specialized brake equipment, automatically controlled, are stopped from top speed in about the same distance as the heavier standard equipment operated at a considerably lower speed. With the heavier, high-speed equipment using the standard high-speed passenger brakes, however, the braking distance is increased, and it is necessary to respace the signals.

In general, the speeding up of freight and passenger trains in recent years has made some signal installations more or less obsolescent, and the installations of the high-speed trains has only hastened the day when radical improvements must be made.

It has also been necessary to set back the contacts for grade crossing signals, to insure the 20-second warning required by the A.A.R. rules. In some instances additional crossings, less frequently used, have been protected with signals.

Many things have been done in the design and construction of the power units and cars to minimize stress on the track and to insure ease and smoothness of operation, which, naturally, will be reflected in greater safety. A saving in weight of the equipment obviously decreases wear and tear on the track, reduces cost of operation and makes it much easier to accelerate the trains and stop them from high speeds. Special materials of light weight and great strength have been used for this purpose, and articulated trains have been introduced for the first time in trunk line service in this country.

The designers have taken special precautions to construct the equipment to insure a maximum degree of safety in case of accident.

Outstanding features of the power units, whether Diesel-electric, rebuilt steam locomotives or newly designed locomotives, are the efforts which have been made to provide rapid starting and acceleration and to insure easy and smooth riding. The use of the dead man's handle in Diesel-electrics and unusually successful efforts to improve the counterbalance and reduce the dynamic augment of the steam locomotive, are typical of some of the steps which have been taken to insure safe and smooth operation.

I have already spoken of the careful checks which are made on the trial runs of new trains. The original schedules, laid out after careful calculation, are checked in actual operation and adjusted to insure smoother operation. The problem then becomes one of educating the crew to the new requirements and restrictions. As typical of the care which is taken in this respect, one road has carefully laid out zones over which certain top speeds are to be observed, with special restrictions wherever necessary. Roadside signs indicate the zone speeds and restrictions. On some roads engineers are assisted in checking speeds by the use of speed recorders, which are said to give the man greater confidence, and can also be used in checking up to adjust speeds for better handling at critical places.

The entire crew, as well as employees along the line, is keyed up for this more intensive type of service. Employees along the road are required to look over the train as it rushes past, and to signal if all is right. If they note anything unusual that may need attention, they must so indicate. The brakesman is required to acknowledge every one of these signals from trackmen, crossing watchmen, signal men, station men, passing trains, etc.

In the same spirit the train is critically inspected at each stop. The inspection at terminals between runs is almost microscopic in its thoroughness.

These trains have also placed a larger responsibility upon the police department.

More than ever is it important that children and trespassers be kept off the track and that good housekeeping be observed in keeping loose materials off the right-of-way.

Safety efforts, always regarded as of first importance, promise to have an even more impressive part in railroad operations. Here again, the foundations have been soundly laid for a more intensive use of the railway plant. American railroads today enjoy an enviable record for safe operation. It is interesting to note that among the railroads which have introduced high-speed trains are those which stand at the very top of the list in this respect. These new trains, in turn, have already done much to key up the organization to still higher standards of safety observance.

Report of Committee on Prevention of Highway Crossing Accidents

By H. A. ROWE

Manager, Claims Dept., Delaware, Lackawanna & Western Railroad

The report of this committee for the year 1934 shows an increase in the number of accidents, fatalities and injuries at railroad-highway crossings compared with the year 1933—the record being as follows:

Year	Accidents	Fatalities	Injuries
1933	3,235	1,511	3,697
1934	4,128	1,554	4,300
Increase	893 (27.5%)	43 (2.8%)	603 (16.3%)

However, it may be well to have an immediate comparison between the last past year and the peak year of railroad-highway crossing fatalities, 1928—as follows:

Year	Accidents	Fatalities	Injuries
1928	5,800	2,568	6,667
1934	4,128	1,554	4,300
Reduction	1,672 (29%)	1,014 (40%)	2,367 (34%)

Casualties during the four months of June, July, August and September, 1934, in the Careful Crossing Campaign, compared with the same period, from 1928 to 1934, inclusive, were as follows:

Year	Accidents	Fatalities	Injuries
1928	1,799	858	2,092
1929	1,827	749	2,140
1930	1,371	640	1,505
1931	1,103	496	1,196
1932	899	432	1,022
1933	990	491	1,124
1934	955	450	1,161

It will be noted that automobile registration on December 31, 1934 was almost 25,000,000 vehicles, an increase of 4.6% over the preceding year, and it is almost identical with the number of motor vehicles registered in the peak year of railroad-highway crossing accidents when the registration was 24,750,000.

Gasoline consumption, which is a fair barometer of automobile use, was 17,220,567,000 gallons during 1934, an increase of approximately 7% over 1933. The increasing use of smaller cars, with greater mileage per gallon of gasoline, indicates that the traffic over and across railroad tracks was beyond the peak year of railroad-highway crossing accidents. About 92% of all such railroad-highway crossing accidents involves the use of automobiles. The remaining 8% includes persons in animal-drawn vehicles, bicyclists, pedestrians, etc.

During the year all railroads in the United States operated 1,099,365,072 locomotive miles, or 707,442 miles to each crossing fatality. Expressed in other words, there was one crossing fatality to each locomotive journey comprising twenty-eight times around the world at the equator.

The number of automobiles to each railroad-highway crossing fatality during the year was 16,019—a creditable showing to the advantage of the automobile insofar as fatalities is concerned. However, there were 5,794 automobiles registered for each crossing injury, and this record is not so favorable.

Your committee again recommends that individual railroads particularly stress the necessity of their train crews and others giving *adequate and timely warning to the public of the approach of trains to a highway crossing;* that *warning from engine should be continued until the crossing is definitely reached;* that the standards of protection established by the Joint Committee on Grade Crossing Protection be employed where necessary at crossings to facilitate uniformity and public understanding of the signals; that crossings be periodically inspected and maintained in sound, travable condition with all obstructions to the view removed wherever practicable; that advantage be taken of the opportunity to address school children and students of colleges and universities on the subject of railroad-highway crossing safety, no opportunity being lost to present the subject at luncheon clubs, automobile clubs, and any places where automobile drivers may gather.

THURSDAY MORNING SESSION

October 17, 1935

Report of Committee on Non-Train Accidents

By E. B. PERRY

Assistant to General Manager, New York, New Haven & Hartford Railroad

The reduction of over 46 per cent in non-train accidents to employees on duty, accomplished in the past three years, is gratifying. However, the very fact that material reductions have been so readily made supports the belief that a large decrease from the 1928 figures is still easily possible.

We have felt that no good purpose would be served by a mere recital of statistics. That which has happened cannot be corrected but should be used as a basis for thought and action to prevent recurrence. Your committee are agreed that they should outline plans for the future rather than recite history.

A review of the statistics indicates the major causes of non-train accidents fall into the following classes:

Use of hand tools, apparatus, etc ; Collapse, fall, etc., of objects; Handling rails, ties, bridge timber, etc.; Handling freight and supplies; Falls of employees not includible in class (a) to (f).

(Report had been distributed in advance to all delegates.)

There has been a marked and steady decline in non-train accidents per million man hours worked—the 1933 figures being the lowest on record.

Use of Hand Tools and Apparatus

By H. R. COLE

Assistant to Vice President, Erie Railroad

All tools and machinery should be inspected at least monthly. Proper tools should be used for different classes of work. Reclaimed tools such as clawbars, cold chisels, etc., should be thoroughly tested before placing in service. New men should be instructed in the use of tools and how to keep them in proper condition. Tools should not be left in dangerous places where employees may fall over them.

Metal spurs should be used on ladders. The use of a rubber collar on cold or hand chisels to prevent pieces of material from flying is suggested. A 50 ton air jack can be used at wheel pits eliminating use of jacks with lever which might slip.

A speed tool can be used for removing or applying nuts to bolts, flexible stay-bolt caps, reaming frame bolts in close quarters, and dome caps. This fits closer around nut and is not liable to slip off as readily as an open end wrench. An improved journal jack with extension arm to hold wheel to rail can be used to prevent jack from slipping or wheel raising. Particular attention should be given to renewing brake shoes on car retarders; straps of canvas doubled and stitched can be used for placing these shoes in order to avoid danger of bruised fingers. Wood should be used at all times between steel and head of jack to prevent slipping of jacks.

All tools should be removed from top of bridges or placed in a safe location to prevent falling when trains are due. Track jack lever sockets should be made square so that lining bars instead of round wooden bar may be used. Track jacks must not be used between rails except under flag protection. Employees should not place hand or foot under rail being held up by bar or jack and if necessary to clean underneath rail should use a stick.

Tools should be properly stowed on motor cars and other vehicles on which they may be carried to prevent falling off and possible derailment of car or accidents.

Employees should be forbidden to wear gloves while using emery or grinding wheels. Warning signs and safety locks should be placed on switches to motors, such as turntables, etc., to avoid possibility of someone throwing switch and setting machinery in motion while man is working on machine. Annual, or more frequent, inspection by testing and whitewashing of all crane hooks, pins and chains on all lifting equipment is suggested.

Men should not work too closely together when certain kinds of hand tools are being used. They should stand in proper position to prevent striking glancing blow and those holding hand tools, which are being struck with other hand tools, should also place themselves in a position where they will not be struck.

Collapse, Fall, Etc., of Objects

By J. R. TENNEY

Supervisor of Safety, Western Maryland Railroad

Standard scaffolding, scaffold boards and blocking should be used. Men working on scaffolds should be instructed to be careful in handling tools to avoid injuring persons working or walking below. They should not leave loose material or tools on scaffold or platform when they are away.

Hoisting derricks and other equipment should be regularly inspected and kept in good repair.

Heavy material should not be stored overhead. Racks should be provided and where floor space will not allow this, only light weight material should be stored overhead. Employees should not throw tools or material from locomotive, cars, buildings or scaffolds without knowing positively there is no one on floor or ground below. When using ladders in repairing cars, precautions should be taken to prevent ladder slipping. Frequent inspection of buildings and premises should be made to see that property is in good repair and safe condition. Workmen should be warned to watch for loads suspended and carried by crane and hoist and must not ride on loads so carried. In erecting side staging on bridges, scaffold planks should be properly supported to avoid possibility of staging slipping. Material stacked should be placed in such manner as to prevent its falling.

All overhead lines, shafts, pulleys, etc., should be inspected frequently. Steel angle irons should be applied to edges of roundhouse pits to provide safe foundation for jacks. Engine tanks should not be overloaded. Employees should not stand too close to passing trains from which material can fall and cause injury. When any objects are jacked up, such as cars for removal of wheels, a substantial base should be provided. Safe hand and foot holds should be provided.

Falls of Employees Not Includible in Classes (a) to (I)

Employees should not be permitted to step on or walk on top of rails, frogs, switches, guard rails, interlocking machinery or appliances.

Walkways, passageways, platforms, etc., should be kept clear of any objects over which an employee might trip and fall.

The use of creepers during icy weather is suggested.

The use of safety belts by boilerwashers, water service and bridge and building men, telephone and telegraph men, and employees working on running boards and other places where footing is limited should be required.

Employees should make certain that platforms and scaffolds are solidly placed and without defects prior to using them. Supervisors should make frequent inspection to see that this is done.

A waste avoidance committee to inspect premises may detect any waste and also obstructions or holes which might result in injury.

Lighting facilities should be sufficient.

If walks are removed from bridge, holes excavated, or other obstructions placed near tracks, they should be protected by proper notice until corrected, to prevent employees from falling.

Care should be used to remove grease or oil on bottom of shoes. During the winter months, platforms, sidewalks and other places where men perform their work out doors should be kept free from ice and snow. Sand, cinders or salt should be used plentifully.

Whenever it is necessary to use a metal cover for pits, etc, the surface of the metal should be roughened to prevent slipping and falling.

Employees who have cuffs turned up on their overalls should be required to have same sewn to prevent tripping over same or catching them on any object.

Handling Rails, Ties, Bridge Timber

By S. L. WITMAN

Supervisor of Safety, Reading Company

Only one man should be designated to give signal for raising or lowering material (usually to foreman) and men should stand clear of ties being handled by machinery.

Proper team work and cooperation should be insisted upon when handling heavy materials and supervising forces are instructed to see that men work safely.

The use of rail laying machine and derricks for handling heavy material carrying rail where footing is not secure must be avoided. When using power equipment for loading or unloading material, the crane should be directly over the ties or timber for a straight lift, sling properly secured and man placing sling positively into clear in all directions before giving signal to hoist. No men should be allowed to stand or walk under the suspended load or between the suspended load and car. When freshly creosoted timbers are being placed, short ropes should be used to keep stringers from slipping out of hands of employees. Rubble cars used in handling rails, ties, bridge timbers, etc., should be inspected to see that the axles, boxing, etc., are in good condition and suitable for the load. Hooks, clamps and cable sling should be inspected to insure they are in good condition and properly applied before lifts are made.

Old coal cars in which panels have been cut and are in the tie trade have been found to facilitate the unloading of ties. The use of tongs in handling ties and tie removals is suggested. Men should be instructed in proper manner of lifting to prevent strains and sprains. Unloading ties or bridge timber from a moving train should be prohibited. In unloading a car the load should be reduced evenly. Chains should be used to permit carrying yard frogs under rubble cars.

Accident Prevention at Freight Stations

By W. C. McALISTER

Freight Agent, New Haven Railroad, Boston

Steel or wooden bridges at freight houses should be securely fastened. The use of a special truck or dollies for handling barrels, pianos, and other heavy articles

is suggested. Employees should be instructed in the proper handling and storage of all freight and supplies to prevent damage or injury to themselves or others.

Hand trucks should be pulled, not pushed. Power trucks should be operated from the head end and only by employees qualified. Care should be used rounding corners. Keep from speeding, reckless driving or other careless practices. The use of gloves to protect hands from cuts and scratches when handling sheet steel, barb wire, etc., is suggested.

The use of torches, lanterns, etc., should be prohibited around gasoline or any inflammable liquid. Goggles should be worn when working with acid, lye or caustic solution. Platforms should be kept free from holes and temporary obstructions. Snow and ice should be promptly removed. Boards with protruding nails and other dunnage thrown from cars should be properly disposed of. Safe platforms for trucking and sufficient men to perform work properly will prevent injuries.

Report of Committee on Uniform Practices in Accident Reporting

By C. E. HILL

General Safety Agent, New York Central System

The present rules provide, so far as employees are concerned, that report should be made to the Interstate Commerce Commission of all deaths and injuries where there is a loss of more than three days during the first ten days following the time of the accident.

During the past eighteen months, there has been an expression from the Reporting Bureau that some amplifications be made of the reporting system. Starting in November of last year we received a letter from Dr. M. O. Lorenz, Director, Bureau of Statistics, in Washington, in which he suggested for our consideration the amplification of the present reporting system, first, by the enlargement of what is known as Form V, providing for a list of all non-train employee injuries, containing the name, the occupation, and a description of the injury. He also recommended the adoption of what is known as Form U, which was to contain similar information, covering those casualties not now included in the present reporting system, where there was a disability of more than one day or the shift on which the employee was injured. In addition to that, he suggested a report of non-employee cases, where the injury was the subject of a letter to the respondent.

The Committee of Direction at a meeting in New York in December last year unanimously went on record as being opposed to these additional reports. Dr. Lorenz and his staff in Washington, after a discussion of the entire proposal, agreed to withhold for the time being at least, the request of these additional reports.

The Committee of Direction meeting in New York in July opposed these additional modified reports suggested by Dr. Lorenz.

Dr. Lorenz stated that he was bringing the matter to the attention of the Interstate Commerce Commission.

There is another matter I wish to discuss.

This committee, after many conferences, proposed what is known as Interpretations of Rules Governing Monthly Reports of Railway Accidents, to the Interstate Commerce Commission and it was submitted to Dr. Lorenz for his review and suggestions. Dr. Lorenz made only a few minor changes and then had these interpretations printed and they were released to the railroads of the country in March of last year. The subject was discussed at our annual meeting in Cleveland in October of last year, and it has also been brought to the attention of all reporting agencies, all safety officers, and all operating officers in the various departments.

We feel that, as a result of those interpretations, defining in unmistakable language what is expected to be reported, there has been an improvement in accident reporting.

ADJOURNMENT

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Vice-Chairman in Charge of Program—M. W. HEISS, Proximity Manufacturing Co., Greensboro, N. C.
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J. E. GROCE, Pacific Mills, Lyman, S. C.
WALTER HUMPHREYS, National Association of Wool Manufacturers, Boston, Mass.
W. H. NICHELS, JR., Virginia Industrial Commission, Richmond, Va.
R. W. PHILLIP, Editor, Cotton, Atlanta, Ga.
E. E. PLACE, American Mutual Liability Insurance Co., Boston, Mass.
T. A. WILSON, North Carolina Industrial Commission, Raleigh, N. C.

WEDNESDAY MORNING SESSION

October 16, 1935

The first session was called to order by Mr. W. V. Gaudet, safety engineer, Liberty Mutual Insurance Company, Roanoke, Va., who presided in the absence of other officers.

Opportunities Afforded by Textile Vocational Training to Further the National Safety Program

By H. H. WILLIS

Dean, Clemson Textile School, Clemson, S. C.

Accidents in the textile industry may be divided into two general groups, (1) mechanical accidents (approximately 20 per cent) attributable to a lack of proper safety devices and (2) non-mechanical accidents (approximately 80 per cent) due to inattention or physical ineptitude on the part of the operator or to improper or inadequate instruction on the part of overseer or supervisor.

Since the National Safety Council and other organizations began their work in accident prevention, the number of mechanical accidents in industry has been decreased, due largely to the installation of mechanical safety devices. For the past few years, however, it has been recognized that safety devices alone cannot solve the problem. The human factor enters largely into non-mechanical accidents. How can the number of such non-mechanical accidents be reduced? The answer seems to lie in training each individual in the plant to be safety-minded.

This problem of making individuals safety-minded is being met in various plants by the establishment of an active safety committee among the workers and by a definite educational program which includes talks on safety, analyses of accidents, and moving pictures which illustrate the right and wrong way of handling a particular job. In addition, there is constant safety supervision from the top down and emphasis placed on care being taken by each person.

Educational campaigns are reducing the accidents in the textile industry. The National Safety Council in its 1934 report gives some significant figures. Although

the average frequency rate of injuries for the whole industry was 8.65 per 1,000,000 man-hours of exposure, the Winnsboro Mills at Winnsboro, S. C., had a rate of only 0.75. This same plant had a severity rate of only 0.01 as compared with the general average severity rate of similar size mills of 0.42. While Winnsboro Mills were having an accident frequency rate of 0.75, other mills of similar size had rates ranging from 15.3 to 23.6 per 1,000,000 hours of exposure.

You will be interested in knowing how Mr. A. E. Jury, agent of the Winnsboro Mills, is able to keep his accident frequency rate so low. He accomplishes it—(1) by thoroughly believing in the advantages to all employees and to the mill in keeping accidents to a minimum throughout the organization; (2) by discussing accident prevention regularly at overseer meetings; (3) by very active service of a safety committee representing all departments, which committee meets regularly once each month, the minutes of the discussions being posted on the bulletin boards of the mill; (4) by constant inspection of machinery and operations with a view to making them safer for operatives.

The system used by another large company which has a very low accident rate is essentially as follows: Accident prevention is considered an operating problem and the operating organization assumes responsibility for preventing accidents in the same manner that it assumes the responsibility for production. The operating organization is divided into a series of safety committees, beginning with the workmen, and continuing through the ranking supervisors and department heads who form a central safety committee. It is the duty of the central committee to direct the accident prevention work of the plant. The membership of the central safety committee is constant whereas that of the workmen's committee is changed at regular intervals so that all employees of a department may take part in organized safety work.

The workmen's committee is divided into such sub-committees as appear necessary such as: (1) a hazards committee; (2) an employee follow-up committee; (3) a housekeeping committee; (4) an injury investigation committee, etc. In case these sub-committees cannot take care of a reported case or condition, it is then referred to the central safety committee for decision and action.

The central safety committee has an educational sub-committee which organizes safety activities such as safety displays, talks, and contests in safety. Some plants give a cash prize at regular intervals for the best suggestion offered by a worker as to how to improve operations or machines so as to increase the safety of the operatives.

Recommendations that machines be equipped with safety devices falls within the province of the Hazards committee. Although most of the new textile equipment has mechanical safety attachments, these devices have not been added to all of the older machines. One of our textile seniors spent the summer installing safety locks on the shipper for roving frames which, of course, was to prevent any one from starting up the frame while the operator was cleaning certain gears or repairing the machine.

The Employee Follow-up committee which sees that the employee knows safety rules is important. I knew a skilled textile worker who had an accident resulting in the loss of an eye. He sued the company and was awarded $2000. He won this verdict largely by his statement that he did not know that it was dangerous to perform the particular job in the manner in which he was performing it when the accident occurred. This accident cost the worker his eye and cost the mill over $2000. Both losses were preventable.

The Housekeeping committee, as the name implies, inspects working conditions. Many accidents occur in the textile plant from falls. Loose bobbins carelessly left on the floor and covered with lint have been responsible for many injuries. This committee prevents many accidents by insisting on order, system, and cleanliness in work.

When an accident occurs, the real cause is determined and a preventive measure is suggested by the Injury committee. I read of one case in which a girl fell while going down the stairs at stopping time. The first investigation disclosed that she had disobeyed plant orders in running down the steps in high heeled shoes. But a subsequent investigation further disclosed that the tread of the steps was so badly worn and so rough that any one using the stairs was liable to fall.

One large textile company which has active committees similar to those above, has reduced its accidents materially during the past few years. In 1934 its frequency rate of accidents was only one-seventh of the general average for the cotton textile industry, whereas its severity rate (number of days lost as a result of disabling injuries per 1000 hours exposure) was only one-tenth of the general average for the cotton goods industry.

All the discussion thus far indicates that if the 80 per cent of textile accidents attributable to non-mechanical causes is to be reduced, we must have educational campaigns to make each individual safety-minded. As has been said, the safety committees in many mills have been making enviable records for their individual plants. How can the field of safety education be widened? In part time and continuation schools in textiles and in evening vocational classes in textiles, such as are being conducted in a large portion of the mills in the Carolinas and Georgia, safety education should be stressed as a part of the regular training. Our textile schools should teach prevention principles and methods, in other words "safety-*mindedness*." Little attention has been given this phase in the past. Safety is a part of textile vocational training which offers great opportunities in development. It is a humanitarian as well as a thoroughly practical project.

Most of the graduates of our textile schools are going into the industry. Many of them will in the course of time become overseers and superintendents; therefore it behooves the textile schools to (1) familiarize their students, in so far as possible, with both the mechanical and physical hazards incidental to the operation of a cotton mill; (2) to indoctrinate these students with the principles of safe operation; and (3) to make them familiar with the savings in humanity and actual operating costs that can be brought about by accident prevention. Thus these future leaders in the industry will be equipped to take their part in making the textile industry a safer industry.

The Use of Simplified Statistics in Employee Education

By J. T. TROLINGER

American Bamberg Corp., and North American Rayon Corp., Elizabethton, Tenn.

After reading Mr. J. C. Furnas' recent article in *Readers Digest* "And Sudden Death," I was impressed by my feelings toward the general use of statistics. I thoroughly agree with the thought which he expressed to the effect that the publicizing of figures pointing out the 36,000 auto fatalities last year, together with almost a million injuries, makes no more impression on the average American citizen than a simple statement to the effect that so and so many million wild ducks were killed during 1934. One well versed on accident facts could quote statistics hour after hour without making any lasting impression on one's listeners. The use of statistics, regardless of how simple, should be most sparing in the education of employees. Nothing is less interesting to the average employee than figures. Of course people like ourselves have to use them to determine where the "leaks" are.

The description of an accident to an employee is much more impressive than a report at the end of the month. In our annual reports we should summarize our accidents for the year but also give a brief description of those from which safety lessons could be learned.

A discussion I heard at the Sixth Annual Greater New York Safety Congress between Thomas A. Walsh of the American Optical company, and Stanley Pembridge of Price, Waterhouse & Company on "What can be done by the safety department which will impress the executives in an organization with the effectiveness of the safety," brought out the fact that frequency and severity rates with the supporting figures fail to impress executives with the actual importance of safety work. Even for executives we must make statistics interesting.

Let us consider the average plant which does have accidents, the plant in which the employees are not thoroughly sold on safety. First of all, we should adopt some method of approach bare of all statistics to interest the employees.

Such, as I have already pointed out, would be an accurate description of a major accident which has occurred in the plant, giving the cause, following up with graphic descriptions and gradually working into the use of a few figures showing the number of days lost and loss of wages to the injured party. From this, we could take one department and work up a few charts showing the accident trend. One idea only should be covered by a chart, and it should not be in the nature of a graph, but in the form of an illustration which can be easily visualized. For instance, in the machine shop a small board could be erected with the picture of a man holding an electric drill. The portion under the drill bit could be movable so that as lost time accidents occurred a black spot could be made indicating the hole in that portion of the board. This part could then be moved over and the driller, designated as Mr. Accident, would be shown waiting for the next victim. Such a progressive chart as this would be much more impressive than a weekly or monthly report stating the number of lost time accidents which had occurred. In addition we could have another chart, not stating, but illustrating the number of lost days. If we cared to, we could have a third chart showing the monetary loss to the injured employee. This should also be in the form of an illustration.

By the time we had succeeded in educating the employees in a given department or division to take notice of such pictures or, statistics if you choose to call them such, perhaps there would be some other department in the plant on which we could begin our slow and laborious method of selling. Eventually, a friendly competition could be worked up between these two departments, and from this point we could most probably go from department to department and division to division and in the course of a few years develop a group of safety conscious employees.

Statistics may be used indirectly in the ducation of employees. Good housekeeping will definitely reduce accidents. In order to teach the employees this a practical method must be inaugurated. The Safety department should grade the various departments and award some kind of cleanliness trophy to the department each month which received the highest rating. Each employee would realize that there was a systematic rating method; he would not be as interested in the figures on which the trophy depended as in the trophy itself.

Several years ago, there appeared in a trade journal, an article on the use of accident statistics, a part of which dealt with the use of statistics to interest workers in safety. It was suggested that graphs or charts should be prepared showing first, the monthly average number of closed cases; second, the average number of days lost per closed case; third, the average compensation benefit per closed case; fourth, the comparison of lost time accidents sustained in the course of employment with lost time accidents occurring outside of employment and: fifth, the trend of eye accidents and other serious accidents. Even though we were to use an accident thermometer or changeable pictures of airplane races, auto races, etc., I do not believe information of this kind is simple enough to interest the average employee. It would be all right to show, as I have already indicated, in a very simple way, the total lost time or the total number of lost time disabilities, but to reduce our lost days to an average number per closed case would be a little bit beyond the average worker. Instead of attacking the monetary question from the standpoint of average benefits we should show the monetary loss sustained because of the accident.

There are ways of educating employees through the limited use of simplified statistics. I have already indicated, however, how far we should go and what fields we should cover. We should only use those figures indicating the number of lost time accidents, the number of days lost and possibly the monetary loss to those. Let us now briefly consider a few methods by which these figures can be placed before the employees without having them appear as statistics.

The National Safety Council has recently completed a safe practices pamphlet on the subject of "Safety Stunts." From this pamphlet we can secure a number of practical ideas for presenting statistics in a visual manner which should tend toward the education of employees. We should bear in mind the admonition of the National Safety Council that regardless of what stunt we may use, it has only a temporary value and should be changed to some other idea as soon as the novelty has worn off.

Industry has done a wonderful job in the reduction of its accidents. However, we are still far from attaining the goal. According to one of our large casualty companies, the total cost of America's industrial accidents during the last ten years has amounted to more than one billion dollars. This would have employed more than 60,000 men at $30 a week throughout the entire period, or would have supported for one year 1,285,000 men at $15 a week. Employers and employees alike are sharing the burden of this tremendous accident cost. If partly through the limited use of simple statistics we can educate our employees concerning accidents, we shall have accomplished a noble purpose.

THURSDAY MORNING SESSION

October 17, 1935

Eliminating Infections Caused by Minor Injuries

By W. C. HORTON, M.D.

Medical Adviser to the North Carolina Industrial Commission, Raleigh, N. C.

Before offering any suggestions as to methods of eliminating infections caused by minor injuries let's make a little study of what we mean by *minor injuries*. What is the proportion of minor to major injuries in industry? What may operate to transform a minor into a major injury?

In industry we understand a minor injury to be of small import, one which does not damage deep or vital structures of the body; one which necessitates the loss of very little time or no time from work, and which leaves no defects or permanent disabilities. Approximately 75 per cent of all industrial injuries are minor.

There are times when minor injuries assume major proportions. A workman scratches or lacerates his hand and pays no attention to it and about the third or fourth day after the skin becomes red and hot, red streaks up the arm manifest themselves, pain develops, the axillary glands enlarge and are tender, there is a rise of temperature and we have an established infection. This simple separation of the skin will follow the vicious course and terminate with many of the permanent damages of a major injury. My contention is that no injury can be looked upon as *minor when the skin is broken. The skin opened by a pin or needle prick has all* the potentialities of a major accident. The reason for this should be understood by everyone. However insignificant the tear, laceration or puncture the circulation is opened up to the outside and unfriendly world which is ever teeming with bacteria seeking an opportunity to enter the tissues of the body and do all the deviltry of which they are capable.

The portal of entrance once provided and the bacteria present, it requires only a few minutes for the struggle between destructive germs and healthy human cells to begin.

Infection is the great runner up of medical cost in industrial accidents. From July 1, 1933 to June 30, 1934 there were 1440 infected accident cases reported to the North Carolina Industrial commission. In the following year there were 1435 of the reported accidents infected. This meant increased loss to employer, employee and insurance carrier.

The average medical cost in 83 infection cases	$24.06
The average medical cost in two years—1933-1935	13.40
So these cases of infection reflect an increased cost per case	*$10.66*

Last year 28,814 accidents resulted in 250,519 days lost from work, an average of 9 days per case. In the 83 cases of infection 936 days were lost from work, an average of 11½ days per case. So in these cases of infection disability was increased more than 40 per cent. The last two years experience shows us that 2875 cases of infection at an average excess medical cost of $10.66 per case gives us a total excess medical cost for the period, of $30,647.50.

Making the same application to additional compensation paid on account of infections we find that the average of $27.05 per case includes an excess of $7.76 which in 2875 infections in the two years makes a total of $22,310.00.

So, *the so-called minor injuries* which were allowed to become infected in the industries in North Carolina during a period of two years ending June 30, 1935, cost the employers in excess of the normal for medical and compensation the nice little sum of $52,957.50.

Thus far I have tried to point out to you the real meaning of a minor injury, its momentous siguificance whenever the skin is broken, the relative number of infections to total number of reported accidents, the excess cost of *infections* to all concerned. These thoughts, preliminary to the subject assigned, have been introduced to try to impress upon you the real necessity for eliminating infections in minor injuries.

How to do it hardly seems to come under the head of medical subjects, since in the largest number of cases of infection the process is already inaugurated before the doctor sees the case.

Why are 5 per cent of the reported industrial accident cases infected? Because of neglect on the part of the employee to report the accident to the proper authority; because of neglect on the part of such proper authority to handle the case promptly; because of negligence or inefficiency on the part of some one in position to give the proper first aid. Inasmuch as there do appear a few cases of infected minor injuries which have been dressed by a doctor immediately after the accident, we might include a fourth reason for the development of infection; that is, because of the indifference of the doctor in thoroughly cleaning a wound at the time of the first dressing.

Now if our diagnosis is correct the treatment should be easy. Lets take up each one of the four causes set up as probable contributions to the prevalence of infection in the minor accidents in industry. First, how may the neglect of employees in reporting accidents be cured? By constantly impressing upon them the importance of immediately reporting all accidents. What it means to them and to the employer. That it is not effeminate to rush to the first aid room with these insignificant lacerations. Make them safety minded. A talk by your plant surgeon now and then will be very effective. If persuasion does not work try penalization or merit marks. Give them merit marks for promptly reporting accidents and penalize them for not doing so.

The second cause enumerated is that of neglect or procrastination of the foreman or person to whom the accident is reported. When any such foreman is slow to send the *minor* accidents reported to him to the first aid room or to the doctor, the employer can easily introduce an argument to him which will carry the right weight. The third cause standing in the way of eliminating infections in minor accidents may be discussed under two headings:

a. Failure to administer first aid properly.

b. Failure to recognize the added danger of infection in certain types of wounds.

Failure in the first instance is due to lack of conception of the full meaning and importance of a thorough cleaning of the wound before applying the antiseptic. A mistake is often made by applying large quantities of iodine over surface and then securely binding. In a few hours an iodine burn results.

In the second class come the type of injuries which require special discretion in handling. Puncture and piercing wounds of all kinds should never be left to go with a smear of iodine or mercurochrome over the opening. Often this type of wound has had bacteria carried into the subcutaneous tissue and the best of antiseptics applied to outside will not prevent infection. These wounds should be enlarged and cleaned and drained. Unless the first aid man is sure of himself he had better send these cases on to the doctor. At least he should have discretion enough to know when to send them to the doctor.

The unfavorable conditions arising from these two phases of neglect or ignorance or lack of information may be cured by providing a trained first aid man or woman for your plants.

The fourth source of evil is the indifferent doctor. I am glad to say this is so negligible in summing up the causes of infections in industry that it need not be discussed further than to say if you have too many cases becoming infected after the doctor has had an opportunity to clean and asepticize the wound immediately after the accident, you would do well to get you another plant surgeon.

Everything that I have tried to say here may be summed up in the words of Dr. Kanavell, a noted hand specialist of Chicago, who says, "When treatment is prompt, infection is rare."

Safety Engineering, Education and Enforcement

By W. Y. GAUDET

Safety Engineer, Liberty Mutual Insurance Co., Roanoke, Va.

Safety engineering combines engineering, advertising and salesmanship. It is planning, organizing and executing. No real safety engineer will admit defeat. He knows that, somehow, accidents can be eliminated, and he is never satisfied until he finds the underlying cause for each. The qualifications, therefore, for a real safety engineer are as high as for any textile executive.

Straight engineering in the safety field is, first of all, knowing how to provide the proper safeguards for that inanimate object, the machine, and its accompanying equipment. It is also necessary to know what is required to make all physical conditions in any plant as safe as possible. Practically any machine or any type of equipment can be guarded to insure the safety of the operator. Of course, there are unusual conditions in some places that require a tremendous amount of study to correct. These, however, are few and far between. Statistics show that only a small percentage of the accidents occurring in industrial plants are machine accidents.

It is my definite opinion that if the management of a textile mill, or any other type of industrial plant, wish to eliminate machinery accidents, they can easily do so by obtaining the assistance of safety engineers and providing the guards which are now known for all of their equipment.

Education in safety is a very great problem which demands constant work and follow-up. If the individual was not subject to so many changes, it would be a relatively simple matter. But all individuals are different because of the various forms of idiosyncrasies, mental alertness, physical capabilities, etc. A form of teaching for one employee will not be satisfactory for another.

If we are to accomplish anything in teaching safety, we must first know our subject. That does not mean merely to be able to recognize a dangerous condition or practice, but able to present a solution to the problem.

The second part of this problem is the method of teaching. Merely pointing out the danger and telling the men to be careful not to do the dangerous thing, or to stop unsafe practices, will accomplish little. The individual must be aroused and the actual interest in safety sustained. If we do not have the patience and perseverance to explain the reason for the safer way, to show by example and to continue to remind the unsafe worker, we will make very little progress.

Now, how can this education of employees be attained? In a textile mill, the superintendent is directly responsible to the management for cost and production. Under these two headings comes the matter of safety. In turn, the superintendent will place responsibility upon those directly under him in each department, namely, overseers. The overseer may in turn place the responsibility in certain sections upon his section hands. Then the section hand will place the responsibility upon each individual employee. Basicly, therefore, everyone in a mill is responsible for accident prevention.

It has been developed through experience that after the management has been sold on the idea of safety, the key men to work through are the overseers. They are men of responsibility, who should know every operation in their departments and should know the proper way of working on every operation. A really good overseer who gets out the best possible production will rarely have one of his men injured.

Here are a few of the means that an overseer has in educating his employees.

First, proper instruction in the duties of the employee. If, when hired, he is shown the proper method of doing the job and the reasons for doing it that way, very little trouble will be experienced. However, if the information is given in a vague form, there will surely be some misunderstanding resulting in either personal injury or damage to product. Oftentimes, an overseer fails to realize this fact, and because he is so thoroughly familiar with each and every operation, he is prone to give too little information to the new man. He overlooks the fact that everything this employee will do is something new to him. It is essential, therefore, that sufficient time be given and every minor detail be explained.

When an overseer feels certain that every employee in his department knows the proper way to do his job, he has but one feature to keep hammering home. This is advertising the safety story.

We have all seen the amazing results of intensive and continuous campaigns for the moulding of public faith. It is not too much to believe that any idea or article can be sold with an ample supply of money and intelligent use of available material. Why can't we tell the story of safety as dramatically and constantly as we advertise cigarets? Why cannot we constantly, as we do in production, talk safety, use the various tools we have at our command, such as safety bulletins, meetings of employees, and any one of a thousand features, for obtaining safety interest the same way that a manufacturer uses money in advertising?

If safe practices are properly explained to employees, and each safety rule has been thoroughly discussed, there will be very little reason in the majority of cases for discipline. However, unfortunately, we have very few mills that properly put to the employees the reason for each rule or practice.

If rules are explained, I can see no reason why a safety rule should not be adhered to religiously by the employee. If rules are not logical, there would be reason for violation. However, in most cases, they are logical, and no trouble should exist. I, of course, realize that there are a few individuals who have a warped mind and do such things as violating a rule merely for the sake of violation. When this occurs, however, such criminal should be taken care of either by a penalty, or by firing him.

I like to use the example of a production request. If an overseer ordered a piece of cloth to be made with 50 picks and found a day or so later that this piece of fabric had been purposely woven with 80 picks to the inch, it would be considered a distinct violation of his order. The overseer would probably penalize or fire the violator. What possible difference could there be in the overseer issuing a rule which would prohibit an employee from running down the stairs, and then find much to his dismay the following day, two or three employees running up or down the stairs? That is a distinct violation just as serious as the violation of a production order.

The Intangible Values of Safety

By W. H. NICHELS, JR.

Member, Virginia Industrial Commission, Richmond, Va.

The monetary value of a safety program is often greatly emphasized. In fact, overemphasis on monetary results quite often leads to an undervaluation of the factors which produced these results. It is not our purpose to criticise the monetary returns of accident prevention. They are vital to the continued success of industry, but there are certain intangible values equally important. These values are component units which contribute materially to the success or failure of any effective safety program.

The major portion of intangible values arises from a healthy and vigorous mental conception of the purposes to be attained by accident prevention effort. The proper mental attitude on the part of an employee is an educational process. He acquires a safety attitude through careful training at the hands of foremen or supervisors who give him the benefit of their long experience in preventing accidents. The selection of personnel to accomplish the safety goal is, therefore, important and

progress is promoted or retarded to a degree commensurate with good or bad executive management. Any perfunctory or passive display of interest, on the part of the management, toward training and supervision is lacking in the inspirational influence necessary in the safety campaign.

A like responsibility rests upon the operative to accept those measures calculated to improve the opportunity for working under safer conditions. The benefits to be derived from the mutual desire to produce, without accidental loss of life or loss of or injury to limb, justify every well planned measure and every safeguard compatible with the hazards inherent in industry. The ultimate goal in every instance is the abrogation of the causes of accidents rather than an amelioration of their injurious results or of a lesser frequency ratio.

The prevention of accidents is not altogether an industrial problem. The gross costs of accidents outside the industrial plant are far greater than those within the sphere of commercial enterprise or industrial development. There is an appalling number of fatal accidents and lesser injuries on the highways and streets of every community. In most instances industry has responded to the responsibility of safeguarding against accidents and curing hazardous situations more effectively than governmental agencies. For instance, a comparison of the statistical records of steam railroads has shown a decided about-face, with a constant improvement in accident prevention. Here, as in every other field, the results obtained are in keeping with the inculcation of safety consciousness as a "habit of thought."

The security of the operative goes hand in hand with the prosperity of the employer. They dwell under equal duties and incur like responsibilities by a failure to observe the salient principles of accident prevention. The payment of medical and compensation benefits or the recovery of damages does not mitigate the deleterious effects of incapacity resulting from accident, nor allay the fears, actual and potential, of innocent dependents who rely upon the continued health and earning capacity of the worker for support.

An unnecessary cost for the employer not only disturbs the balance sheet but produces lost time, labor turn-over and loss of morale. These intangible factors are not susceptible of precise calculation However, careful estimates have placed them on a comparable balance with the tangible factors. In the main, if we speak of the costs of accidents, as shown by compensation benefits and medical costs paid, as being tangible quantities, the intangible factors of loss in morale, labor turn-over and lost time will approximately equal in cost those which are susceptible of computation. Hence, an effective approach to a solution of the problem in its broader aspects involves appreciation of a more vigorous educational campaign to promote measures of correct safe thinking on the part of each individual. The records show that the majority of accidents are produced by negligence, carelessness or inadvertence, all of which involve an erroneous application of thought processes in coping with a given hazard.

To promote diligence in the exercise of safe practices on the part of the person of average prudence, it becomes important to supplement plant training by careful preparation at home and in the public school. In this way safe habits of thought are inculcated and erroneous ones eliminated insofar as compatible with human frailties. The sooner a public appreciation of safety is aroused and taught along with other lessons in the home, discussed earnestly by the adult members of the family, and emphasized in the class-room as well as in the plant, then shall we be more hopeful of the future safety of our roads and streets, of the mishaps of plant operation, and of those occurring in the home and in other fields of activity.

Let us realize that the solution of the problem is one of mutual concern to society as a whole. It requires the co-operation of the individual in civic life and as an operative in industry—the closest attention to supervisory control, a real and dynamic interest on the part of executive management, an active participation on the part of governmental agencies, particularly school boards and teachers and a greater public appreciation of the fundamental principles necessary in the promotion of safety—to the end that it may be treated as an educational problem of the most vital daily importance.

ADJOURNMENT

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A. P. Schendorf, National Pneumatic Co., Rahway, N. J.
Glenn H. Shaw, Ohio Edison Co., Akron, Ohio.
George R. Whitmore, Illinois Power and Light Corp., Peoria, Ill.

* Deceased.

Officers Elected for 1935-36

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Vice-Chairmen—
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George R. Whitmore, Illinois Power and Light Corp., Peoria, Ill.

MONDAY AFTERNOON SESSION

October 14, 1935

The opening session was called to order by General Chairman H. V. Schreiber, Capital Transit Co., Washington, D. C., who presided. A brief address of welcome was presented by Frank H. Miller, president, Louisville Railway Company. Chairman Schreiber then reviewed the progress of the section.

The general chairman also presented the paper, entitled "Safety Features of Cars and Buses," prepared by E. L. Greene, General Superintendent, York Railways Company, York, Penn., chairman of the Engineering Committee of the Section.

A considerable part of this session was occupied with a "Dramatization of Modern Personnel Practices in Employment, Selection and Training," as practiced by the Milwaukee Electric Railway and Light Company. This feature, entitled, "Schultz Gets a Job," was presented in four acts, by J. G. Dickinson, Superintendent of Accident Prevention for the company; William Hackbarth, Supervisor of Training, Transportation Department; and A. T. Jastrow, Chief Instructor, Transportation Department.

Job Pride and How to Develop It

By G. B. POWELL

Supt. Trans., Louisville Railway Co., Louisville, Ky.

A brief of this subject is:

1. Make the job something to be proud of.
2. Select men who fit the job.
3. Train thoroughly and follow up continually.
4. Base discipline on records only and demand co-operation and loyalty.

Make the Job Something to Be Proud of. There is no job that cannot be improved to lighten the work or make it more pleasant. In the case of bus and car operator convenience at the stations; relief points where there is shelter; uniforms which provide comfort are important items. The rate of pay must be all that the income on the property will allow and by all means above corresponding rates for men of a similar caliber in the vicinity.

An operator's job being continuous produces fifty-two weekly pay checks per year and if the rate of pay is above that of corresponding labor in the neighborhood, the conveniences superior to that of other industries, and the working conditions better you have established a job which will attract the better men.

Select Men Who Fit the Job. The men selected to work as transit operators must be young, physically fit and mentally alert, with sufficient education to assimilate the proper training; yet men having advanced educations are failures on the job because it does not have a lasting appeal to them.

Train Thoroughly and Follow Up Continuously. The new man should not only be taught the proper method of doing the work, but also the advantages of the job so that before his training period is over he is thoroughly aware of the fact that he has the best job he has ever held. Probably more important than the preliminary training is a school for operators who have been in the service ninety days. If they have succeeded in remaining ninety days it is quite probable they intend to remain. The follow up must be continuous through a supervisory force, assisted by the department head, and this follow up is just as important in connection with developing job pride as it is in connection with efficiency or safety.

Base Discipline on Records. If I were called on to give the outstanding reason for loyalty and co-operation I would not hesitate to say that it is basing discipline on the man's record. In other words, if a man has a good record for obedience, efficiency and safety he need have no worry because of an accident or breach of discipline. Likewise, if his record begins to deteriorate and his attention is called to this fact, he at once knows that it is necessary to improve the record or he automatically discharges himself. This method having been in effect on this property since 1920 is a success.

Demand Co-operation and Loyalty. Assuming that the management is fair and square, that the wages are the highest the income will afford, the working conditions arranged by committees elected by the men themselves, discipline based on the man's ability to produce a good record, then co-operation and loyalty to the firm can be demanded and those few who are not loyal, can be dropped with full sanction of the majority.

An active safety campaign was inaugurated on our property in April, 1921, in the form of contests between the divisions. The award is a monthly banquet. The winner of the first month's contest had a record of 2,100 miles per accident. This was so pitifully low, when we look back on it from to-day's results, that it is laughable. In July, 1935, the average was 68,760 miles.

The next step was the selection of a safety committee, one man from each unit. These men, selected by their fellow workers, were required to make a safety inspection of the entire property monthly and their suggestions for improvements were acted on by the management.

Car house meetings at which the director of safety has equal time with the operating speaker are held regularly and frequently there are meetings called by the safety captain. These are both safety and social meetings and have produced wonderful results.

Records of miles per accident were posted at the various units daily in various forms, among which was a street car race around the world, each vehicle being advanced daily the number of miles they accumulated between accidents. The old thermometer chart with the red stream rising as the mileage accumulated was also used.

Another important item was the posting at each division headquarters, the individual operator's safety record by means of a pin board, placing a pin in the chart opposite the name for each accident chargeable to him, the color of the pin indicating the type of accident. This system has been maintained.

The men at each division elect one of their number as safety captain for the month and if he succeeds in leading his men to success his reward is a full uniform.

By 1925 the average miles per accident had risen to 20,000 so that the rule was changed relative to only the winner's attending the banquet. It was specified that in addition to the winning unit, any unit which could average 30,000 miles per accident for the month would be invited. Under this rule we frequently have the employees from all divisions present, and always 75 per cent or more. Another added incentive was that if a division ran 100 per cent for 30 days or won the contest two consecutive months the men have the privilege of bringing their ladies.

In 1921 we started out to combat accidents to save money. Within two or three years our safety director convinced the general manager that this was wrong and he changed the appeal to one of saving human lives. Increased interest was noticeable.

Awards for Safety Achievement

By NEIL FUNK

Louisville Railway Company, Louisville, Ky.

In our company we have demonstrated over a period of some years, that a system of awards and contests has an enduring value. Through our plan of awarding winning car barn groups a safety dinner, with a prize of a new uniform to the winning group's captain, we have consistently improved the mileage per chargeable accident. In 1920 we suffered a chargeable accident for each 2,100 miles of operation. We now are running at a figure in excess of 30,000 car miles, and we have established a high mark of 104,000 miles between chargeable accidents.

I think, however, that there is much to be done in clarifying the contest idea among transit companies. In the determination of ratings of companies in such contests as the Brady Award, which our company has had the honor to receive, there is a woeful lack of common understanding as to how accidents are classified and defined. To me it seems beyond the understanding of any man how comparisons can be made in our industry as at present it is attempted. How many men can you find who will agree on a sensible definition of a "chargeable" accident? There is much to be done in clearing up this whole situation, and I hope that this Section will address itself to the task.

As I see it, the Safety Award idea is one of our best weapons in reducing the frequency of accidents involving our vehicles on the streets, but the best use of the weapon is not being made. Street railway operators can be stimulated into doing better and better, their interest can be aroused and kept alive, and our contribution to the safety of streets and highways can be enhanced, by a carefully considered and well directed system of contests and awards.

WEDNESDAY MORNING SESSION

October 16, 1935

Relation of Municipal Traffic Department to the Safety of Utility Operation

By W. O. DOWNS

Commissioner of Public Safety, Birmingham, Ala.

We have established a custom in our city that on any occasion such as a Fair, a circus, parade or celebration, our traffic officers and the chief of police go over the situation ahead of time with the superintendent of transportation of the electric company operating the street cars. As a result we handled last year one of the largest crowds Birmingham has ever had, without a single injury to either man or automobile.

In some cities there is a spirit almost of enmity between the operators of street cars and busses and the police department. Where this exists, you cannot expect the co-operation of these two organizations in making the streets safe. We are constantly making efforts to keep the feeling between these two in Birmingham of a friendly nature, and have been very successful. For example we willingly furnish a sufficient number of men to assist the transportation companies when they are handling large crowds. In return we have been able to get perfect co-operation from the officials of the companies.

Another item is that the operators of street cars and busses should be required to observe all traffic laws and requirements just as do the drivers of private automobiles. If this is not done, it has a tendency to build up in the minds of the motoring public a resentful attitude towards the police department and the operators of street cars and busses.

Finally, the main thing is to see that every individual, whether he be the operator of a street car, a Model T Ford or the finest automobile, is given the same treatment when he is obeying the law or violating it. In other words, it does not pay to arrest one individual for an infraction and permit a dozen others to go unpunished. And, above all, it is absolutely necessary that the men engaged in the enforcement of traffic laws be given 100 per cent co-operation in the prosecution of their cases in court after the offenders have been put under bond. There should be no "fixing."

It has been made very clear to us that as the number of arrests goes up for the violation of traffic laws, the number of accidents goes down, and, as the number of arrests comes down, the number of accidents mounts.

High Cost of Accidents

By W. M. WIX

Safety Supervisor, Transportation Dept., Georgia Power Co.

Factors in the hidden cost to employers of accidents resulting in injuries to employees—excluding compensation and liability claims, medical and hospital cost, insurance premiums, and compensated lost-time of the injured employees—include the following. H. W. Heinrich of Travelers Insurance Co., found, after extensive research:

1. Cost of lost time of injured employee.
2. Cost of time lost by other employees who stop work—(a) out of curiosity, (b) out of sympathy, (c) to assist injured employee, or (d) for other reasons.
3. Cost of time lost by foremen, supervisors, or other executives, as follows: (a) assisting injured employee, (b) investigating the cause of the accident, (c) arranging for the injured employees work to be continued by some other employee, (d) selecting, training, or breaking in a new employee to replace the injured employee, and (e) preparing state accident reports, or attending hearings before Industrial Commissioners.
4. Cost of time spent on the case by first-aid attendant and hospital department staff, when this time is not compensated by insurance. There is also the cost of first aid materials.
5. Cost due to damage to the machine, tools, or other property, or to the spoilage of material.
6. Cost due to interference with production, failure to fill orders on time, loss of bonuses, payment of forfeits, and other similar causes.
7. Cost under employee welfare and benefit systems.
8. Cost in continuing the wages of injured employee in full after his return—even though the services of the employee (who is not yet fully recovered) may for a time be worth only a part of their normal value.
9. Cost due to the loss of profit on the injured employee's productivity, and on idle machines or equipment.

10. Cost of subsequent injuries that occur in consequence of the excitement and weakened morale caused by the original accident.

11. Overhead cost—the expense of light, heat, rent, taxes, interest in investment, and other such items—which continues while the injured employee is non-producer.

Cost to the company of the lost time of injured employees can be figured easily. But the cost of time lost by other employees when accidents occur, is more difficult to account. Yet, it often is a large item.

Time spent by administrative officials on accident matters is certainly a large hidden factor in total cost. We estimate that our division superintendents devote as much as half of their time either to the handling of accidents or to counseling men that are wont to have them. Then there is the cost of investigating unreported accidents, referred to as blind claims. Such investigation is of great cost and does not show in claim settlement reports, since it involves the services of legal-trained investigators, notarys public, stenographers and executives. Added to this is the proportionate cost of time spent by officials and agents in following up and disposing of accident matters by properly recording and reporting them to government bodies.

Minor injuries to transit employees, requiring only first-aid and a few hours from work, make a notable indirect accident cost in a year's time. Last year, for instance, our company averaged spending $10 each, on medical treatment and first-aid, for 30 minor accidents.

Accidents to roadway, trolley, car maintenance and garage workers entail much expense due to damaged machines, tools and equipment. These costs, which are not included in claim department settlements, mount up rapidly.

In the case of traffic accidents, the street car or coach has to be repaired the same as the encountered vehicle or object. Damage costs of the latter are handled as claim expenditures, but those of company equipment are not. Neither are the costs of getting the damaged equipment off the streets and to the shop for repairs, or the increased depreciation of the equipment because of the damage. Company equipment damage costs are, indeed, the major indirect cost item of traffic accidents.

Though immeasurable, the cost in loss of business due to accidents in the transit industry is great. Delays in schedule resulting from traffic accidents cause many passengers to catch rides, other to go back and get their automobiles, and still others to walk. Frequent delays irk some passengers into making other transportation arrangements.

Depending on the nature of the injuries, many employees are unable to take over their regular work immediately when they return after an accident. So their inefficiency costs the employer the difference between their regular and their impaired usefulness.

A more indirect but, nonetheless, real cost of accident is the employer's cost due to the loss of profit on the injured employee's productivity, and on equipment which is made idle by his enforced absence. In our industry this applies only to track, trolley, shop and garage workers, since cars are kept running by extra operators.

A surprisingly significant cost is for subsequent injuries to an employee or person, and to equipment, in consequence of the excitement or weakened morale caused by the original accident. Often one accident begets another.

Overhead cost which continues while the injured employee is not working is an item to be included. In our industry, this cost is especially significant in accidents to key roadway or shop men, whose disabilities often make a crew idle while the overhead continues.

Then there is the operating cost of the safety and claim departments. Besides salaries, office and traveling expenses, a big part of the claim department cost is for court and legal services.

Every accident exposes the transit company to costly public ill will, to the ill will of the injured employee, of the injured persons, and of other public parties.

If an injured employee is not satisfied with the compensation or discipline given him, he may become disgruntled and touch off labor troubles. He may give a politician, who is prejudiced against utilities, a thought to engender costly public dissension. He may aggravate his injuries to get a more generous "adjusted" settlement. Or the disgruntled employee may resort to court proceedings.

Satisfactory compensation or damages must be paid. If the settlement is too meager or untactfully made, it may mean the ill will.

Finally, the public generally is faced. Knowledge of easy claims and settlements causes unscrupulous persons to prey upon the company's coffers. Knowledge of seemingly unfair settlement can cause people to stop riding cars and coaches. When transportation is just one of several public services rendered by a company, it can cause aggrieved people to criticize and attempt to boycott these services, such as sale of electrical and gas appliances. Or such knowledge may embitter them so that, if they serve on juries for company cases, they return unjust verdicts. Here again, company agents—from the claim, legal and public relations, as well as supervisory staffs—must spend a large part of their time at great cost—combatting prejudice and fraud.

What does an accident cost the employee? If he is paid for all his lost time, he may think it costs him nothing materially. But seldom does a man receive the equivalent of his salary in compensation. This is particularly true if he isn't hurt much, but laid off for disciplinary purposes. Then he loses his income. Nervous restlessness in his idleness causes him to spend or want to spend more for amusement and dissipation. Frequent accidents can cause a man to be fired and, as a consequence, have less chance for another job. Partial or permanent injuries cause an employee disfigurement, embarrassment and often an undesired change of occupation.

Transit accidents cause the public, meaning the city and citizens, considerable expense in several indirect ways. Traffic blockades require the services of traffic officers. Their time is an accident cost, for fewer such men would be needed if there were no accidents. Transit accidents start fires. The fire department is called at cost to the city.

Appalling is the cost of accidents to the public-at-large due to their effect on compensation and other insurance rates. Compensation insurance rates in large American cities have increased tremendously in recent years. The more accidents there are, the more need there is for such insurance, and the more costly it becomes.

Probably, the biggest cost to the public is the increased passenger fare due to accidents. Our fares would be considerably less were it not for the high cost of accidents. For earnings are limited to a small percentage above our operating and capital expense, and a big slice of the latter is spent for accidents, directly or indirectly.

An immediate cost to the passenger is the paying of taxi fares to complete transit trips interrupted by accidents and the loss of work. The latter loss is especially great where a plan or office official is delayed, and his staff doesn't work much until he shows up. Occasionally, persons lose their jobs because traffic accidents have delayed them. On several occasions, our superintendent has been asked to furnish affidavits proving that certain employees or school children were delayed because of accidents, to prevent their dismissal. Such troubles ferment ill will toward the company.

Thus, we agree, that accidents cost our company, its employees and the public in these and, doubtless, many other ways. What is to be done about it? *Prevent accidents.*

For 11 years, the Georgia Power company, which provides transportation, electric and other services has developed a comprehensive safety program. I will briefly describe some of the methods and results of our accident prevention work.

Our operators were carefully selected as to physical and mental fitness, and were given extensive instruction before they were put to work. Each year, they are given an examination by our operating and safety instructor for correction of hazardous operating habits and defects they may have developed. Each man over 40 years of age is given an annual physical examination. Those with dangerous defects, such as high blood pressure and heart trouble, are treated and checked monthly as to results. The safety instructor and myself are on the job continuously, counseling trainmen as to safer operating methods, particularly those who have had accidents. The superintendents, too, work with the 600 men on accident matters.

The result is that there has been no lost time accident to transportation employees since December 27, 1932. The safe operation of cars has been increased from 2,285 miles per accident report in 1924 to 7,289 miles in 1934.

From 1924 to 1934, the number of accidents to our street railway employees decreased from 190 to 2, whereas those for the entire company decreased from 624 to 230.

In 1924, 6,422 accident reports were made by our street railway department; claim settlements consumed approximately 6 per cent of our gross revenue. In 1934, only 1,664 accidents were reported, and settlements consumed some 3 per cent of gross revenue.

A comparable decrease in one of the indirect costs of accidents is revealed in the fact that repair costs to major-damaged street cars dropped from $11,129 in 1924 to $3,728 in 1934. The number of pull-ins because of failures and accidents, dropped from 1,749 in 1924 to 88 in 1934. Therefore, the average number of miles operated per pull-in for the system increased from 9,341 in 1924 to 108,968 in 1934. Allowing for the possible decrease in total car operation over the 11-year period, these gains are still outstanding. Thus costly accidents *can* be prevented.

Safeguarding the Design and Operation of Motor Bus Garages

By MARTIN SCHREIBER

General Manager in Charge of Plant Public Service Coordinated Transport

After careful selection and training of men, the next important step in a safety program is to inspire them with a passion for that neatness and order which will tend to promote care. The beautifying of the garage site with shrubbery and lawns is good. Even window boxes help. The building should be neat and constructed of substantial, fireproof material. Provisions must be made to take care of waste material, such as parts and waste crankcase oil.

In building a new garage it is advisable to secure a site of ample area not only to provide storage space for existing equipment, but to take care of future growth of the business. Outside area for the servicing of buses with gasoline and oil before entering the building is desirable.

Where possible, the garage should have frontage on two or more streets, so that buses will be routed through the building with little maneuvering. The building should be set back from the street line to reduce dangers to pedestrians on sidewalks, and to keep buses from waiting on the street. Storage space of not less than four hundred square feet per bus is recommended and interior columns should be kept to the absolute minimum. As elevators and ramps add accident possibilities, garages should be one story in height if possible.

Doorways ought to be not less than fourteen feet wide, and of sufficient height for the type of bus operated. Overhead doors automatically operated with the controls set as to prevent the door from stopping when only partly raised, are recommended. Clear glass panels are desirable in doors. Small doors with panic latches adjacent to each large door are recommended for emergency exist and to conserve heat in cold weather.

The interior floor area of concrete should have a smooth troweled finish, for while a rougher surface may give better traction, it is very difficult to keep free from grease. If large unbroken areas can be provided, it will permit the use of tractors with revolving brooms for this work, otherwise dependence will have to be placed on hand scrapers. Concrete floors should be graded to quickly drain off water or other liquid; shallow V-shaped drains in the valleys are good. Because of the possible presence of gasoline the surface flow should pass through oil and grease separating traps before entering the city sewers, for explosive liquids in piping has caused disastrous explosions. The traps must be accessible for frequent cleaning and be vented.

Inadequate illumination is a source of danger. As most of the mechanical work is done during the day windows and skylights should be designed to furnish the light necessary at each location, and to illuminate the whole interior. For work at night and on cloudy days, artificial lighting must be provided to duplicate daylight. The use of light-colored or aluminum paint on ceilings and walls above the dado will aid in the uniform distribution of light. All window frames and skylights should be of metal, and equipped with wired glass. The use of corrugated glass in skylights practically eliminates expansion cracking, with its danger of falling pieces.

It cannot be expected that mechanics will do careful work when their hands are numb with cold, or when they have to wear heavy gloves. Therefore, to promote safe, efficient work, the garage must be heated. In shops the temperature should not be allowed to fall below 60° F., while in the office 70° F., is required. Temperature should be maintained by automatic thermostats, particularly where oil or gas is used for fuel. Blower type unit heaters furnish better distributed heat than is possible with pipe coils or radiators. Drafts and uneven temperature induce colds and other ills, causing loss of time and reducing efficiency.

Closely akin to temperature control is ventilation. Fresh air should be brought in through the unit heaters. In summer, these can be used as fresh air intakes. Additional provisions should be made for ventilators in windows and skylights. Automatic louvres between the floor and the breathing line, opening into wall stacks remove polluted air, their action being helped through the positive pressure built up by the fresh air intakes. Similar louvres opening directly to the external air are also useful. In some cases, power exhaustion of foul air is necessary. Ventilation is particularly needed in pits or depressed shops where heavier gases may collect. It is better to supply fresh air to each pit rather than to remove polluted air from them because to draw all the foul air and gases in the garage to the pit, will endanger the men there. Carbon monoxide is a positive danger in garage work; particularly when a new engine is being "run in." Large diameter hose, vented to the outside, should be slipped over the end of the muffler pipe during this process. Another help in keeping air pure is a high ceiling, but this requires additional heat and it is necessary to strike a balance.

Compact portable instruments are now available to detect carbon monoxide and they are advisable for occasional testing. A similar device analyses exhaust gases of individual buses, permitting accurate adjustment of carburetors and reducing the discharge of poisonous gases both in the garage and on the street. Another portable apparatus permits the analysis of garage air from the explosive-vapor standpoint.

Safety men should be furnished with adequate facilities. A man can work better and safer in an erect position than when lying on his back under a bus. Pit construction is advisable, and experience has shown the advantage of the "depressed shop." This consists of open end pits terminating about ten feet from the building wall, the intervening space being at the level of the pit floor. This open area is furnished with work benches so that a man can step from the pit to the bench without climbing steps. With proper lighting and ventilation, this has solved the problem of under-bus work, and has met the regulations of municipalities prohibiting ordinary pits. The addition of an outward swinging door in the depressed shop, with a panic lock, may prove of great service in avoiding accidents in case of fire or other emergency.

These pits are usually four feet wide, and four and one-half feet deep, and spaced sufficiently far apart (say twelve feet) to permit work on the sides of the bus and engine. Five pits are necessary in a one-hundred bus garage to take care of overhaling, inspection and similar work. Side walls of the pits should have recesses for lamps, protected by screens, of sufficient capacity to light the under part of the bus, doing away with extension wires. Shelves for small tools help to induce carefulness in the mechanic. Funnel type receptacles leading to a storage tank between the pits will take care of crankcase drainage, and tend to keep the floor clean.

The steps leading to the depressed shop, as well as others used by the mechanics, should have safety treads; preferably of the open grating type to eliminate the accumulation of grease. The walkway across the open end of the pits should have a substantial railing. An overhead track equipped with hoist or chain block is advantageous. A revolving portable stand for holding the engine during its overhaul eliminates the need of heavy lifting. Pit jacks for lowering heavy units, such as propulsion motors in gas-electric vehicles, have added to safety and efficiency.

Goggles should always be provided for mechanics working with grinding wheels and lathes and their use must be insisted upon. Belts, gears and other moving parts must be thoroughly guarded. First aid kits should be on hand, with men instructed in their use.

Cleanliness is one of the prime requisites for safety and particularly so in garages where oil and grease are dripping on the floor. The floor must be frequently brushed and scraped. Floors of pits and depressed shops require particular attention. The

floors and sidewalls should be washed at least once a week and frequently painted. Metal containers with self-closing tops are desirable for discarded waste.

Where bus painting is done special precautions are necessary, particularly where the spray method is used. This sometimes requires the use of a specially designed air-tight room, or the construction of an overhead canopy. In the former, positive ventilation must be supplied, with the vapor-laden air exhausted. The room should have natural daylight as far as possible, and be supplemented by artificial illumination, all electric light fixtures being made fume-proof because of the explosive nature of the spray. The canopy type has been found satisfactory when the bus is surrounded by moving air, supplied by pumps through gratings in the floor and exhausted through the hood. In either design, the painter must be equipped with a respirator, and its use strictly enforced. Metal fireproof lockers are needed to hold the day's supply of paint, to reduce the hazard of fire.

Certain other operations require special treatment, and sometimes isolation. For example, the battery room should be separated from the main shop by a wire screen, to prevent acid burns. The men in this work require special training. Safety is further increased by furnishing diluted acids only, and by the use of rubber gloves.

Lubricating oil, in large quantities, is preferably stored in underground tanks, properly vented. All other flammable material, such as kerosene and paints, should be stock in special oil houses, with self-acting fire doors, always kept closed.

Proper sanitary facilities go a long way toward cultivating morale. Clean, well designed toilets are important. Individual wash basins, or large circular fountain type wash stands should be provided. In either case, hot water and soap are needed, especially for mechanics. Furnishing of shower baths has been helpful in raising the standards of the men. Where space and conditions permit, a lounging and smoking room for lunch hour is beneficial, and tends to eliminate the stealing of a smoke in forbidden territory. The garage should be furnished with drinking fountains.

As operators of passenger equipment, we have special obligations for the patrons who use our buses, assume that everything possible has been done for their protection.

A system of "defect" cards, one of which is turned in by the operator after each run, even if the bus is in satisfactory condition, has been found valuable. If a defect is reported, it is referred to the mechanical department, and the bus held in the garage until repairs have been made and approved by the foreman. In addition the bus must be thoroughly inspected at the end of specified mileage, say 1,500, when it is placed over the pit and examined. Brakes are checked on electric testing machines. Brake blocks should be roughened or ground when found to be glazed or inefficient, and drums "turned" if scored; the latest device permitting this work without removing the tires, thus saving time. At set intervals, a complete overall is necessary to forestall breakdowns and possible accidents on the highway.

Skidding accidents, due to unequalized brakes or worn treads are potential sources of injuries. Where tires are worn smooth, but still have considerable rubber, a portable machine is available for cutting new tread groves without removing the wheel from the bus. This has been found very satisfactory. Air lines in the garage will aid in inducing the tire man to maintain proper tire pressure at all times, and numerous outlets will reduce tripping hazards.

Protection to passengers is afforded by the liberal use of safety glass in buses.

Heating with exhaust gas is always potentially dangerous due to the possibility of leaks, and should be replaced by blower type hot water heaters or other safe types. Every bus should be equipped with a fire extinguisher.

So far, attention has been confined to the mechanical section of the garage, but the operating end has its problems too. Clean and cheerful surroundings have a great effect on the operator starting out on his day's run, and will be reflected in the care he exercises and in his treatment of passengers. Providing barber and tailor shops and shoeshining equipment tends to improve his appearance. A full-length mirror shows him how he appears to others.

The use of bulletin boards, with safety suggestions will help to keep this subject in mind. A colored light shining above the board when important notices are first put up will insure their being read.

The receiver or cashier is always the objective of the "holdup man," and his protection from needless danger is worthy of consideration. He should be given the security of masonry walls and bulletproof glass, and his means of intercourse with

persons outside the "cage" must be so devised that it does not involve needless exposure. He should be furnished with facilities for turning in an alarm, and control of the lighting. Ample provisions for the ventilation of the cage must be made.

The handling of gasoline must be safeguarded. The buses should be filled in the open air under a canopy, separate from the main storage building. Bulk gasoline should be stored in vented underground tanks. Where it is impossible to segregate tanks containing fuel oil from the more explosive types, the filling caps should be clearly marked. Smoking must be absolutely prohibited in this vicinity, and all bus motors stopped and preferably light switches turned off before servicing is done. The use of drip cans under the bus intake opening is desirable. Fire extinguishers should always be on hand.

To avoid danger of electrical fires at gasoline pumps, all circuit breaking switches should be of non-arcing type. The use of safety vapor-proof fuse boxes is advantageous. The insertion of a tight wire mesh or pierced metal strainer in the bus tank at the filling cap will prevent a possible explosion from an exterior spark.

All wiring must be in conduits, and the filling of junction and receptacle boxes with a non-flammable plastic will add further protection. Providing polarized plug-in receptacles at frequent intervals will reduce the length, and liability to accidents, of extension wires. These wires must be amply protected against abrasion. All light bulbs exposed to explosive gases should be enclosed in vaporproof globes, and, when necessary, protected by metal cages. Motors used around the garage should be sparkproof.

Open flames should be confined to special rooms. Arc welding sometimes seems imperative on the garage floor, and when necessary should be isolated as far as possible, and extreme precautions taken to prevent a fire. The boiler room should be separate from the garage, but where conditions do not permit this, it must be divided from the storage section by unpierced, gas-tight walls, with the only entrance from outside of the garage. Provision must be made for an adequate supply of oxygen to the furnace that cannot be shut off; a deficiency of air or improperly proportioned combustion chamber particularly where oil is used as the fuel, has caused explosions. A frequent inspection of oil burning equipment is necessary. Devices such as automatic low-water and fuel-oil shut-offs will prevent boiler explosions.

The use of gasoline in engine cleaning may cause serious injury to the employee, if a spark is accidently produced. Nothing more flammable than kerosene should be used, and then only with care. Cigarette smoking being another potential danger, it must be prohibited and a plentiful distribution of "No Smoking" signs will aid to this end.

For fire "first aid," a plentiful supply of fire extinguishers is valuable. They should be of the types necessary for the kinds of fires likely to be encountered. For convenience sake, these can be concentrated at fire stations, conspicuously designated, with at least some of them close to exit doors, so that they can be used in an emergency with the least risk to the employee. Sand pails should be generously distributed throughout the building. In order that these features may be of value, employees must be educated to their use by frequent drills, and by their assignment to specific duties in emergencies. The installation of fire sirens, actuated by push buttons at convenient locations, is advantageous, as is also the furnishing of auxiliary pull-boxes to the city fire system.

The prevention of the spread of a fire ought to be considered in the design of garages. All garages exceeding ten thousand square feet in area should be equipped with automatic sprinklers. The use of standpipes are recommended, with outlets and fire hose spaced to reach every part of the garage.

Garages over thirty thousand square feet in area require fire walls. Doorways can be allowed in them, provided they are protected with self-closing fire doors; such openings to be limited to one hundred and eighty square feet in size where operating conditions will permit. Of course, these doors must be kept in perfect operating condition, and no obstacles ever placed in the way of their free movement. The erection of draft curtains, and parapets on interior walls will tend to prevent the spread of fire, while exterior parapets will protect pedestrians from falling roof snow and ice.

Most modern operators of transport equipment agree that to provide for the fullest protection of life and property, is not only humane, but good economics.

The Problem of the Worker Returning After Long Unemployment

By HART E. FISHER, M.D., F.A.C.S.

Chief Surgeon, Chicago Rapid Transit Company, Chicago, Ill.

With the resumption of industrial activity, unless we profit by past emergencies and make preparations for the resumption of normal times, I am much afraid that we shall find the new order of things costly to industry both in man power and finances. Those things that were thought sufficient for successful employee and public relations in the past will not quite fit in the new order of things. We must *realize that those millions returning to gainful occupation after a long interval of* unemployment with its attendant sacrifices and worries will have undergone a decided change of thought as well as a physical change within their bodies.

You who are concerned with the prevention of accident causation and who have accomplished such remarkable success in the reduction of accident frequency and severity in your industry will have a man's size job on your hands. Where in the past you have carried the story of safety to the employee through the medium of mass education, in the future we must individualize the worker and carry our instruction by personal contact, as each man is different from his brother and a different method of approach is essential.

What are the types of employees that will be available to industry on the resumption of industrial activity and what is the nature of the material that the safety engineer and his staff will have to deal with?

Those employees who have been retained during the depression to maintain a skeleton force constitute the first group. These men will be advanced in years and yet they are the backbone of your company, around which you will have to build up your new personnel. During the years of depression they have had employment but their work in many cases has been increased due to taking over additional duties. Their responsibilities have become greater and this has taken a toll of their mental as well as physical reserves. With business recovery will we find these men able to carry on, when we need them more than ever? I am of the opinion that many of them will suffer from the reaction; I have recently seen some of my good friends pass on suddenly from causes that I believe can be traced to the pressure under which they were working.

Are we directing attention now toward safeguarding these old employees to conserve their efforts? Maybe a well devised vacation would assist them to recover some of their reserves.

The second class includes those formally employed within your company whose service was terminated. They have been unemployed from one to six years. They have become older and at the same time their skill has suffered from lack of daily application. Their spirits have become dampened due to economic insecurity. Their former safety consciousness has likewise received a set back. Will they be as good safety men at their work as before? Their mental and physical condition will have developed defects that will show up under stress and make for accident proneness. Their sense of discipline has suffered and will be reflected in the early months of their reemployment. They may have built up a fear complex or even a feeling of malice due to being laid off, and fear of inadequate security does not make for orderly work performance. Many have the belief that all industry is responsible for their unemployment and this belief has been strengthened by the almost daily criticism directed at industry by political reformers.

In the third group we find the potential workers, those who never before have had a steady occupation. These young men and women have left school or college since the onset of the depression. It is to this group that we look for new blood and spirit for the future. These young people, numbering hundreds of thousands want to work. It is unfortunate for industry as well as the nation that they are denied the right to work. They emerge from school with ambitions high, but the prolongation of the depression has gradually dampened this spirit and their enforced idleness leads them to believe that education is a mockery. Their mentality receives a great shock and, their desire for constructive endeavour having been deadened, it will be difficult to adjust them to the routine and discipline of industrial life. These youngsters, who should be the backbone of industry, have been handicapped.

One daily hears the statement that "the good old days are gone never to return and life in the future will be different from the past." But such statements come from the middle and the old aged. Young people bring youth into the nation's affairs and their ambitions and hopes, if not blunted, will soon restore confidence. They will make their own "good times."

The fourth group of prospective employees are the chronically unemployed, whose numbers have been greatly increased through the depression. These people desire to work as little as possible. They believe the world owes them a living. In this group we find many of radical tendencies. They are easily lead by trouble makers, incited to mischief, and are not capable of thinking for themselves. Not all are radicals, of course; a considerable proportion only desire moderate contentment without responsibility. Some rove from place to place.

To these chronically unemployed, we must add a new class which, prior to the depression, were desirous of gainful occupation but through the long years of idleness have had their will to work killed. They would rather remain on government dole than accept remunerative work. The alien part of our population outnumbers the native born in this respect.

The sixth group of applicants comprise the old age group. They represent many years of useful occupation and will be a real asset to industry if they are given a chance to apply themselves.

Some may say that many in this group have become too old and have physical defects that will be hazardous in employment. I am not talking from theory, but from actual experience of some 23 years of contact with transportation employees; and I know that by proper placement, *job analysis and medical supervision* the old employee can be maintained at gainful work for many more years than might otherwise be possible.

There is one group of prospective and willing employee that is practically barred from industry through fear of the compensation laws. I refer to those who are crippled or have one or more defects. Placement of this group in work that will fit their condition will return to that industry the asset of many a loyal and efficient employee. Many can be trained for new tasks to fit their physical lack where they will not be a hazard to the industry. In all my experience I have never known an unfair award by the compensation boards to an employee who had a deformity and subsequently received injury.

What will be the physical condition and what the mental caliber of these different groups? All of them have experienced greater or less hardship during the past six years. Their troubled minds have received constant shocks. When men cannot see relief for an economic situation, their hopes become deadened, repeated disappointments lead to disillusionment and loss of confidence with those in authority. A suspicion complex is developed, and when you add to their confused state of mind the propaganda of self-seeking leaders, they look to anyone for relief as long as some action is forthcoming. A troubled mind and emotions held at high tension are soon reflected upon physical bodies. Fear, grief, worry, anger and malice build up a complex that will persist for a long time, and when actual physical suffering if not privation is added the impressions are more lasting and of greater intensity.

Thwarted ambitions and suppressed desires are especially unfortunate for the younger people because they are in the formative period. They will carry these emotional buildups for an indefinite time and in many cases a permanent effect will be left upon them.

Suspicion and malice must be allayed and an honest effort devoted toward building up confidence in the working personnel. Some will be loath to accept the practices and plans that were common in industry prior to the depression under the name of welfare and employee relations. Industry must place its cards on the table face up, for good employee relations will be forthcoming and industrial strife avoided by no other procedure.

During the past six years we have been remarkably free from epidemic disease throughout this country, but when the reaction sets in following the depression we may find the individual vitality and reserve forces so depleted that disease may

assume serious proportions. Many diseases and physical defects will be traced back to the depression years.

I am convinced, by 23 years of experience, that accidents are due to the following factors, and what is said for the transportation industry will apply to accident occurrence in all other industry, as well:

1. Mental limitation which is the lack of normal mental capacity for orderly thought. As the brain directs our actions it will be seen that should the mind be limited, the functions performed by our responsive actions may be incomplete or disrupted, and so precipitate an unusual occurrence or an accident. Training and experience usually broaden the mental capacity for constructive and orderly thought and performance. Should the individual's capacity be limited, he will be at a loss to understand fully your safety plan. Therefore ignorance due to lack of education and training doubly makes for accident proneness.

2. Next is the inability of persons to visualize a potential accident hazard. The poor safety record of some companies may be attributed to this lack of accident visualization on the part of the safety engineer, foreman or supervisor. Some of those engaged in safety work await the actual accident occurrence before they institute safety measures. If the safety man cannot foresee accident potentialities, how can we expect the working personnel to exert caution?

3. Another factor in accident causation is lack of ability to judge speed and estimate distance. This occurs within our ocular mechanism and we may have what is known as monocular or one eyed vision instead of binocular or stereoscopic vision, normal in most persons. The condition may be unknown to the worker and to the medical examiner.

4. Another factor is limitation of the normal color fields of vision. These persons may have narrowed fields of vision or telescopic sight. The possessor of such a defect while his acuity of vision may be normal, still will be unable to see objects at right angle to the eye. Many do not know they have this condition and are accident prone if they are operators of vehicles or work around moving machinery. The motorist so afflicted does not see the pedestrian nor the vehicle approaching from the rear, nor does he see such moving objects coming from the side streets until they are within the range of his fields; then it is often too late to avoid an accident. Have you ever been in an automobile, the driver of which was constantly turning his head from side to side as he proceeded? Well, his fields being limited, nature was trying to compensate for his lack and he instinctively kept turning his eyes to bring within his narrowed fields various objects.

5. The fifth factor is known as reaction time. A person may see or hear an accident possibility and before he can bring his muscular forces into performance the accident has caught up with him. There are three forms of stimulation, visual, auditory and tactile. The period it takes for a person to react after stimulation, we call reaction time. If this reaction time is delayed, either through normally slow performance or through distraction or illness, the hesitation may produce an accident. The methods used for the detection of reaction time are standardized.

6. The sixth factor is that of some physical defect or disease which prevents safe and orderly work. These defects and diseases cannot always be detected by superficial medical inspection; their detection can only be made through clinical examination, including X-ray, laboratory tests of blood and urine, the Wasserman test, cardiographic records, metabolism tests and blood pressure examination. Any examination less than this falls far short of the detection of the accident prone man and gives a feeling of false security to both the worker and his employer.

Should defects be found that make the man a hazard at his work, he should be placed where his defect will best permit him to work in safety. Do not junk human material, conserve it. With a little patience and effort the defective man can be fitted into your personnel and he will be able to carry on for many years in useful activity.

I want to call your attention again to the great part in accident causation played by mental distraction, which receives scant attention in industry. The most efficient and safest work is produced in an environment where disturbing elements are absent. Distracting noises may cause a work error or precipitate an accident. Scenes through open windows tend to distract a man's attention. Fault finding foremen, and hurry are distractions.

Then we have the element of climate. Where the worker is too hot or cold he is in danger. These conditions distract the mind, sap vitality and induce fatigue.

Disturbing thoughts caused by anger, grief, worry, envy, hate, jealousy, malice, greed, selfishness and disappointment, may be directly accountable for destroying the orderly processes of thought and submerging them in these powerful emotions. These emotions are known to alter the fluids of the body, suppress or stimulate glandular action, and work havoc with the nervous mechanism.

Some of us are so mentally constituted that we can carry on safely and efficiently even in the face of such disturbing elements, but there are many less fortunate.

Should the employee, in addition to his disturbed state of mind, have his body tormented by pain or discomfort due to sickness he is apt to come to grief earlier and the results of his accident be more serious. When a man is sick in mind and body you have an accident prone liability; but where health and a calm mind exist in an environment of comfort, you have the safety man's dream.

What, then, are we to do to protect both employee and employer from the frequency and severity of accidents.

We must plan a broader employment selection. We must consider the mental state of our personnel returning to industry. We should change our age limit for the new employee permitting older men to find work and encouraging the young recruit to take up gainful occupation in a safe manner. It is essential that there be greater personal contact between management and employee and a better understanding of each other's problems. The physical condition of those returning to work after prolonged unemployment must be carefully examined for mental or physical defects and each individual be placed where his physical condition will permit of safe work. This means a medical policy far superior to that in vogue in the past, both as to equipment and personnel and we should extend our study of preventing illness as well as accident prevention.

We must individualize the instruction to reach each employee personally and not rely on mass education in safety. Fit the handicapped worker in the industrial niche that his physical condition will permit. Be more careful in introducing the employee to the work he is to perform and let there be a more thorough interest and understanding by the foreman or supervisor of the problems of those under his direction. After employment, we must consider maintenance of men from a physical standpoint and give the same care to their health as we give to our rolling stock and other property.

Employee health is so closely interwoven with efficient work and with safety that we must open our eyes to the necessity of aiding the employee to maintain himself as nearly in physical perfection as possible. If we fail now, government regulating bodies may make plans for employee health and economic security.

WEDNESDAY LUNCHEON SESSION

October 16, 1935

Newly Appointed Safety Committee of American Transit Association and the Work Cut Out for It

By THOMAS FITZGERALD

Vice-President, Pittsburgh Railways Company, Pittsburgh, Pa.

The importance of accident prevention to transit companies was exemplified for me last week by two serious accidents in Pittsburgh involving street cars. In one a truck pulled out of line and collided head-on with a street car which had just started from a service stop. In the other, a collision occurred as a result of a

truck driving through an intersection against a red light. A number of people were hurt—some seriously. The newspapers carried the stories, featuring prominently the fact that street cars were involved and that the street car operators were required to post bond.

You can see the implications here. Transit companies find it very difficult to secure a favorable public opinion. In addition, juries, affected by general sentiment, often render verdicts for damages based on the idea that "someone should pay" for individual misfortunes. Of course that someone is the transit company.

The direct cost of accidents in terms of cash outlay is terrific but the indirect effect on public relations and impairment of service make accident prevention most important to our industry. Recognizing these facts, the American Transit Association appointed a committee which, aside from its chairman, consists of men who have made outstanding contributions to transit accident reduction. They are all convinced that there is a fertile field for more important results in the better coordination of efforts, not only within the industry, but also with other interests, notably municipal traffic authorities.

Please bear in mind that in this discussion the word transit covers street car, trolley bus and gasoline bus operations. The committee hopes to suggest methods by which the accident prevention efforts of all transit companies may be applied most effectively for the industry and for individual operations. While our program may appear very ambitious for a start, we were unanimous in our opinion that the work should proceed along the lines outlined below. It might have been better to have had a complete and exhaustive analysis of the whole problem before attacking specific problems, but the particular problems suggested are so apparent that the committee was sure of its ground. Perhaps the most important recommendation provides for a staff officer of the American Transit Association to bring about the maximum coordination of accident prevention activities throughout the industry. The first duty of this individual should be to make an analysis of the general problem and a check of the suggested program with a view to making desirable adjustments.

The following particular lines of activities were recommended:

1. Development of uniform classification of accidents.

The prerequisite for a uniform classification of accidents is a clear definition of the term "accident." We all are aware of the difficulty of finding a definition acceptable to every operator, but we must sink our personal preferences in order to gain the advantage of being able to compare the results of our operations with other similar operations and with the average. No better lead to inefficiencies can be devised than these comparisons. We may be far ahead on the average but far behind on some particular type, and thus by information from our superiors quickly improve our performance. Initially, the classes of accidents should be limited in number and simple in definition, thus forming a sound basis for further subdivision and refinement as we learn from experience.

2. Promotion of safety activities through contests.

Contests naturally flow from definitions and classifications of items which may be used to measure the ability of a management to achieve results. With some fair basis on which to measure achievement the American Transit Association should sponsor contests between operations which are comparable. Because of the sounder and broader basis on which comparisons would be made, such awards as the Brady Medal would have a greatly enhanced value.

Regional as well as national contests should be staged to bring about results in the transit field comparable to those achieved by contests in the field of motor trucks. There is a large field for improvement and so far we have not had the benefit of contests as intensive and far-reaching as the contests in other fields.

3. *Study of employee accidents.*

While the transit industry has made an enviable record in the reduction of public accidents, the same cannot be said of employee accidents. The improvement in public accident performance will compare favorably with that of any other industry, but, so far as employee accidents are concerned, we have lagged seriously behind the others. Probably this was due to the relatively greater importance of the public accidents, both as regards public relations and tremendous cost.

However, in spite of the fact that employee accidents are *relatively* few in number and low in severity, they offer a most fertile field, and we would miss a splendid opportunity for the improvement of safety and of morale if we did not intensify our study of this type of accident, seeking their elimination.

4. Analysis of causes of accidents.

Underlying all accident prevention work worthy of the name must be the most searching scientific effort to discover the causes of accidents. It is easy to discover that some part was defective in workmanship, material or design, or that some man was careless or inattentive, but there is a broad unexplored territory in the underlying mysteries of why these elements failed. The discovery of one underlying cause of a type of accidents is worth hundreds of discoveries as to the superficial cause of particular accidents.

The application of scientific engineering methods to the analysis of accidents would seem to be a comparatively easy task, and so it would be except for the peculiar conditions brought about by the occurrence of an accident in our operations. Claims departments are primarily interested in the defense of the company against unfair claims. It would be excellent if all of the conditions surrounding accidents could be analyzed and coordinated so as to bring out all of the pertinent facts, and if these facts were used by all concerned to form a basis for even-handed dealing. Unfortunately, this is not the case. Particular facts are seized upon by ambulance chasers and distorted in such a way as to produce an impression in the minds of juries exactly opposed to conclusions derived from a consideration of all of the facts in their proper relationship, so that claims departments have been constrained to restrict investigation and analysis within a comparatively narrow range as to personnel and scope of investigation. This great danger of fake claims and distortion of facts prevents the analysis and investigation of accidents along scientific engineering lines which should be started just as soon as the accidents occur. Some method of harmonizing these two interests must be devised so that we can investigate and analyze for prevention without unduly weakening our defense against raids by running thieves.

5. Public Cooperation.

Time is too short to elaborate all of the ways in which transit accidents may be prevented by wise methods of traffic control, adequate regulations, and enforcement. Public transportation vehicles are efficient users of the capacity of our streets. Their operators are rigidly selected, trained, and supervised. They are the safest vehicles. Therefore their representatives have the duty and the right to cooperate with civic authorities and organizations in the promotion of such measures as will contribute to the safety of general traffic conditions. Some method should be devised in every community through which this cooperation can be made effective. We can heartily endorse Dr. Miller McClintock's proposal, made at the American Transit Association Convention, to bring about the formation of an active committee of citizens for the purpose of promoting the improvement of traffic conditions in the interest of all the people.

6. Cooperation with other national organizations.

We have in mind particularly cooperation with the National Safety Council, not only in the reduction of traffic accidents, but especially in the reduction of employee accidents.

Coordination of activities within our industry will have to be accomplished to a much greater degree before we can hope to realize the great advantages of thorough cooperation with other national organizations such as the National Safety Council.

7. Employee Selection, Training, and Re-Training.

Much excellent work has been done along these lines, but it is doubtful if any centralized study has been made of all of these activities either from the standpoint of accident prevention or of efficiency in operations. Without doubt, the desirability for changes and improvements in the methods of selection and training of employees would be brought out by a competent analysis of the causes of accidents; but in the meantime there is a large field for good work in the collection and dissemination of information regarding these activities. There will be radical differences of opinion as to the value and results of different methods, but out of comparisons and explana-

tions should come a sure improvement in the technique used. We in Pittsburgh are much interested in the use of psychological tests in the selection of car operators, and we are experimenting under the guidance of a scientist specializing in this subject. If it has any value at all, it will be worth many times its cost.

ADJOURNMENT

Vehicle Fleet Section

Officers 1934-35

General Chairman—A. E. Lundsteadt, Bowman Dairy Company, Chicago, Ill.
Vice-Chairman for City Bus Fleets—Fletcher McLean, Jr., Triple Cities Traction Corp., Binghamton, N. Y.
Vice-Chairman for Inter-City Buses—Earl Hensley, Pacific Greyhound Lines, San Francisco, Calif.
Vice-Chairman for Dairy Fleets—Virgil Kling, Louisiana Creamery, Baton Rouge, La.
Vice-Chairman for Ice and Coal Fleets—J. Albert Green, Geyser Ice Co., Waco, Texas.
Vice-Chairman for Laundry Fleets—H. C. Angland, Troy Laundry & Cleaners, Minneapolis, Minn.
Vice-Chairman for Newspapers—W. F. Burk, The Respository Printing Co., Canton, Ohio.
Vice-Chairman for Petroleum Fleets—H. C. Waterhouse, Cities Service Oil Co., Chicago, Ill.
Vice-Chairman for Public Utilities—J. R. Steele, Oklahoma Gas & Electric Co., Oklahoma City, Okla.
Vice-Chairman for Retail Stores—A. O. Henzler, Wieboldt Stores, Chicago, Ill.
Vice-Chairman for Motor Freight—C. C. Rosenbarger, Markel Service, Inc., Kansas City, Mo.
Vice-Chairman for Bakery Fleets—C. S. Butler, Junge Baking Co., Joplin, Mo.
Vice-Chairman for City Trucking—L. Gusman, City Transfer Co. Ltd., Honolulu, Hawaii.

Officers Elected for 1935-36

General Chairman—R. C. Haven, Continental Baking Co., New York City.
Vice-Chairman—W. F. Burk, The Canton Repository, Canton, Ohio.
Vice-Chairman—H. Pierce Brawner, Atlantic Greyhound Lines, Charleston, W. Va.
Vice-Chairman—J. R. Steele, Oklahoma Gas and Electric Co., Oklahoma City, Okla.
Secretary and Chairman Engineering Committee—Dwight M. McCracken, Liberty Mutual Insurance Co., Boston, Mass.
Chairman Membership Committee—A. E. Lundsteadt, Bowman Dairy Company, Chicago, Ill.
Chairman Program Committee—C. C. Rosenbarger, Markel Service, Inc., Kansas City, Missouri.
Executive Committee at Large—
Marcus A. Dow, Greyhound Management Co., Cleveland, Ohio.
Charles H. Ruth, Evening Star Newspaper Co., Washington, D. C.
Charles S. Morgan, Jr., American Trucking Associations, Washington, D. C.
J. W. Lord, Atlantic Refining Co., Philadelphia, Penn.

TUESDAY MORNING SESSION

October 15, 1935

The first session was called to order by Mr. C. J. Knurck, field engineer, Motor Truck Division, Markel Service, Inc., Kansas City, Mo., who presided.

Controlling the Speed of Commercial Vehicles

By G. S. THOMPSON

Safety Engineer, Central Mutual Insurance Co. of Chicago, Detroit, Mich.

My first contact with the automobile was in the very early nineteen hundreds, when 15 miles an hour was speeding. When the speedometer made its first appearance, it was the desire of every owner to reach the limit of the register. This fact leads me to believe that all of us want speed. I certainly want it, and so do you. Why not face the fact and be honest about it?

Mr. Sidney Williams made a significant remark some time ago before the 21st annual highway conference. He said, "Speed is relative." I do not think any one has said any thing regarding speed that has a greater import. While it is true we cannot have life without motion and motion and speed are relative, we must also realize that uncontrolled speed leads to destruction.

Speed is in direct relation to automobile construction. If we continue to expect the manufacturer to produce faster and more powerful units, then unless we progress in the same degree as drivers, we can expect the present accident condition to continue. Give the baby an alarm clock and a hammer, and as far as the clock is concerned, you have a disaster. Merchants have purchased vehicles and then put men with more muscle than brains behind the wheel and wonder why things begin to happen. But things don't happen, they are caused and Mr. Merchant is to blame just the same as is the person who gave the baby the hammer. The smash up is the result, not the cause.

We have heard and seen demonstrations of speed and the application of brakes. We can now prove that the fellow who states that he can stop on a dime, when put to the tests finds that his dime consists of ten pennies. Our legislatures and city fathers have tried to establish limits for speed, the effort is laudible but terribly inefficient. In my city the ordinance says the speed limit shall be 20 miles per hour, but permits the motorist to travel at 30 if conditions permit. This is sensible, but puts the power of arriving at the decision of "if the conditions warrant" in the hands of a policeman, and it doesn't work out because the driver is relieved of a certain amount of responsibility, and generally says to himself, "Let the cop catch me if he can." You who own or operate a motor vehicle carry on your shoulders a great responsibility and you cannot delegate this to any police department. It is yours and you must assume it or stop driving.

We have a semblance of control in our cities, but outside of the city limits, the driver is tempted to step on it. What are we going to do about it? Some want legislation requiring the use of speed governors. This is all right provided the city is flat, but how about the city that has many hills? We have a great many fleets that use them and have splendid results, but you can't delegate responsibility to a mechanical governor. Yet I am sold on their use. Some may fit a condition better than others.

But education in the use of the vehicle is the best controlling device that any one can use. You who lay out the time schedule for your routes are the men who cause speeding in many instances. You lay out a schedule almost impossible if drivers are not to speed. This may make a splendid record for you but when you look up your operating expense, including repairs and tires, it shows rather badly.

Why not start an educational program by testing your drivers for the judgment they use in handling the vehicle. State facts, reconstruct accidents, ascertain what could have been done to prevent the accident. Let the drivers in conference arrive at decisions.

Set your schedules only after careful deliberation. Please realize the importance of this, because men will make the schedule regardless and if they have to speed to do it. Test the new man out with an experienced driver. We must educate our drivers that it is our desire that they travel over the highways in a safe manner.

Carbon Monoxide in Moving Motor Vehicles

By F. M. VAN DEVENTER

Mechanical Engineer, Cities Service Oil Group, New York City

The fact that the exhaust gases from automotive engines contain sufficient carbon monoxide to produce asphyxial death does not constitute news. Between 500 and 700 such deaths occur in the United States annually, usually because an automobile engine is operated within a garage with closed doors, either intentionally or unintentionally.

However, the fact that carbon monoxide in exhaust gases can and does seep into the passenger compartment of moving vehicles in sufficient quantities to impair the judgment of the driver in the control of his car has only recently been proved by exhaustive studies made by the Cities Service Oil Group. The investigation led to the astounding conclusion that approximately five per cent of the cars picked at random from state highways by state police for examination contained sufficient quantities of carbon monoxide in the passenger compartment to impair the judgment of the operator in controlling his vehicle after an exposure of from one to two hours or more.

The physiological effect resulting from the absorption of small concentrations of carbon monoxide over a sufficient period of time is familiarly called "drowsiness." This may or may not be preceded by such warnings as headache, dizziness, or nausea. A car traveling at the rate of 50 miles per hour traverses a distance of 75 feet in one second. Hence, if the mental reaction time of the driver be delayed only one-half a second, due to the dulling effect of carbon monoxide, his car will travel 37 feet during that time before he will begin to apply the brakes. A car driven by such a driver constitutes a hazard to the public safety on the highway equal in seriousness to that of another car equipped with faulty or defective brakes, even though that driver may be mentally alert.

Only a "hat-full" of the exhaust gases from an automotive engine slightly out of adjustment, when mixed with the air in the body of a coupe, will produce an atmosphere containing sufficient carbon monoxide to result in the form of impaired judgment already referred to.

The importance of the findings is illustrated by applying the observed percentages to the total number of cars on American highways. There probably are one million automobiles being operated on the American highways in which the drivers are exposed to sufficient quantities of carbon monoxide to make them physically unfit to exercise prompt and proper judgment, particularly in cases of emergency. Approximately half the vehicles tested were found to contain measurable traces of carbon monoxide. While such conditions do not constitute a definite hazard to safety at the present time, these cars should be considered in the same category as a felon on parole, because the presence of any carbon monoxide within the car is a warning that a defective condition exists. The defect will not correct itself, but the probabilities are that road vibration and similar factors will make it worse, resulting eventually in a dangerous atmosphere within the car.

In studying the course of the carbon monoxide and the manner in which it finds its way into the passenger compartment of cars, it was found that the swirling eddy currents which follow behind any but a perfectly streamlined vehicle may, under certain conditions, be drawn into the body of the car producing it. Several instances of this type were found.

It was found that a car following too closely behind another, particularly in heavy traffic, may under certain conditions pick up a sufficient quantity of the exhaust gas from the preceding car to result in a dangerous mixture within the second car.

Leaky gaskets in the exhaust manifold and the various connections between it and the muffler itself, result in the discharge of exhaust gases under the hood or floor boards of the car. Unless the entire body construction, including the floor boards and bulkhead, be absolutely air tight, the vitiated air under the hood or car will filter into the body or passenger compartment. Loose pistons and leaking piston rings permit products of combustion to "blow by" the cylinders into the crankcase. These gases may then be discharged through the oil filler cap and thus vitiate the air under the hood in a manner similar to a leaking gasket.

"Preventive maintenance" is recommended as the only effective means of minimizing the effect of carbon monoxide upon highway accidents. Since the concentration of carbon monoxide in the air within a car is always in direct proportion to the relative amount of this gas in the exhaust mixture of the car producing it, it follows that the first point of control is to minimize the amount of carbon monoxide in the exhaust of all cars. This may be done through a periodical routine checking and adjustment of the ignition and carburetion systems. Cars thus maintained will be safer because of the reduction in the amount of carbon monoxide produced and they will operate with better economy and performance because of the greater energy released from the more complete burning of the fuel within the motor.

The other preventive measures comprise a periodical examination of the entire exhaust system and the immediate replacement of leaky gaskets or connections, together with a similar inspection of the floor boards and bulkhead, keeping them tight, so that should exhaust leaks occur, the vitiated air cannot enter the car.

Many illustrations showing how improper inspection and maintenance has been largely responsible for several deaths are available. These are taken from cases tested at the request of state officials. In one case the operator of a truck, while under the influence of carbon monoxide fumes, drove off the highway. Being thus awakened, he then purposely went to sleep in his cab with the engine running, but was asphyxiated when discovered. When the test instruments were placed within the cab, they showed a concentration of carbon monoxide which would result in the death of any person seated in the cab after a brief exposure. When the exhaust gases were tested with the Cities Service Power Prover, they showed an excessively high proportion of carbon monoxide. An examination of the exhaust system disclosed that the seam of the muffler contained a rip which permitted exhaust gases to be blown inwardly against the floor board. Openings around the poorly fitted floor board then permitted the deadly gas to filter into the car. The operator had unknowingly prepared for his nap in a lethal chamber as deadly as that used by the State of Colorado in imposing the death penalty upon convicts.

In another case, two occupants of a coupe were asphyxiated while the car was parked. Within a few minutes after the instruments were placed within this car, a death-producing mixture was indicated. Again the Power Prover showed that, due to mal-adjustment of the engine, the exhaust was excessively rich in carbon monoxide. A leaking gasket on the exhaust manifold and a sheet iron heater placed around the manifold resulted in the discharge of a death-producing mixture into the coupe.

In still another instance, the driver of a passenger car drove off a straight road into the ditch. While endeavoring to regain the highway, he collapsed at the wheel and was later found dead. For the purpose of the test, the investigator wore a gas mask and drove the car over the same route which had been traversed by the owner on his final ride. The detector indicated that when traveling on the highway, there was sufficient carbon monoxide within the car to account for the driver going to sleep behind the wheel; and when the car was stationary, the mixture was heavy enough to produce death. The Power Prover indicated excessive monoxide in the engine's exhaust and a "haywire" repair of a leaky gasket, together with poorly fitted floor boards, as the cause factor.

Another operator of a truck, after having been on the highway a few brief hours, drove his car directly into the rear of another truck parked at the roadside. The truck was demolished beyond the possibility of determining the source of exhaust gas, but an examination of the dead driver's blood indicated a sufficient concentration of carbon monoxide in his system to account for his poor driving judgment.

Based upon the foregoing examples and a study of the several hundred cars tested, it is in order to recommend a periodical examination and inspection of all cars. This examination could be most effectively applied by including it in the compulsory examination of other safety devices of the car, as is now provided for in some eastern states. Such an inspection would reveal the existence of conditions which result in the infiltration of carbon monoxide into cars on the highway. The resultant reduction in deaths, injuries and property damage would thoroughly justify the effort.

All who drive long hours on the highway are urged to stop occasionally for a "breathing spell." The army marching custom of a five-minute rest out of every hour becomes a splendid driving rule. An occasional pause to exercise in the fresh air not only tends to replace with oxygen any carbon monoxide which one might have breathed during the preceding hour, but the resulting relief of muscular and mental tension renders the drive a more pleasant and a safer one.

Using Models in Discussing Accidents and Training Drivers—A Demonstration

By EDWIN D. JACKSON

Asst. Supt., Motor Vehicle Service, Post Office Dept., Chicago

A number of years ago while seeking different and more impressive ways in which to train truck drivers we conceived the idea of illustrating traffic laws and safety rules by means of toy automobiles on a replica of a city street.

We constructed a flat surface about four feet long by two feet wide, set at an angle of approximately 17 degrees so as to be visible from all parts of the instruction room. Upon this we outlined two intersecting streets, one of which contains a double street car line with a safety island, and an alley. At the intersection we erected a three light "stop and go" signal which is operated by means of a small flash light battery which is used in illustrating the red, yellow and green signals.

Class rather than individual instruction is given. After roll call announcement is made that each one will be called upon to demonstrate problems involving traffic regulations and safety rules by moving a toy automobile on the replica in the same manner in which he would drive his machine.

The driver called upon proceeds with his demonstration describing each move and explaining his reason therefore after which without comment inquiry is made of the class whether all agree with him. If any disagree they are requested to demonstrate their way. The problem is then thoroughly discussed and the instructor in order to firmly fix the principles in the minds of all present again makes the correct demonstration and restates the law or rule involved.

Whenever possible the problems are stated in such manner as not to suggest the method of its solution. For instance, if we desire to test a driver's knowledge regarding the law which requires one to stop before emerging from an alley. We state the problem as follows: "You are the operator of this car which is standing in this alley. It is now your duty to drive it onto the street and park it as near the intersection as the law will permit. In your demonstration explain each move you make so that all may understand."

There is no suggestion that there is a law which requires that a stop be made at the sidewalk line before emerging from the alley.

In order to demonstrate that it is not safe to pass an overtaken street car at a street intersection the following problem is given:

"Your car and a street car are standing at the near side of a street intersection. As all of the passengers board the street car and it starts forward you start your car. It is your duty to pass the street car as the motorman is in no particular hurry at this time. Now move your car, while I move the street car, and demonstrate how you would drive under this condition."

If the driver attempts to pass the street car within the intersection I quickly stop the street car and move up a car from the left, which had been standing at the intersection, in such manner as to cause a collision. We then explain why it is

unsafe to attempt to pass any overtaken vehicle at a street intersection when the vision to either side is obscured.

In order to illustrate the proper way in which to make a left turn the following problem is given:

"Your car has been parked along the right hand curb while you were making deliveries in the vicinity. Your next stop is on the intersecting street toward the south of your present position (the top of the replica representing north). It is now your duty to proceed from your present position to your next stop. Please demonstrate how you would drive under these conditions, explaining each move you make and give reasons therefore."

In making a proper demonstration in this instance the driver must tell what precautions he should take before starting from the curb, signals required, etc., he must show how he would reach the center line of the street and make the left turn around the center of the intersection. While he is engaged I generally move a car forward from the opposite direction so that unless he stops his car while in the act of turning a collision will occur. This is to test his knowledge of the law which grants the right of way to vehicles proceeding straight across the intersection over those making a left turn therein.

In demonstrating the correct way in which to make a right hand turn at an intersection we place a car in the lane of traffic nearest the center of the street and then request that the car be moved to a place on the intersecting street to the right.

In making this demonstration the operator must make his way into the first lane of traffic and make the turn as close to the curb as possible. As he approaches the intersection we operate the "Stop and Go" signals. Sometimes the operator fails to note this and makes the turn against the light.

In demonstrating how one should drive from one side of a street to the other the following problem is stated:

"Your car is parked along the right curb on this street while you are making a delivery. Your next stop is on the other side of the street and because of the weight of the article to be delivered there you cannot carry it across but must drive across and stop your car at the curb in front of the place of delivery. Now move this toy car in the manner in which you would drive explaining as you proceed."

Sometimes an operator will move the car across the street in a diagonal manner and stop it with the left side at the curb instead of making the complete turn and stopping with the right wheels at the curb as the law requires.

To illustrate the law which prohibits the passing of an overtaken street car on the left side we state the problem thus:

"You have been following this street car for quite some distance and finally decide to pass it. While I move the street car you move this toy showing how you would pass under these conditions, explaining your acts." And in order to make it easier to pass to the left than to the right we place other toys along the right side of roadway making it difficult to pass on that side.

The safe driver, of course, will wait until he can safely pass to the right rather than violate the law and pass to the left of the street car.

These problems, taken at random, are sufficient, I think, to illustrate how vividly traffic laws and safety rules can be taught by means of models on a replica of a city street. Each one can see exactly how each move should be made and not knowing who will be called upon to make the demonstration each must pay very close attention throughout the session. Moreover, we have found by experience that the drivers become very much interested and watch each move intently trying to detect some error on the part of the demonstrator. Frequently some very interesting discussions arise over disputed moves.

In preparing for these sessions the instructor should make a careful survey of the accidents in which the drivers were involved during the previous six months and prepare special problems illustrating the rules and regulations involved so that there need be no repetitions of those types of accidents.

We have found that drivers not only grasp safety principles quickly by this method of instructions, but that they can explain how their accidents occurred far more easily by the use of models than by written reports.

So the accident investigator after preparing a replica of the scene of an accident drawn to scale requests the driver to demonstrate in detail each move made by all

involved, from the time he approached the place of the accident until after it occurred, by moving on the replica toys representing each vehicle implicated.

By this means the investigator is enabled to secure a far more accurate and detailed account of the accident than is possible through the usual question and answer method. By it also he can detect discrepancies which otherwise might pass unnoticed.

For example, a driver submits an accident report wherein he stated that while crossing B street westbound in A street his vehicle is struck by a truck southbound in B street at a high rate of speed, the left front of the other car coming in contact with the right front of his; that when he was about 50 feet from the intersection he observed the approach of the other vehicle which was then several hundred feet from the intersection; that he continued since he was approaching the intersection so far in advance of the other car; and that just before the collision he again observed the other car nearby whereupon he turned toward his left and applied his brakes but was unable to avoid a collision.

If this driver should be called before an investigator who uses models he will find a replica of the scene of his accident placed in front of him and he will be told that the blue car, for instance, represents the car operated by him while the red car represents the other car involved. He will then be requested to place the blue car in as nearly the same position on the replica as his car occupied in the street as he approached the intersection and at a considerable distance therefrom, say about 200 or 300 feet if possible on the replica.

The driver then places the blue car in the first lane of traffic at a distance representing about two or three feet from the curb and advises that when at that place his vehicle was moving about 30 miles an hour. He then moves the toy forward to a place corresponding to the place where he stated he was when he first observed the approach of the other vehicle. His toy is stopped there and measurements taken and it is found that the place was about 50 feet from the intersection.

He is then requested to place the red toy in the position corresponding to that of the other car when it was first observed by him and places it in the lane of traffic nearest the center of the street at a point which upon measurement proved to be about 150 feet, not several hundred feet, from the intersection. He then moves the blue toy toward the intersection explaining that he reduced his speed as he did so to about 15 miles an hour; that on arriving at the east sidewalk line he looked toward the left for traffic continuing his course and then again to the right at which time the blue toy is near the center of the intersection.

At this point he again observed the other car which was then crossing the north curb line of the intersection as indicated by the red toy; that he turned toward his left and the other driver toward his right and that the right front fender of his car and the left front of the other car came into contact.

Apparently there are not many discrepancies between the two versions of the accident as given by the driver. However, it so happened that the building located at the northeast corner of the intersection extended to the sidewalk line on both streets. Now by drawing a line representing the field of vision of the driver from the place he indicated he first observed the other vehicle, you will observe that the other car could not have been seen from that place unless it were within about 50 feet of the intersection, and as it was approaching from the right, it had the right of way over the other car.

The driver, disconcerted by this disclosure, quickly admitted that he did not observe the other car until just before the collision occurred, which might have been only a theory in the mind of the investigator had he not insisted upon a visual demonstration.

Even the most illiterate driver can, by the use of models in discussing accidents, re-enact every one clearly and concisely, thereby reducing the work of the accident investigation department.

TUESDAY LUNCHEON SESSION
October 15, 1935

National Fleet Safety Contest

Sixteen plaques and 28 certificates were awarded in the National Fleet Safety Contest. In this contest 500 fleets, operating 33,000 vehicles which traveled 561,000,000 miles, participated.

The plaques were presented to the winning contest units by R. I. Catlin, Aetna Casualty and Surety Co., Hartford, Conn., and Vice-President for Public Safety, National Safety Council, as follows:

Inter-City Bus Division—Large Fleets—Greyhound Lines, Cleveland, Ohio.
Inter-City Bus Division—Small Fleets—The Utah-Idaho Central Railroad Company, Ogden, Utah.
City Bus and Taxicab Division—Large Fleets—Triple Cities Traction Corporation, Binghampton, New York.
City Bus and Taxicab Division—Small Fleets—Baton Rouge Electric Co., Baton Rouge, La.
Passenger Car Division—Group I—Sinclair Prairie Oil Company, Tulsa, Okla.
Passenger Car Division—Group II—Texas Pacific Coal & Oil Co., Fort Worth, Texas.
Passenger Car Division—Group III—Southern Sierras Power Co., Riverside, Cal.
Passenger Car Division—Group IV—Erie County Electric Co, Erie, Pa.
Inter-City Trucking Division—Large Fleets—Southwestern Transportation Company, Texarkana, Texas.
Inter-City Trucking Division—Small Fleets—U. S. Engineer Department, Gulf of Mexico Division.
Dairies Division—Louisiana Creamery, Baton Rouge, La.
Public Utilities Division—Large Fleets—Atlantic City Electric Company, Atlantic City, New Jersey.
Public Utilities Division—Small Fleets—Connecticut Power Company, New London Division.
Miscellaneous Manufacturing Plants Division—Pittsburgh Steel Co, Monessen, Pa.
Petroleum Division—Large Fleets—Atlantic Refining Co., Baltimore, Md.
Petroleum Division—Small Fleets—Shell Petroleum Corp., Houston, Texas, Refinery.
Bakeries Division—Large Fleets—Junge Baking Company, Joplin, Mo
Bakeries Division—Small Fleets—Nolde Brothers, Norfolk, Va.
Newspaper Division—Canton Repository Company, Canton, Ohio.
City Trucking Division—Large Fleets—U. S. Engineer Dept., South Pacific Division
City Trucking Division—Small Fleets—U. S. Engineer Department, North Atlantic Division.
Department Stores Division—Large Fleets—United Parcel Service Company, West Division of Los Angeles.
Department Stores Division—Small Fleets—United Parcel Service Company, Ventura and San Bernardino.
Coal and Ice Division—Large Fleets—Central California Ice Company, Turlock, Merced and Modesto.
Coal and Ice Division—Small Fleets—Rainey-Wood Coke Company, Swedeland, Pa.
Laundries Division—Large Fleets—Troy Launderers & Cleaners Minneapolis, Minn.
Laundries Division—Small Fleets—Elk Laundry Company, St. Paul, Minn.
Beverages Division—Large Fleets—Coco-Cola Bottling Company, of New York, Newark, N. J.
Beverages Division—Small Fleets—Coco-Cola Bottling Company of New York, Bridgeport, Conn.

WEDNESDAY MORNING SESSION
October 16, 1935

The Conference Method of Driver Education

By L. K. COVELLE

State Supervisor of Trade and Industrial Education, Oklahoma State Department of Vocational Education, Agricultural and Mechanical College, Stillwater, Oklahoma

To have a successful conference it is necessary to select fifteen to twenty men who collectively have 150 to 200 years of actual experience in driving motor cars.

In teaching by the conference method the leader's skill and success are dependent upon the utilization of the experiences of the men. The men should be placed in a semi-circle around the table, so that each man can see the other. There should be a blackboard in front of them, just behind the conference leader.

A leader should prepare his lesson as carefully and systematically as any good instructor.

If skillful, the leader will use what we call the case method of instruction—putting a case problem on the blackboard pertaining to safety in driving.

Every man present, through his experience, can contribute to the solution of the problem. If all participate, a great deal of information will come to light. Any question arising relative to the problem in hand can generally be solved by the group, for the simple reason that it comes from a group to which it is a live problem.

In the analysis of the case the instructor will use four steps, namely, preparation, presentation, application, and inspection. He may use any one of a number of methods of developing these four phases—lecture, question and answer, demonstration, illustration, conference method—whichever may best serve the purpose of causing the men to do their own thinking and reasoning in the light of their actual experience and of bringing them to the realization that they must think out problems for themselves as individuals.

In other words, the conference method should build a guide post which will help the man think out his own safety problems in the future

The Importance of Physical Examinations of Commercial Vehicle Operators

By WILLIAM J. SWIFT, M.D.

Examiner of Applicants, Greyhound Lines, Chicago

My procedure in making an examination has one object in view, to determine whether or not the applicant is mentally and physically fit for the position of bus operator.

The examination begins when the application is first filed with the regional director. The man's past history should be investigated. Next—a personal interview should be held with the applicant to observe his appearance, intelligency, education, height, weight, development, deformities, etc. We follow the policy that each applicant should be 5 foot 9 inches tall, and weigh at least 165 pounds. Of course, he should not carry too much weight.

When the applicant enters my office, I try to make him feel at ease. Ordinarily, I first test the eyes and ears. The Snellin test is made. The applicant stands 20 feet away from a well illuminated chart. There are several strips of various colors and he is asked to identify these colors. A large number of various colored yarns

are thrown on the desk and he is asked to match the colors and call their names. This is a much better test than the test chart.

In making the vision test care must be taken that the applicant has not memorized the chart. If doubt exists I use a card board with a small opening so that it can be moved from letter to letter with no chance to see but one letter at a time.

In the eye examination additional tests should be made for:

1. Previous attacks of inflammation, injuries, scars, etc.
2. Infections.
3. Ocular palsy or squints.
4. Previous use of glasses and why?

The pupils are examined for size, shape, equality and for light and accommodation. The eyes are tested as to their mobility, and their sensitiveness. In questionable cases the man can be referred to an eye specialist, but I have seldom found this necessary.

I would say that if the applicant cannot read at least 20/30ths, he should not be passed. I am not in favor of passing a man who requires glasses to drive.

I, then, check his family history for strokes, heart trouble, epilepsy, brain diseases, insanity, tumors, kidney trouble, and other diseases that are more or less inherited. He is quizzed as to his past history, and I observe his demeanor during the questioning. His medical history is gone over. We would not want a typhoid carrier in our employ. One of the worst epidemics of small pox this country ever knew was started by a Pullman Conductor who brought it back from Montreal.

Next I take his height and weight either with or without his street clothes.

The next step is to record the patient's complexion, the color of his eyes, and the color of his hair for identification purposes.

The ears are tested by the watch test, the whispered test, and by occasionally dropping the voice in conversation with the applicant, and by examining the ears with a speculum which enables the examiner to see the condition of the external ear and the ear drum. One should also examine the mastoid bones. Men with defects of hearing, discharge from the internal ear, defect in the drum, or involvement of the mastoid bones should be rejected, for such men may become dizzy and so imperil the safety of the passengers.

The reinforced Rhomberg test should be made for equilibrium. The applicant is asked to stand with his feet placed parallel and close together. He is asked to extend his arms and in turn bring the tip of each index finger to the tip of the nose, first with the eyes open, and then with the eyes closed. Marked swaying is a cause for rejection.

The motor branches of the cranial nerves are easily tested. Minor defects are not grounds for rejection unless they have a serious pathological basis. For example a facial paralysis with the mouth drawn much to one side would be a cause for rejection. Any obnoxiously disfiguring scars would likewise mean rejection, not that he might not be a good driver, but because his appearance would not be appealing to passengers. Skin disease to the face or scalp that is displeasing to the sight is grounds for rejection. Then too, any defects of the head of any consequence are grounds for rejection. Infected teeth should call for the postponement of the application until they are in proper healthy condition. A man who has sustained a concussion of the brain should not pass, not only because of the injury, but because claims might be made on the basis of an aggravation of such a pre-existing injury.

Next the expansion of the chest is taken. A minimum of 3 inches should be the standard. The abdominal measurement should be less than the chest on inspiration. The lungs should be carefully examined by percussion and auscultation to determine the presence of tubercular cavities, former lung involvment, or other lung pathology.

The examination of the heart, and with this the taking of blood pressure is naturally closely related, is of great importance. An applicant with a leakage of any valve of the heart should be rejected. The heart should be examined both before and after exercise.

No man with a rupture should be accepted until the hernia has been operated upon and cured, and sufficient time elapsed for healing to have become firm and permanent. An existing hernia may become strangulated at any time, and immediately incapacitate the man and also lay the foundation for even a death claim against the company on the basis that an aggravation occurring as a result of his occupation. Motor coach operators must handle heavy suitcases and trunks from time to time. I, therefore, recommend that no man be employed who has a hernia.

The sexual organs should be carefully checked and no man with a venereal disease should be passed. I am speaking particularly of the active and contagious stages when they are a menace.

While the patient is stripped, all deformities and scars should be recorded not only for identification purposes but to prevent a claim that they were due to an accident sustained in the employ of the company.

Examination of the back, hips, shoulders, upper and lower extremities is essential.

The examination of the urine must be made and the physician should see to it that the specimen is that of the applicant. The presence of sugar or albumin is a cause for at least postponement or in many cases for a complete rejection. Either condition may be temporary, but often this cannot be determined by a single examination. It may be necessary to the man to return for subsequent examinations. Infections of the genito urinary tract which includes the kidneys and bladder often result in marked impairment of vision and other serious disabilities. A person suffering from albumin in the urine, and/or diabetes are more susceptible to serious complications such as infections in case of injury than a normal individual.

It is my sincere opinion that these examinations are of utmost importance. Since I have been making examinations of the Greyhound motor coach operators there has been a drop in the number of accidents for the simple reason that men physically or mentally unfit are not given the responsibility of driving a coach. Several years ago, it was no uncommon occurrence to have twenty-five injured people brought to my office a day. Now the accidents are few and far between.

THURSDAY MORNING SESSION

October 17, 1935

COMMITTEE ON THE DRIVER

Because of general interest in new and scientific developments in measuring driving ability, training drivers and other driver problems, the meeting was open to the public and covered private as well as commercial drivers.

Dr. Alvin R. Lauer, Associate Professor of Psychology, Iowa State College, as Chairman of the Committee, opened the discussion regarding the present status of testing for driving ability. His statements were based on eight years of experiment and experience in the examining of large numbers of private and commercial drivers. He pointed out that:

Tests for Drivers

The tests so far developed can be compared to any other psychological and medical examination or diagnosis. Just as an insurance examination indicates a possible span of life, the psychological tests indicate a person's chances of having accidents rather than predicting whether he will or will not have an accident. Such tests are more diagnostic in the extreme cases, that is, among the very superior and the very inferior groups.

To get a fair index of a driver's ability it is necessary to measure him in many different ways. Any one measure, such as reaction time, or even any two or three measures, however good, cannot be considered seriously. People who expect results from one or two simple tests are expecting magic. However, certain groups of traits

may be used much more effectively than other groups in predicting aptitude for driving.

The measures of driving ability so far developed are no better than the persons using them. In other words, such tests can be useful only if given by persons well trained to apply them. It would be nice if we could buy dental tools to fill our own teeth, but so far good results have only been obtained when general tools are used by *skilled dentists.*

Use of psychological tests as measures of driving ability are warranted as a basis for specific training of drivers and follow-up work with them. It is herein that their chief value lies. In general, tests are well received by drivers who feel that they get from them help in understanding their capabilities which is worth the time and effort spent.

There are two fundamental requirements in developing tests of any kind. First, does it measure consistently or accurately? Will it give the same result twice if repeated on the same person? Unless these conditions are met within a reasonable margin of error, the time taken for a test may be largely wasted. This latter is true of many sections of examinations now used by states for licensing drivers. Second, does the test measure what it purports to measure? For example, if a test measures traits which have nothing to do with driving they may be impressive but valueless in preventing accidents. The only way of determining whether a test is measuring a driving ability is to try it out on drivers whose records are known. This is technically called the "validation" procedure.

Commercial vehicle fleets are the only places where groups of drivers are available with complete mileage and accident records, and it is to them that scientists must look for drivers on whom the tests may be tried out to find whether they really measure driving ability.

In dealing with drivers it is not enough that we should urge them to be safe, this is useless unless they know how to be safe. Therefore, we must instruct them to do specifically this thing or that thing. The tests are useful in determining what specific things drivers should be told to do.

Note: For details of the tests with which Dr. Lauer has been working see the articles "Science Measures the Driver's Defects" in the July, 1934, issue of the NATIONAL SAFETY NEWS and the "Manual of Tests for Automotive Operators" published in June, 1934, at Iowa State College, under the auspices of the National Research Council.

Training Drivers

Amos E. Neyhart, Assistant Professor of Industrial Engineering, Pennsylvania State College, State College, Pennsylvania, described the technique of training drivers individually or in groups. He pointed out that the only way we can develop to the fullest the capabilities of drivers is by determining what practices are safe and unsafe, and then making these practices serious habits. Without such habits to begin with drivers seldom develop them by themselves with the result that many drivers on the road today do not recognize their bad habits as such, and are consequently led into accidents.

In examining a thousand cases, it was discovered that the pupils had generally acquired the good or bad driving practices of their teachers. Pupils who learn from teachers with bad accident records were not unlikely to have bad records themselves. This evidence refutes the theory that a teacher who has had accidents will, by virtue of this experience, be able to point out the causes of these accidents and thus help their pupils avoid them. In practice such people may not realize why they have the accidents, or may not recognize other bad practices which they are passing on to their pupil, but which have not yet resulted in accidents to the teacher, simply because they never got into the proper jam.

As people grow older more time must be spent in teaching them to drive from scratch. People more than 60 years old take about 36 hours of instruction and practice, whereas pupils of high school age average a little more than 13 hours.

Driver training can successfully be done in groups, at least if they are substantially of the same age. At State College High School, a group of 24 learners were trained this way. Class-room work was given to the entire group, each pupil had a manual of driving practices for home study. Practice in handling a car, however, was given to the students in groups of four, each driving 15 minutes out of an hour period while the others watched. The group method benefits both the student who is driving and the others, for the student who is driving is stimulated to his utmost effort to make a good impression, and the others are continually reviewing the performance and thus rehearsing the habits. This results in much economy in the instructor's time and car mileage. In training drivers singly the average mileage was 114.6 whereas for the group method it was 72 per driver.

Training by these methods results in the formation of proper habits to begin with. All the pupils were carried to the point where they could easily pass the Pennsylvania State Drivers' License Examination and their accident record subsequent to licensing has indicated them to be well above average in proficiency, although more data will have to be accumulated to demonstrate this clearly.

During the following year, driving practice will be made a regular part of the State College High School's course, and every student who has reached the State age limit will be given an opportunity to learn driving. Pennsylvania State College will offer a course of training for instructors in driving in the 1936 Summer School.

A step by step method of teaching driving is set forth in "The Safe Operation of an Automobile—a Manual for Teachers and Learners," prepared by Mr. Neyhart. These lessons and experiences are more fully explained in the October, 1935, issue of "Safety Education."

Massachusetts Relief Project for Developing Driving Testing Equipment

Dr. Harry R. DeSilva, Professor of Psychology, Massachusetts State College, Amherst, Mass., explained with illustrations the accomplishments of the Federal Emergency Relief Administration's project for research on driving skill which he has been directing. The object of this study is to help the driver by giving him *positive* council instead of merely the customary negative admonitions against such faults as excessive speed, carelessness, lack of courtesy and drunkenness. This is being done by use of laboratory equipment which determines some of the driver's abilities and indicates what course his training or re-training should take.

A driver has certain inherited potentialities which he cannot improve by any amount of practice. He should know definitely how he stands with respect to these abilities so that he may act accordingly. In other abilities a driver may improve greatly with practice. In perfecting himself he should know in which of these he is weak so that he may take steps to improve.

The laboratory tests now devised include the following:

1. Braking-Reaction Test.
2. Steering Tests.
   (a) Miniature steering.
   (b) Full-sized steering.
3. Speed-and-Timing-Estimation Test.
4. Visual Tests.
   (a) Glare-blindness.
   (b) Movement perception.
   (c) Depth perception.
   (d) "Tunnel Vision."
   (e) Visual Acuity.
   (f) Color-blindness.
5. Auditory Tests
6. General Tests including the training of drivers.
   (a) Miniature-Highway Driving Test.
   (b) Moving-Picture Driving Test.
   (c) Experimental Road Car.

7. Tests for Fatigue and other Physiological Handicaps.

The program of testing drivers with this equipment began at the Eastern State Exposition in Springfield, Mass., in 1934, when 2,500 people were measured for braking-reaction and steering. An additional 2,000 people were tested out with these and other devices at the 1935 Boston Automobile Show. In the meantime approximately 1,000 people have been examined in the laboratory.

In all of this work an attempt has been made to interpret the results of the tests so that the individual taking them will become a better driver.

Some interesting data have been obtained; for example, men seemed to decrease in average braking-reaction time until about 23 years of age, after which there is a steady increase. Scores on the steering tests improve up to the age of about 19 after which they decrease gradually.

In the design of this equipment which must be used on the general public, it has been found important to make it resemble parts of the car or other things with which the driver is familiar, although this has no effect on the accuracy of the test. It is thought that full-sized cars can be especially equipped for giving many of these tests and thus the acceptance by the public will be further increased.

In reply to a question from the audience it was stated that at the present time such tests were not available to fleet operators in any large scale, although Dr. Lauer had taken his equipment "on tour" during the summer and had examined the drivers for a number of public utility companies. Sometime in the future such equipment may be available to nearly everyone.

Milwaukee City Service Commission Driver Testing Device

J. Stannard Baker, Secretary of the Committee, described the special test equipment developed by Herbert W. Cornell, Chief Examiner and Secretary of the Cities Service Commission of Milwaukee, following designs suggested by Dr. Sadie M. Shellow and constructed in the shops of the City Electrical Department.

This device consists of a combined pursuit meter (steering test) reaction-time test, color-blindness test, and peripheral-vision test, so arranged that any of these may be used as distraction for the others in addition to audible distractions.

The equipment has not yet been standardized on any considerable number of drivers, but this is planned. Ultimately it is hoped that it can be used for the selection of drivers to be employed by the city.

A communication was then read from Glen U. Cleeton, of the Carnegie Institute of Technology who has been developing selection tests for street car operators. The substance of his comments were that tests now in use are helpful in selecting employees who have fewer accidents than is the case with unselected men, but many high-accident men seem to have emotional qualities and personality traits which are the cause of many accidents.

An opinion was stated that existing emotional tests and personality-trait tests do not thoroughly measure the qualities which have been observed in several high-accident men. Experiments with measuring devices related to emotional qualities will be made during the next year when more results may be reported.

Dr. Morris S. Viteles, Professor of Industrial Psychology at the University of Pennsylvania, commented that training was more important than selection in drivers, either for private or commercial operators. He stated that in the Philadelphia Electric Company, all drivers were required to take a one and one-half hour, scored, road test over a selected route under a supervisor who marked his habits and performance according to 15 or 16 headings. A few of the men showed uncertain bad habits, but most of them were correctible with two or three hours of special instruction.

Dr. Viteles pointed out also that the driver-testing equipment established at the National Institute for Industrial Psychology in London, had not been used on a sufficiently large scale to finance the research by the charges made for the tests. Part of the equipment was exhibited at the principal meeting of psychologists in Great Britain and attracted so much attention that it was proposed to put it on exhibition at public gatherings and charge admission to defray the costs of further research.

Driver Fatigue

Dr. Andrew H. Ryan, Consultant in Industrial Hygiene of Chicago, who conducted a long series of experiments on the fatigue effects of driving for the Dodge Brothers Corporation presented some new and interesting data on this subject.

For several months a group of ten drivers were given certain tests before and after a long day's drive. The tests included postural steadiness, vascular skin reaction, hand-eye coordination, visual acuity, complex reaction and mental addition. The impairment in the driver's ability before and after a day at the wheel was calculated, and a measurable loss of efficiency of performance was noted after a day of automobile driving.

In the course of the experiments, four of the drivers had fairly serious accidents. With remarkable similarity, these drivers showed unusually poor performance on the morning tests on the days on which they experienced accidents, especially in the errors made in the complex reaction test and in hand-eye coordination.

This experience also indicated that road accidents are more apt to happen after the onset of fatigue. This may account for the accident rate increases generally observed in the late hours of the day. The accident experience in connection with these fatigue tests indicated that the most hazardous period for drivers who start out on the road at eight o'clock in the morning is between 4:45 p. m. and 6:15 p. m., after continuous driving of from 250 to 300 miles. The drivers were standardized to approximately 300 miles of which about 40 were city driving.

F. C. Libbey, Superintendent of Transportation of the Memphis Power and Light Company, stated that Dr. Lauer had examined drivers from all departments of his company. Physical defects revealed by the tests were corrected wherever possible by physicians and some of the drivers went personally to doctors for special treatments. The results were favorable, particularly from the educational standpoint.

J. G. Dickinson, Superintendent of Accident Prevention of the Milwaukee Electric Railway and Light Company, stated that special tests for driving ability had been used in Milwaukee for more than a decade and that 610 truck and automobile drivers had been re-tested and re-trained. Mr. Dickinson pointed out that while the tests will not indicate for certain whether a man will have accidents, they are most helpful in showing whether men can be trained successfully. By an examination which takes roughly half a day, practically all the men are weeded out who cannot successfully complete the training course requiring 23 days. It is cheaper to use the selective tests than to attempt to train drivers and then find that they will not be successful.

Dr. H. A. Heise, of Milwaukee, Wis., spoke briefly of the tests for alcohol in blood and urine which can be used to determine the degree of intoxication of drivers who have been involved in accidents or arrested for drunken driving. He referred to the discussion and demonstrations before the Street and Highway Traffic Section, where this whole subject was developed during the Friday morning session, on October 18, 1935.

On Thursday afternoon, October 17, a special session was held, where speakers discussed "Industry and Its Motor Vehicle Accident Problem." The records of this session will be found in this volume, under the special subject title, on pages 103-110.

ADJOURNMENT

Wood Products Section

Officers 1934-35

General Chairman—F. W. Braun, Employers Mutuals, Wausau, Wis.
Vice-Chairman—E. G. Padgett, North Carolina Industrial Commission, Winston-Salem, N. C.
Vice-Chairman—William Haggerty, Edward Hines Western Pine Co., Hines, Harney Co., Ore.
Secretary—M. C. Goodspeed, General Electric Co., Erie, Pa.
News Letter Editor—J. A. Purdy, Michigan Mutual Liability Co., Detroit, Mich.
Engineering Committee Chairman—F. A. Pollock, Lumbermens Mutual Casualty Co., Chicago, Ill.
Membership Committee Chairman—Robert Ormsby, B. F. Huntley Furniture Co., Winston-Salem, N. C.
Poster Committee Chairman—Robert A. Shaw, Murray Body Corp., Detroit, Mich.
Program Committee Chairman—Harry J. Kelley, American Seating Co., Grand Rapids, Mich.
Statistics Committee Chairman—E. K. Prichett, Grand Rapids, Mich.
Publicity Committee Chairman—P. J. Brand, Pullman Standard Car & Mfg. Co., Pullman, Chicago, Ill.
Members at Large—
R. C. Barr, Lumbermens Mutual Casualty Co., San Francisco, Calif.
E. Ross Farra, Grand Rapids Safety Council, Grand Rapids, Mich.
Harry Guilbert, Pullman Company, Pullman, Chicago, Ill.
Roland Jones, The Surty Manufacturing Co., Inc., Chicago, Ill.
W. S. Paine, Aetna Life Insurance Co., Hartford, Conn.
Louis W. Kerberg, Mengel Body Co., Louisville, Ky.

Officers Elected for 1935-36

General Chairman—J. A. Purdy, Michigan Mutual Liability Co., Detroit, Mich.
Vice-Chairmen—
Harry J. Kelley, American Seating Co., Grand Rapids, Mich.
William Haggerty, Edward Hines Western Pine Co., Hines, Harney Co., Ore.
Secretary—M. C. Goodspeed, General Electric Co., Erie, Pa.
News Letter Editor—Nils Juell, Hayes Body Corp., Grand Rapids, Mich.
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Membership Committee Chairman—F. W. Braun, Employers Mutuals, Wausau, Wis.
Poster Committee Chairman—R. L. Woods, Fisher Body Memphis Div., General Motors Corp., Memphis, Tenn.

Program Committee Chairman—P. J. Brand, Pullman Standard Car Manufacturing Corp., Pullman, Chicago, Ill.

Publicity Committee Chairman—Roland Jones, The Surty Mfg. Co., Inc., Chicago, Ill.

Statistics Committee Chairman—Dr. Thomas Dobbins, Servell, Inc., Evansville, Ind.

Members at Large—

R. C. Barr, Lumbermens Mutual Casualty Co., San Francisco, Calif.
E. Ross Farra, Grand Rapids Safety Council, Grand Rapids, Mich.
Harry Gutlebet, Pullman Company, Pullman, Chicago, Ill.
Louis W. Kerberg, Mengel Body Co., Louisville, Ky.
F. A. Pollock, Lumbermens Mutual Casualty Co., Chicago, Ill.

MONDAY AFTERNOON SESSION

October 14, 1935

The first session was called to order by General Chairman F. W. Braun, Employers Mutuals, Wausau, Wisconsin, who spoke briefly on "The Past, the Present and the Future of the Section."

Trend of Accidents in the Wood Products Industry

By E. K. PRICHETT

Representing The Furniture Manufacturers Ass'n. of Grand Rapids, Michigan

Accidents in the entire Wood Products industry show an encouraging decrease in numbers, frequency and severity in 1934. The decrease in severity was decided.

In 1933, 549 accidents were reported; in 1934, 428, a decrease of 22 per cent. Frequency in 1933 was 18.26 and in 1934, 14.69. Severity was 1.56 in 1933 and 0.91 in 1934.

Every one of the four divisions into which the industry is divided shows a reduction in the number of lost time accidents, as follows:

Year	Furn.	Sash & Dr.	Box & Pkg.	Miscel.	Total
1933	155	133	138	123	549
1934	120	129	125	54	428
Reduced	35	4	13	69	121
Percentage	23%	3%	.09%	56%	22%

Not a single death was reported from accidents in the entire industry during the year. In 1933 there were ten, five in the furniture division, four in the sash and door division and one in miscellaneous.

Our report shows that this record was made on a total of 28,553,000 man hours.

These twenty-eight and a half million hours represents over three and one-half million eight-hour working days, which reduced to years gives us 11,900 man years, or 119 man years for each plant reporting. With such long contact with high speed machinery and the great number of men employed (14,305) of all different temperaments and mentalities, is there any wonder that we have some accidents?

The following paragraph from our report of accident rates for 1933 is a challenge for action:

> "Standings of the woodworking industry in comparison with other major groups show that much progress is necessary before the woodworking companies as a whole can attain a leading position in industrial safety. Records of individual units, however, show that much lower rates are attainable."

A fair number of plants, both large and small, are making excellent records, some going for two or more years without a lost time accident; but the standing of the industry is lowered by others who do not give sufficient attention to safety.

Accident prevention is a profitable investment. Shops where safety is the rule attract the best men, and they work without interruption.

An accident disturbs the whole shop, reduces output, causes inferior work.

It is almost universally true that where there are the fewest accidents, the morale and physical conditions of the plant are the best.

It is regrettable that the logging and lumbering division was not able to make a better showing for the year. Forty-four lumbering companies reported an average employment of 19,595 men who worked 19,825,000 man hours. The average frequency was 83.83 in comparison with 15.29 for all industries, and severity of 4.80 as compared with 1.70. The industry ranks 30 in frequency and 29 in severity in a list of thirty major industries.

Saw mills and planing mills make the best showing, with a frequency of 40.06 and severity of 3.45. Timber treating plants are next with a frequency of 68.70 and severity of 3.99. Logging operations had a frequency of 153.10 and severity 7.17.

That accidents in Grand Rapids have been reduced in the last three years is shown by the following: In 1932, with an average employment of 3,534 men, 509 accidents were reported to the Department of Labor and Industry—14.4 per cent of the men employed. 1933 showed 432 accidents reported on 3,400 employees—12.7 per cent, and in 1934, 494 accidents on an average employment of 3,794—13 per cent. The increase in 1934 is negligible. These were mostly minor accidents, as will be noted from the fact that there were only 59 compensable accidents in 1932, 49 in 1933 and 52 in 1934. Forty-four of the latter were temporary, and eight permanent partial disability.

For the first eight months of 1935, conditions improved further. On an average employment of 3,514 for the period 363 accidents were reported, or 10.3 per cent. It will be noted that the average employment increased 16 per cent, and accidents reported were 10 per cent.

Our general average of accidents is still too high.

We of Grand Rapids are proud of the safety record of the Grand Rapids Chair Co., manufacturers of high grade dining room and bed room furniture. They have gone more than two years without a lost time accident, leading all other companies in their class and making a national record.

The company joined the local inter-plant safety contest for the past two years, and has won awards for the first and third quarters of 1934, and the inter-plant placque for the greatest average improvement for the years 1931, 1932, and 1933.

Another Grand Rapids company known all over the world for the quality of its product, has made an enviable record of safety. The most enthusiastic supporter of safety work is its president, Mr. M. R. Bissell, Jr.

The Bissell Carpet Sweeper Company has, ever since we have had a safety council in Grand Rapids, been represented in its activities. F. W. Pullen, superintendent, is the head of the Safety department.

New Hazards Presented by Modern High Speed Wood Working Machinery

By H. E. SERLEY

Insurance Dept. Mgr., The Brunswick-Balke, Collender Co., Chicago

Our main plant at Muskegon, Mich., employs 800 men working approximately 1,500,000 man-hours per year. Slightly more than 50 per cent are in woodworking departments.

Our high speed machinery includes: 8 shapers turning 7200 R.P.M.; 1 router turning 20,000 R.P.M.; 1 50 inch and 1 36 inch planers; 1 daniels planer; 5 jointers —1 veneer; 1 matcher (flooring); disk sanders; 12 band saws, all sizes; 1 all-electric molder; 6 madison lathes.

There are also power saws, spoke lathes and many other slower machines. Not all of the saws, jointers and lathes are in what we call the "woodworking department."

Careful planning of these machines has provided for enclosing all parts, leaving an opening in front for the insertion of the work and its removal when the operation is through. Occasionally blocks slip or tear loose, but as the spin of the knives is away from the opening the only damage is a split block, a lot of noise and a moment lost to stop the machine and clear out the fragments. At no time does the operator's hand come within eight inches of the knives. Once the piece is set in place the machine brings the block up to the knives turning it around for the cut and then back to position for removal.

Unusual attention is given to keeping knives sharp and tightly set at all times.

For the past five years our record in the woodworking departments has been dented but twice—once in 1931 when a cold room temperature caused a man to slip his hand into a mitre saw, losing 30 days. The second blow was in 1933 when a flyback on a rip-saw caused a loss of two weeks' time. We now use a self-feed attachment.

During the same period we had 46 lost-time accidents in other departments: 10 in 1931 with 297 days charged, 10 in 1932 with 409 days; 16 in 1933 with 332 days; 8 in 1934 with 621 days; and 2 this year to date with 52 days charged. Only 31 of these were serious enough to involve compensation.

I admit the record for the entire plant is not to be boasted about, but we are patting ourselves on the back for the strides we have made beginning in the spring of 1934—a stretch of 227 days and again right after the first of the year, 214 days both falling just short of a million hours of work with no accidents. We will catch that prize yet.

The record mentioned in our wood machine departments is due to a foreman, Mr. Beatty, and a hard working safety committee which has the backing of the plant management and maintenance department. Mr. Beatty also is a permanent member of the safety committee along with all department heads.

During the last Congress at Chicago, our factory superintendent happened to be here for several days and was persuaded to attend several of the morning sessions. It is significant that safety meetings began to mean more, recommendations no longer lay in the doldrums and the new current ran on through to the workers. Our accident reports reflect this change.

First, in answer to my question on the accidents likely to occur in using high speed machines, Mr. Beatty picked his shapers as the safest. My recollections of what used to be said of a shaper are nearly unprintable, but it does seem there are some hazards—not entirely overcome by the safety that is being built into the machines by the manufacturers today.

Our shapers, except in one department, are run with guards. The work we do allows the use of the chute type of guard. Not all plants can use this type of guard or can any standard rule or guard be recommended but a good safety man can select some guard from the many used on shapers so as to avoid the dangerous practice of operating without it. Improved collars of the grooved type are used in some cases, but on all jobs sufficient time is given to have machine properly set up.

The one rule in force is dismissal of any man caught trying to run a shaper without a guard.

The operation without a guard is one in which the opening in toilet seats is cut out and shaped. Here a heavy hard wood hand chuck is used and no accidents have yet resulted.

Exhaust systems with adjustable hoods remove most of the cuttings and no man is permitted to use his hands for brushing off the table; a strip of wood or some other material is used.

On our jointers a slatted type of sliding guard is used. It is held in place by a spring so as to cover the knives beyond the width of the stock. I don't believe these are the best guards available for they can be pulled back and caught on the edge of the machine table. We depend on the workman and supervision to avoid the practice.

Fixed adjustable guides are a great aid and should be used.

For the machine itself, steel lips on the opening and round heads are guarantees against *trouble* and accidents.

Our planners are all automatic and protected by bars to keep hands from rolls, adequate exhaust system of a large enough capacity to remove fairly large chips. Sectional feed-rolls are used.

In all of the operations on these and other machines—the stock is watched for imperfections liable to cause trouble and also the workmen are careful in not trying to push a machine beyond an ordinary or normal cut.

We do not operate any moulders. The machine should be protected by exhaust systems; roundheads used for getting away from chips clogging. Sectional feed-rolls are best, if not used, kickbacks are preventable with sectional finger devices. The rolls should also be guarded by bars or strips fastened to the frame.

Drum sanders used in our plant are of the automatic feed type, guarded and fully exhausted.

Disc sanders are also guarded and equipped with exhaust system.

On the belt sanders—the exhaust system hood acts as a guard in part by covering the belt and pulleys. Sliding grips are used in most cases to force the belt down on the material. In others, a block of wood shaped for easy holding is used.

Guarding of lathes is rather limited. Driving belts or gears can and should be covered. If care is taken to have face plates kept in good condition and the machine guarded as above, the prevention of accidents and safe operation lies in the hands of the operator. Careful centering of stock goes a long way towards this end.

We recommend goggles for a number of the jobs on lathes, and our men use them.

I have heard saws classed as the most easily used machine without a guard, but so used, they are *not without* hazards. There is no valid excuse for a workman using an unguarded saw for a dangerous job just because the work or quantity of stock run takes only a few minutes. An accident takes less than that.

I suggest that anyone desiring details on use, guarding and care of power operated saws make generous use of "Safety Practice Pamphlet No. 20" of the National Safety Council, entitled "Woodworking Machinery & Equipment." Of the 16 pages, more than half cover this one item.

A few good general rules for safe operation of saws are given here; perhaps you would find them valuable as a poster for your saw departments.

1. All inexperienced men must be instructed before allowed to operate saws.
2. A dull saw is dangerous. Report yours if not in good condition.
3. It is not safe to use a rip saw for cross-cutting.
4. Beware of cracked saws.
5. Keep the floor around your saw clean of waste material. Floors often become slippery from the sawdust.

A strip of gravel or slate faced roofing material will give an excellent and inexpensive remedy and your workmen will find it a great improvement and yet not hard to keep clean.

6. Don't attempt to adjust your machine or guards until power has been shut off and machine has come to a complete stop.
7. Don't remove guards without the permission of your foreman.
8. Use push stick whenever possible on small stock. We insist on it whether guards can or cannot be used.
9. Gears, revolving shafts and belts are magnets for loose clothing.
10. Provide saws with plenty of set—as well as being sharp—and the machine with proper spreaders. These go a long way in safe operating and accident preventing.

The providing of a well planned exhaust system for saws and, in fact, any of your high speed machinery is a good safety measure.

We have saws of all types—band, rip, cut-off and swing. They are guarded and used safely. The record speaks for itself. On the swing saw we not only use a counterweight to offset the rebound but have a permanently attached limit chain to prevent pulling the saw out too far.

One of the most notable mistakes in the use of the swing saw is the holding

of the stock with the right hand and using the left hand on the handle to pull the saw forward. This brings the saw blade right out towards the abdomen. Hold the material with the left hand and pull the saw out with the right. The saw is always beyond the operator should anything go wrong.

One of the most important—to some, *the* important part of using high speed machinery—is maintenance. We divide this into three parts.

1. We require that the workman know his machine thoroughly. It prevents accidents from operating it when repairs or adjustments are needed, and also from forcing the work beyond the safe capacity of the machine—it's use when the cutting tools are getting dull.

2. We maintain an adequate department for making cutting tools—sharpening knives, caring for saws and setting up these machines properly.

3. A good maintenance department is nearly 100 per cent insurance that your machine is always in repair—guards kept up and new ones provided as needed—in short, proper policing of the departments.

Much could be said on housekeeping, good lighting, proper electrical devices for each machine, the locating of machines with regards to aisles, posts and other machines, safe clothing, etc., but if the plant is guarding the high speed machines, maintaining them safely and seeing that they are used correctly, these become minor considerations. One condition taken care of practically assures that the other is not neglected.

We attribute a big part of our success to good housekeeping, maintenance by a live maintenance foreman and crew, and the proper hiring of men in the employment department. Our safety man at the plant performs this work, thus becoming familiar with each new man and his progress.

The reason for the strides being made today, to Mr. Beatty's way of thinking, is the second sense of safety that is gradually being molded into the new generations coming to work and its unavoidable absorption by the old timers who now take a pride, not only in the quality of the product they turn out, but that they can do it just as safely perhaps, to their mind, a little more so than the new clan we are developing with our safety efforts.

Our first-aid room suffers no lack of patrons, for we have all been trained to spend a few minutes there rather than throw away days later on.

If we have built safety into our operations through guards and other measures; if our men have realized the only way they can work for us is the safe way, hazards disappear, and the following statement of Mr. Beatty seems apropos "New hazards? I don't believe there are any; it's just the darn fool things we do."

WEDNESDAY MORNING SESSION

October 16, 1935

The Common Causes of Injuries and What We Are Doing to Eliminate Them

By LOUIS W. KERBERG

Personnel Director, Mengal Body Company, Louisville, Ky.

The most common accidents in our plant, certainly the most severe, are caused by machine operations. I believe this is true in most wood-working plants. We do not have the automatic machinery with built-in safeguards found in some of the other industries, and the speed and nature of the operations add to the hazards. Possibly part of this condition can be blamed upon ourselves for not insisting upon more research and development of automatic wood-working machinery.

But all accidents are not caused by machines or because they are not properly

guarded. So long as we still have men who will light a match to see if there is any gasoline in the tank, we will have accidents. And this brings us to the elimination of accidents caused by our most common factor, the human factor.

If you are to be a good safety director, a good safety manager, superintendent or foreman, I believe it is first necessary to have or develop the qualifications of an advertising man. That may sound a little peculiar to you, but if you possess these qualifications you are equipped to deal with the human side of the problem. To deal with machinery is comparatively easy, but even after we have thoroughly guarded all machines we still have accidents. Because we still have the human element which is by far the hardest to control.

Are you wondering about the part advertising plays in preventing accidents that can not be prevented by guards? Some of you may think I mean that if you put up "Safety First" placards your advertising is done. But you can put up all the "Safety First" signs you can purchase, placard your plant from end to end with bulletins, and you will still have accidents. In the first place, I never use the words "safety first." I much prefer to use some slogan such as "Work Safety," "Let Safety Be Your Motto." In our plant we use the slogan, "It Pays to Be Safe."

But don't get the idea I am trying to tell you to adopt a slogan, advertise safety and think the job is done. Let us look into the psychology of advertising. If we adopt some of the methods of well known advertisers, I believe to a certain extent we can obtain the same results in safety work. Do these national advertisers say *"Don't* buy John Jones products—they are no good!" or *"Don't* buy Jim Smith's products—he already has made plenty of money?" NO! How many *don'ts* did you ever see in an advertisement? None. I believe we use too many *"don'ts"* in safety work. What does the national advertiser do? He creates a desire within you for his product! And when we have created within the minds of our workmen the desire to work safely we will have done a real safety job.

If I see a sign "Drink More Milk" it doesn't make much of an impression on me. But if I see an advertisement telling me how good milk is for me, it does make an impression. Like most advertising, safety advertising can be done in many ways. We are doing ours by safety signs, bulletin boards, weekly safety bulletins, group meetings, word of mouth, etc. Our safety signs, bulletin boards and weekly news bulletins are perhaps not different from those you use, only they are not as elaborate as some. We are also using a new plan (new to us)—of holding group meetings with our men. Formerly we had mass meetings of all our employees. But now we first have a group meeting with all of our supervisors, outlining our program and our advertising matter. These foremen or supervisors in turn get their groups together on the same day and discuss the whole safety problem with them. We have found this to be very effective. We also use a clock in each department to register the days, months and years since the last accident. We are giving our men safety slogans printed on paper bands to wear on their hats, and by word of mouth we are trying to make our men safety conscious.

National advertisers do not sell all prospects and neither will you sell safety to all employees. It is my opinion that the ones that can not be sold or interested in safety should be dismissed from the wood-working industry and permitted to seek less hazardous employment.

Another hazard prevalent in wood-working is infection caused by splinters, glue, etc. Here is where an efficient first aid department plays a big part. Immediate first aid treatment frequently decides whether the worker stays on the job with a rapid recovery or goes to the hospital. The first aid department can do many things to promote safety in the plant. Often it has an opportunity to report to the safety department hazards causing minor injuries that sooner or later will cause major injuries if not remedied.

In many cases the first aid department can get an impressive safety message across to the worker that would be hard to get across otherwise. Of course, the nurse in charge must be sold on the whole safety program. And in any safety program the foreman is the key man and unless he is interested the program will fail. This is the reason I believe it is better to conduct the safety program through the foremen.

Discussion of Your Accident Problems

Led by J. A. PURDY

Director of Engineering, Michigan Mutual Liability Co., Detroit, Mich.

The importance of accident prevention, Mr. Purdy said, should be recognized before and not after the accident happens.

Anyone acting as safety director or as safety man in a plant of any size has all of the job he can follow in his own particular field. In too many cases there is a tendency for him to try to take care of other jobs. The safety man should only need to correlate other jobs to his own, and see that others do their part in helping him to keep things safe. Cooperation with other departments, and knowing where to get data and assistance, are chief essentials in the job of safety director.

Mr. Purdy emphasized the fact that there are no "new hazards." When an accident occurs, too frequently everybody, whether directly connected with the work or not, starts running around and talking before trying to ascertain in a businesslike way the causes of the accident. Analysis will probably show that it is simply an old cause or old type of accident case that calls for an old answer.

The discussion emphasized the fact that approximately one-third of the delegates present were new members—that is, new in the Congress meetings—and that very probably many accidents which occur are apparently "new" to them. In short, for such new members there may be "new hazards." This emphasized the importance of continued safety meetings and a reiteration of old safety problems.

There was considerable discussion regarding the possibilities of disease due to work on wood, or in wood processes. Some processes lead to apparent injury and compensation claims. Such possible occupations should be closely watched as they are developed, for they are now becoming an "accident problem."

Ideas, safety programs, and plans for shop safety work are developed and discussed in each Safety Congress. They cannot be taken home and applied directly as a complete safety plan in any particular plant. Each plant must take the general points as outlined and adapt them to the particular conditions under which they will have to be used. Each plant is a case in itself.

A careful analysis should be made of each accident as it occurs—both major and minor accidents. This should cover (1) how many? (2) cause? (3) location, which may probably indicate the correct remedy. We must get back to the old study of causes, effects, and answers to accident problems.

Generally the answer to almost any specific safety problem can readily be secured from other safety people who have already had experience with such a problem. Possible sources include the insurance company safety director, the local or national safety council organization, or perhaps the safety director in an adjoining industrial plant. Much valuable time can frequently be saved by consulting one or more of these sources of information concerning an apparently new safety problem.

In discussing types of guards for particular machines, there appears to be a tendency to try to obtain one "universal guard." If this kind of guard cannot be found, frequently no guard at all is applied. But there may be many individual jobs done on this particular machine that can be "individually guarded." This should be done without waiting for the development of the universal guard.

The question was asked, what can be done to put the problem of proper wood machine guards up to the manufacturers of the machines? Mr. Purdy requested that lists of machines and guards made for them be submitted to him in order that the section, or the engineering committee chairman, might see what can be done on this problem.

"Safety Chips"

The final feature of the program was the showing of a film strip, entitled "Safety Chips," by Mr. Clarence F. Otto, safety engineer, Employers Mutuals, Milwaukee, Wis. Mr. Otto described the hazards shown in detail, and also many new types of machine safeguards.

ADJOURNMENT

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1935

TRANSACTIONS

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TWENTY-FOURTH ANNUAL
SAFETY CONGRESS

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THE TRANSACTIONS of the Twenty-fourth Congress of the National Safety Council are published 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.

CARRYING OUT the policy followed for the past few years, the Council is again publishing the Transactions as a condensed record of the Congress proceedings. The papers of each section or division of the Congress have been edited carefully to eliminate extraneous matter and to abbreviate the less essential portions because of space limitations. In other words 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, together with any illustrations submitted by speakers, are on file in the Council library and are available for additional reference.

THE NATIONAL SAFETY COUNCIL at its Congress seeks to eliminate from discussion matters which are not pertinent to the aims 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 14, 1935

GENERAL TRAFFIC SESSION

Governor Harold G. Hoffman, with his second address of the day, opened the sessions of the Street and Highway Traffic Section at the Seelbach Hotel, telling the delegates that the coordination of state and municipal traffic laws is imperative.

"The motorist's unfamiliarity with the conflicting maze of state regulations causes traffic law violations and accidents," Governor Hoffman said. The only way to remove the difficulty is by inter-state cooperation, he added. He suggested that a group of states in any section of the country might arrive at an agreement to make their traffic laws conform to one definite standard. Such a compact, once initiated, would show such favorable results that nation-wide standardization of traffic laws would inevitably result, he declared.

He also urged that Federal Work Relief funds be used to make present highways safer. As measures in this direction he mentioned grade separations, the separation of traffic lanes through divided roadways, and the construction of pedestrian lanes along rural highways.

Are the Average Car and the Average Highway Safe for the Use of the Average Driver?

By MILLER McCLINTOCK

Director, Bureau for Street Traffic Research, Harvard University, Cambridge, Mass.

Any reasonable view of the 36,000 fatalities from traffic accidents last year and the 800,000 or more personal injuries would seem to warrant an emphatic "No." It is possible, however, to be seriously misled in conclusions based upon averages. For example, we have no adequate knowledge as to whether the great majority of our current fatalities are caused by average normal citizens or by a comparatively small group of persons who are distinctly abnormal with respect to physical, psychological, or social conditions. Furthermore, there is an amazing lack of knowledge

about the mechanical and physical conditions of the vehicles and highways which contributed to the fatality record.

The only basis on which we can proceed safely is to attempt an inventory of the more obvious safety factors in vehicles and highways as they exist today.

One can say with confidence that the American citizen is unable to buy any mechanism which is more accurately and beautifully designed to produce its normal functions than is the current motor vehicle. This includes the lowest-priced production as well as the more expensive. Material failures in essential parts have largely disappeared. Roadability has been improved amazingly, through better knowledge of weight distribution, improved tires, better spring suspension, and shock absorption, more accurate and easier steering, and through an improved functional relationship of all parts of the vehicle.

The driver has been relieved of almost a score of mechanical functions. Perhaps most important of all, brakes have been immeasurably improved. Not only has the power of brakes been increased, but modern design results in assurance of efficient operation over long periods of time with minimum maintenance. So far as the driver or occupant of the vehicle is concerned, he has been given greatly improved protection in case of actual collision through refinements in interior design, through shatter-proof glass, and most important of all through the fact that he is surrounded by a type of body which will resist impacts which would have crushed earlier cars out of recognition.

One would be foolish to assume, however, that even the best cars of today are perfect or that they incorporate all of those safety features which will be illustrated in the car of tomorrow. The automobile industry spends millions of dollars each year in the improvement of design for greater safety.

The key to the safety situation so far as the motor vehicle is concerned lies primarily not in the inherent safety features of the new vehicle, but rather in the degree to which the owner maintains the various component parts in such a condition that they may retain their original efficiency. The safest vehicle imaginable may be rendered unsafe in the first five minutes in the hands of a new owner. A vehicle which has just been officially inspected and approved may be rendered unsafe within a few minutes after it leaves the inspection station.

Speed is, and always has been, dangerous. Any body moving at any velocity outside of a complete vacuum is likely to be involved in disastrous collision. In a sense it may be said that speed is the sole cause of all accidents. An American dictator could instantly eliminate all automobile accidents by the simple expedient of confiscating all spark plugs and prohibiting their further manufacture and distribution. The importance of speed is witnessed by the fact that it is the most mooted phase of almost all accident discussion.

If one were looking at the traffic problem solely from the viewpoint of eliminating the possibility of accident or injury, he might be willing to go the length which was just suggested for the American dictator. Most constructive workers in the safety field recognize, however, that we are dealing with a situation which must be solved in a rational manner and that the ideal end is to attain maximum benefits from the use of the motor vehicle, including its all pervasive quality of speed, under conditions where reasonable safety to highway users is achieved.

The fact that a motor vehicle possesses a capacity for speed does not *per se* make it dangerous. The factor of speed becomes a contributing cause to the severity of an accident when it takes place not in a vacuum but under conditions where conflicts are potential.

This leads to a discussion of compulsory mechanical limitations upon the speed characteristics of vehicles. Reference is particularly made to the growing urgency for compulsory governors limiting the speed of vehicles to a predetermined maximum rate, which in logic would probably not exceed the legal rate prescribed in statute. This end would be attained more simply, certainly, and more economically if, for the governor, there were substituted a statutory provision prohibiting the production, registration, or use of any vehicle with sufficient power to propel faster than prescribed by the legislature. In this manner lighter and presumably more economical cars would be produced and the hazard of unauthorized tampering with governor devices would be permanently eliminated.

Without going further into the argument, it may be concluded that this method

of approaching the speed problem is neither in line with the inevitable history of mechanical development, nor is it one which is likely to solve any substantial portion of our highway accident situation.

The compulsory governor proposal, or its early prototype, the placing of bumps or depressions in pavement surface over which it was hazardous for vehicles to operate at a predetermined rate of speed, cannot hope to affect more than a minor and relatively unimportant part of the accident situation. Only a small proportion of total accidents are the result of speed in excess of any maximum which could conceivably be tolerated under compulsory governors. Limitation to 45 miles per hour would not substantially change the total national accident situation, and such as could be accomplished in this manner would be only at a severe cost in the normal and natural development and use of a motor vehicle. Speed as a function of the motor car must be recognized on its face value and instead of destroying it, we must surround it with those controls which will assure reasonable protection.

The motor vehicle of tomorrow may conceivably be so equipped with safety devices that the possibility of accident is greatly mitigated. We might, for example, suppose that it may be possible for a motor vehicle, by an electrical mechanism, to signal its approach to an intersection so that a vehicle on a cross-route might know of its approach. It is not beyond the range of vision to imagine through radio signals a similar warning being given between all cars at all intersections.

The photo-electric cell has been developed to a point where its sensitivity and selectivity is such that it can perform many intricate acts far better than the senses of man. It is not impossible to contemplate cars so equipped with these electrical antenna that the approach of a vehicle to any person or object with which it might collide, would result in a warning or even in an actual automatic control of the vehicle. Similarly, by electrical mechanism working in coordination between the pavement and the vehicle, it is not at all beyond the imagination that speed might be reduced automatically to a safe rate upon the approach to danger spots. Trains today are automatically stopped when they enter prescribed danger zones. Furthermore, similar electrical apparatus is already in existence whereby with suitable refinement, vehicles could be automatically guided around curves or past obstructions and in their own lane. These suggestions merely indicate something of the possibilities of incorporating within the vehicle itself its own inherent capacity to avoid disaster, thus avoiding the consequence of failure in the human factor.

The Highway of Today

In discussing safe highways, let us recall that we are dealing not with the poorest of highways which may be safe with safe operation, nor yet with the best of highways which can be unsafe with unsafe operation. Rather, let us attempt to conceive the normal typical street or highway that confronts the average driver. This average highway is largely safe or unsafe as it is used in an intelligent manner. To what degree have the builders of highways attempted to compensate for the failure in the human factor?

As we are cruising over a beautifully smooth broad highway with easy curves, it is difficult to remember the degree to which the highway builder has relieved us of making critical decisions. The homogeneity of the surface itself is a tremendous advance over the old horse age road. We can anticipate with certainty that we are not going to be suddenly precipitated into a rut or hole, or suddenly encounter deep sand or loose gravel. As we approach the hidden curve, we are relieved of the necessity of judging the shortness of its radius for if it is other than a normal curve, signs tell us of its character. No longer do we have to fight the drag of a heavy crown or pitch, or face the hazard of its throwing us off the roadway in wet or snowy weather. Should we place a wheel off the improved surface, we know that we are not going to drop into a ditch, but can depend upon a standard surface shoulder, and if the shoulder is not in good condition, we know that we are going to be warned of its character. When we look forward to what the highway of the future may be like, we should not fail to remember with appreciation the labors of those who have given the United States its present fine highway system.

The fact is, however, that these streets and highways are the scene of an annual and appalling series of deaths and injuries. What has been done to date

and what conceivably can be done in the future to construct these routes of travel so that they will make failures of the human factor less disastrous?

It may be said that all accidents result from one of four basic types of conflicts: (1) *medial conflict*, (2) *marginal conflict*, (3) *internal stream conflict*, and (4) *intersectional conflict*. These terms and classifications, being somewhat new, demand explanation.

By medial conflict is meant those contacts between vehicles moving in opposite directions at or near the center of the roadway, or any place in the roadway where the paths of oncoming vehicles overlap to a point where direct contact between the moving vehicles takes place. Medial conflicts result in the so-called head-on or partial head-on collision, normally the most disastrous type of collision because the impact combines the speed of both moving vehicles. It is also the primary cause of the side-swiped type of collision.

The permanent physical protection against all types of medial conflict is indicated by the divided roadway of such character as to preclude physical contact between vehicles moving in opposite directions. This is most completely accomplished where the two directional roadways are widely separated as by a parkway strip, though it may be accomplished by any physical structure precluding the overlapping of the opposed vehicle streams. Any division that is used must be of such a character as to preclude disastrous results from any vehicle which may impinge upon it. Even in the poorest design, however, contact between a vehicle and a dividing structure is of relatively low hazard due to the slight angularity of the impact.

Marginal conflict is that type which takes place between moving vehicles and other vehicles, persons, or objects or spaces alongside the outer edge of the roadway. The collision with the parked vehicle is one of the most common illustrations, though at the other end of the range, one finds the disaster simply caused by a vehicle driving off the edge of the roadway into the soft ground or other impediment near the roadway. The simplest cure for this type of conflict is the elimination of the need for the transaction of stationary business in the operating lanes of the roadway. This end is commonly achieved by the provision of central operating lanes physically separated from marginal service roadways. Where right of way is available, this eliminates any excuse for parking or for the stopping or standing of vehicles for any purpose. In its ultimate development, this principle is illustrated by an operating roadway within which vehicles are confined by marginal guards, making the escape of the vehicle from the roadway normally impossible.

Internal stream conflicts are those frictions which take place between traffic units moving in the same direction in the same traffic area. They result primarily in rear-end collisions, and in certain types of side-swiping accidents. If all traffic in a roadway could be forced to move at identical speeds, no conflicts of this character would take place. Slight differentials in speed cause relatively little serious difficulties. If, however, the overtaking vehicle is traveling at 61 miles per hour and the overtaken vehicle at 20 miles per hour, the impact has the power of 41 miles per hour velocity; or is approximately equivalent to the same impact which would take place if the overtaking vehicle were traveling at 41 miles per hour and struck a stationary parked vehicle.

Internal stream friction necessitates constant overtaking of slower vehicles. On two-lane roadways this results in potential medial friction with oncoming traffic for each overtaking operation. A four-lane roadway is the minimum width that permits the necessary segregation of comparatively fast and comparatively slow vehicles moving in each direction, and theoretically ought to be considered a minimum standard for any trunk highway. Mere width of highway, however, is not the only requisite for the reduction of internal stream friction. Much of it results from speed differentials caused by slow moving vehicles decelerating to leave the operating lane or slowly accelerating upon entering the lanes. This situation indicates the need for regular use of decelerating and accelerating lanes at exit and entry points. The remedies indicated are very useful from the physical standpoint, but where possible, could be augmented by regulation bringing about a segregation of commercial traffic which is relatively slow and passenger car traffic which is relatively fast.

Intersectional conflict results from an attempt to move one stream of traffic

directly across the path of another stream and on the same plane. Where this conflict is present, it is complete and absolute. It is the cause of a great majority of fatal accidents, both to pedestrians crossing traffic streams at intersections or elsewhere and the very large volume of intersection collisions between vehicles. Intersectional control by traffic officers or by traffic signals attempts to reduce this conflict by alternating the conflicting movements. In most cities, for the great majority of intersections, it is the type of relief upon which we must depend, probably permanently. With respect to major highways and also with respect to major trunk routes within urban areas, this solution can never be considered adequate or efficient. The cost is substantial and at best it gains its end only by a tremendous reduction in full roadway capacity and in the efficiency of vehicles using the route. In the typical city major points of intersectional conflict as between vehicular units exists on an average of every hundred yards along each route. Intersectional conflicts between pedestrian traffic and vehicular traffic are imminent and always potential along every foot of every route.

The highway engineer has proved his capacity to gain a physical relief and even a complete physical solution of the intersectional conflict problem. One physical remedy is found in rotary traffic circles. Please observe exactly what happens in a properly designed rotary. It merely converts the more serious type of intersectional conflict into the less serious type of internal stream conflict, and hence offers a partial solution for the difficulty.

It is interesting to note, also, that the primary functional advantage of a by-pass route around urban congestion lies in the reduction of the number of intersectional conflict points. The semi-rural by-pass route has few intersections upon it, whereas the through-urban route has many intersections.

The full solution for intersectional conflicts is to be found, however, in engineering structures which physically and permanently eliminate intersecting flow. This structure is typified by thousands of grade separations throughout the United States, where special emphasis has been placed upon the reduction of intersectional conflicts as between rail and automotive units. There are, however, many striking illustrations of grade separations of highway routes, and there should be a growing recognition that wherever the volume of traffic is sufficient to warrant economically such construction, it ought to be prosecuted with vigor.

The urban problem is much more complicated because of the number of intersectional conflict points. There are some instances where a single grade separation within a compact urban traffic area may be of advantage. Such instances are, however, rare, for the gain at the point where the structure is placed is usually lost by the inability of the adjacent intersections to feed safely to the separation or to drain from it anything like the full capacity of the separation.

This condition has led inevitably to the provision of major routes with continuous grade separation. There are numerous striking examples of this type of construction. Some of the best are found in portions of the Outer Drive in Chicago, in the Skyway across the Newark Meadows, and the extended southerly route to the Newark Airport. In this latter case the construction eliminated intersectional conflicts between vehicular traffic, rail units, and shipping. Another project of major importance is the West Side Elevated Highway in New York City. This route carries upwards of 30,000 vehicles per day at speeds substantially in excess of 30 miles per hour through a densely congested area, and in approximately three years records available show only three traffic fatalities.

The considerations set forth with respect to the types of conflicts and their remedy led the Chicago City Council to project a system of "limited ways" for the Chicago area. A limited way was defined as, "A route for automobile traffic providing for not less than two lanes in each direction, a complete physical segregation of opposed streams, accelerating and decelerating lanes at all exits and entries, a separation of all intersections, and with no provision for direct access to abutting property."

The safety effect of a structure of this design is clearly indicated through an analysis of 900 fatal accidents in a specific period in the city of Chicago. If all traffic in Chicago had been operated on limited ways, as defined, only 17 of these 900 fatalities would have been physically possible. The cost of construction of urban routes is always great, but by refinements in design, the Chicago group has

reduced the cost of four-lane limited way construction to $435,000 per mile, which does not exceed the average cost of four simple grade separations, and is only a small fraction of the Chicago cost of obtaining equal capacity through street widening.

Conclusion

What the limited way purports to accomplish is to so surround the highway itself with physical guards, that failures in vehicles or failures in the human factor will not be translated into disaster, or at least that the seriousness of the disaster will be mitigated. Its function is comparable to machine protection in industrial plants.

It is gratifying to note that the limited way principle has received widespread recognition and that many projects incorporating these principles are now in contemplation in various parts of the United States.

Returning to our original theme, we may summarize the conclusions. We have vehicles and highways which can be used safely by safe drivers, but opportunities are presented both in vehicle design and highway construction to give added protection against failure in the human factor.

TUESDAY MORNING SESSION

October 15, 1935

JOINT SESSION WITH INSTITUTE OF TRAFFIC ENGINEERS

The session was called to order by Lewis W. McIntyre, consulting engineer, Chamber of Commerce Building, Pittsburgh, Penn., who presided.

Methods for Studying the Danger Zones on Rural Highways

By CLARENCE P. TAYLOR

Traffic Engineer, Commonwealth of Massachusetts, Boston, Mass.

Traffic conditions on rural highways are different from those on urban streets. There are few pedestrians, long stretches of road, sometimes straight and sometimes curving and hilly, and in general there is an absence of street lights and of frequent cross roads. Higher average speeds prevail, making the problem of keeping on the road, overtaking and passing, and stopping such as require skill and good judgment. These differences, and numerous others, result in accident situations different from those found on urban streets. Hence, the methods used to study rural highway accidents vary from the conventional methods employed for studying urban accidents.

Spot maps, as a means for studying rural accident problems, are almost entirely out of the question. A map of the customary dimensions of one inch to the mile, for the state of Massachusetts, would demand a prohibitive amount of wall space. Moreover, if pins are used to indicate accidents, one pin would cover an area of more than 200,000 square feet. There is also the matter of the true representation of curves and intersections. And finally comes the problem of photographic reduction. However, such a map can be photographed in sections with satisfactory results, and this plan we have followed in Massachusetts.

Three different colors were used to distinguish between cases where pedestrians were struck while walking along and in the roadway, while crossing the roadway, and while on the sidewalk or shoulder. But because of photographic difficulties with the colors, all pins were changed to white. Total accidents, of course, number from six to seven times that to pedestrians only.

Close study of such a pedestrian spot map, as distinguished from a spot map

showing all accidents, should reveal some important facts upon which sound action may be taken. Our study showed that pedestrian accidents occurred almost exclusively through settled territory where pedestrians used the highways with some frequency. It is interesting to note that the four million dollar sidewalk construction project for Massachusetts' state highways is laid out on the principal of need—that is, sidewalks will be built where there is the most pedestrian travel along the highways and where accidents to pedestrians have been most frequent. Pedestrian accidents, it may be observed, occur in zones rather than at points. These zones are determined by the amount of use made of the highway by pedestrians

Since spot maps fail to show exactly where accidents occur, how they occur, and the physical conditions at the location, a method can be devised to show these facts after the fashion of a collision diagram. From the field notes obtained in our survey finals, the highway was drawn to a scale of 300 feet to the inch and such pertinent features are shown as: width and type of highway, width and type of shoulder, curves and radius, intersecting streets and names, driveways, sidewalks and paths, survey stations every 1000 feet, north point, town lines, landmarks such as buildings, schools, churches, etc., guard rail fences, ledges, bridges, lakes, street lights, concrete or stone walls and curbs, obstructions to view, layout widths, traffic count stations numbers, traffic lights, flashing lights and beacons, state highway ends, route markers and geodetic stations.

On tracing paper superimposed above the highway layout drawing, appears the collision diagrams of each accident, with the date, number of persons killed and injured, light conditions, weather conditions and other notes about the collision as given by the accident report but not possible of indication diagramatically. The result is a birdseye view of the highway together with the accidents which have occurred upon it. This permits an immediate correlation of accidents and physical conditions without going out into the field. Done for a whole state highway system, this method of spotting and studying accidents is far more useful and conclusive than a spot map

Of course, the collision diagram in its usual form for certain points, as at intersections, sharp curves and the like, is an important method for studying rural highway accident problems. More often, however, accident conditions develop by highway lengths or zones within a length of highway rather than at isolated spots, and special diagrams of such zones may be prepared on a smaller scale and profitably used.

It is extremely difficult to work up any kind of figures of accident zones on rural highways because of the variation in the requests for such information. However, two rather basic facts have become apparent upon which one can build a valuable set of statistics. First, most requests are for information on the number of accidents, persons killed and persons injured on a particular length of highway—that is, a highway joining two major population centers Next, the questions generally asked are—how many of the accidents involved overtaking and passing maneuvers, how many involved pedestrians, how many cars left the highway, how many accidents occurred after dark?

It is possible to work up a comprehensive group of statistics covering such an accident zone, which will give the answers to these questions and numerous others, and in Massachusetts we have prepared such a "section summary." In Massachusetts, also, since the boundaries of each city and town abut on one another, the accident figures for any section of highway can be broken down into the figures for each town, as we have done repeatedly on our "accident tally sheets." In this way the zones with most frequent accidents can be isolated quickly and the type of trouble ascertained.

By plotting the accident totals by years of the different classes of mishaps for each section of highway, some enlightening trends for different roads and some interesting individual accident characteristics are revealed in a series of specially prepared diagrams showing for example, "trend of totals" and "trend of types."

With accident information divided by lengths or sections of highways, it is simple to make studies and analyses of the effect of different types of highway construction on accidents. Such "accident rate characteristics" may be made for a group of two-lane, three-lane, four-lane divided and four-lane undivided highways. Of course, with the accidents occurring on state highways segregated, accident trends for a state highway system can also be plotted.

(D. Grant Mickel, consulting engineer, Ann Arbor, Mich, who presented the paper in Mr. Taylor's absence, showed interesting diagrams of the various types of exhibits mentioned in the talk, but due to limitations of space on these pages, any attempt to reproduce illustrations would be illegible.)

To compare the accident situation at one intersection with that at another, it is desirable to take into account the factor of exposure, or amount and character of the traffic. An accident index is coming into use in which an intersection is rated on the number of accidents per million vehicles using the crossing. The number of accidents in one year is known and the total vehicular traffic in one year is estimated from traffic counts. This index does not take into account such additional traffic factors as speed, the proportion of turns or the number of street cars, buses, trucks or pedestrians, yet it is a step in the right direction. Much the same kind of index is needed when the accident situations on lengths of highways are to be compared.

To obtain such figures for any particular highway, the total number of accidents, persons injured, and persons killed for a year must be known. Traffic counts at intervals along the highway must be available from which an average figure of a year's traffic between each station may be estimated. The average annual value of traffic between two stations is multiplied by the distance in miles between them, giving the number of vehicle miles traveled The vehicle miles between stations over the entire length of highway are totalled. The total number of accidents divided by the total number of millions of vehicle miles of travel on the highway is the accident index for that highway—accidents per million vehicle miles. A similar index for injuries and fatalities is obtained in a like manner.

Methods of studying accident problems and the studies themselves are a means to an end and not the end itself. If a study is well done it should provide a clear picture of the problem confronting us and, if possible, a clue or an idea of what can be done about it. Thus it may be worth many times the effort spent in preparing and presenting it; if not, it is almost a total loss.

Regulating Speeds on City Streets and State Highways in Municipalities

By RALPH W. EATON

City Traffic Engineer, Providence, R. I.

The speaker said in part: In Rhode Island, because we believe that speed "too high for the conditions" is a major cause of motor-vehicle accidents, we direct certain phases of our accident-prevention program toward the control of improper speeds. In 1932, recognizing the desirability of obtaining as much factual data as possible, we decided to have observers make monthly measurements of speeds of vehicles at points about the city.

A problem soon arose as to procedure in those cases where the observer measured the speed of a vehicle travelling past his post at an excessive rate The observer being a civilian, it seemed obvious that if he did anything, his action should be limited to making a note of the conditions, the time, and the registration number of the vehicle. Orders were given that he do this, whenever he could be certain of the registration number and include the information on the report to the Police Department.

Notice was then given the owner, requesting him to have the person operating that vehicle at the time and place reported come to traffic headquarters for an interview. A careful explanation was then made of what the driver is reported to have done, and of the danger of such operation.

Discussion of this kind leads to an explanation of the accident situation and of the efforts being made to control and improve it. It is made clear that no charge is being made against the driver, but that the purpose is to cause him to realize the existing danger and to operate with more care in future. Officers report that these interviews have, in nearly all cases, been well received, and that most operators leave with a new picture of the situation.

It was realized at the beginning that this system of reporting would have a bad reaction if the idea should go out that the observers were either checking up on

the police or acting as "spotters" on the public. Careful explanations were made that neither was the case. It was explained that the reports were purely incidental to the presence of the observers whose work was directed to another and different purpose—that of determining traffic hazard.

The success of such a system is greatly dependent on its handling by the police officer who conducts the interview. An officer who is interested in traffic safety can and does accomplish a great deal of good.

The two important factors in the control of speed are officer supervision of vehicle operation and accumulation of the necessary data so that such supervision may be properly directed. If the motoring public can be given the impression that its operations are under such supervision, it will drive more safely.

The problem of control of speed when state highways enter and traverse municipalities can be simply stated. There is the state road— wide, well-engineered, constructed for modern, high speed traffic—dumping its traffic into streets which are in many cases of inadequate width, poor geographical layout, solidly built up, and having severe intersection and pedestrian problems. These conditions demand a reduction in speed and increased alertness on the part of the operators.

Unfortunately, operators often fail to respond. Among the reasons for this are:

(1) A lack of appreciation of the degree of speed reduction required by the conditions.

(2) A tendency, after leaving the State highway and entering the town, for the operator to operate at speeds higher than he realizes, and so higher than was his intention.

(3) Impatience with the various conditions which are combining to delay the operator on his journey.

Suggested Remedial Treatment is this:

The motorist approaching the town or city should be confronted with ample signs to indicate the change in conditions. These may serve two purposes—to draw his attention to the conditions; and to carry to his mind to the idea that an intelligent effort is being made to handle the situation.

In Rhode Island, where highways which have been zoned and signed for speed approach cities and towns, in a number of cases the speeds indicated on the signs have been progressively reduced as the highway approaches the town, so that for instance, the motorist on a state highway zoned for 40 m.p.h. will, on his approach to the city, pass signs indicating successively 35, 30, and 25 m.p.h. Also, in a number of cases, large illuminated signs have been installed over the inbound lanes to indicate clearly that traffic is entering a "built up section."

The greatest and most effective instrument for keeping speeds under control in the cases under consideration is the motor-patrol.

Report of Committee on Rural Highway Hazards

By W. SHERMAN SMITH

Assistant Professor of Civil Engineering, University of Toledo, O.

Reflecterization of Highway Signs

Conclusions

1. Highway signs be illuminated as rapidly as funds will permit.
2. Reflector buttons rather than reflector elements or reflecting metal must be used for the purpose.
3. The symbol as well as the outline be reflectorized.
4. Eventually all signs be reflectorized, starting with those denoting the most hazardous and dangerous locations.
5. The motorist be educated as to the meaning of a sign outline.
6. Vandalism must be stopped.
7. Reflector buttons be also used at such dangerous places as: end of bridges, viaducts, culverts, etc.

Recommendations

Data yet to be obtained.

Relative merits of reflecting metal versus glass reflector buttons.

Construction of Sidewalks in Suburban Areas

Conclusions

1. It has been proven that sidewalks along the rural highways have reduced pedestrian accidents.
2. Attention should be at least focused on the hazardous points and separate pedestrian facilities provided at them.
3. The sidewalks should be of a type equal to or better than the roadway which they parallel.
4. Accident records should be more specific and complete, giving the exact location of the vehicle-pedestrian accident and information as to the pedestrian movements.

EXAMPLE: June 21; 3:00 A. M.; U. S. 12, near Chelsea; Sylvan Township; injured, two.

"Dale Yoakum hit two men walking on road. He claimed he went to sleep and was asleep when the accident happened."

On what side of the road were the men?

5. The sidewalks should be maintained in the same manner as are the roads.

Regulation of Speeds in Suburban Areas

Conclusions

1. The lives of our citizens and especially of children residing in the suburban areas of cities, should not be endangered because of the lack of a proper and safe speed on the highway running through such areas.
2. Such speed should be obtained after a careful study of all factors, so as to be reasonable and enforceable.
3. Signs denoting the permissible speed should be erected at the proper places so as to inform the motorist.
4. Someone in authority such as the State Highway Commissioner be designated as the person to conduct the study.
5. The motorist should be educated as to the reason for the sign, and the speed denoted should be enforced.
6. The speed denoted through the "vacant districts" of a village or city should be such as to command the respect of the motorist.
7. Automatic signals should not be used for the sole purpose of regulating the speed of traffic in small villages.
8. The location of the heavily traveled highways in the future should be such as to avoid both the residence areas of cities and the small villages.

The Illumination of Highways

Conclusions

1. Highway illuminations will greatly improve the visibility for night driving and will also reduce the hazard caused by glaring headlights.
2. In order to be of benefit, the lamps must be correctly spaced and mounted, depending upon the type used.
3. Without illumination the chance for an accident is about 3.2 times greater at night than during the day.
4. Examples are to be found in the United States where statistics prove the value of illumination.
5. Considering $500 as the economic loss for each accident, a saving has resulted from the fact of highway illumination.

Recommendations

It was recommended that the traffic bureaus of the highway departments become more interested in securing information as to the percentage of traffic moving during the night. Assumptions will then be unnecessary.

It was further recommended that the several highway authorities install test sections in their respective states, in order to obtain first hand information as to the correct spacing and mounting above the highway of the different types of lamps. The effectiveness on different kinds of pavements and their value as to accident reduction can also be learned.

It was further recommended that the most hazardous locations be lighted first: then the most congested highways; and then other highways which prove from records or from spot maps to be in need of some method of assistance.

The Widening of Highways

Conclusions

1. All state accident report blanks should contain provision for Width of Pavement.
2. Where the volume demands it, the minimum width for 2-lane traffic highways shall be 20 feet; 3-lane, 32 feet; and 4-lane, 42 feet.
3. The minimum width for shoulders shall be 8 feet. They shall have a stable surface.
4. All bridges and culverts shall be wider than the roadway.
5. 4-lane divided highways shall be constructed in preference to the ordinary 4-lane highway.
6. The width of right-of-way shall be not less than 100 feet. Rolling and hilly country may demand more.
7. The shoulders shall be devoid of obstructions such as: trees, poles, weeds, etc.
8. Deep ditches are a hazard. They should be filled up to a safe elevation.

Recommendations

1. It is recommended by the committee that further investigation be made so as to determine something conclusive as to the relationship between pavement widths and highway accidents.
2. From the standpoint of safety it would appear to be advisable to construct 4-lane roadways where 2-lanes are inadequate. More study should be made of 3-lane roadways as to safety and chance for accidents thereon.

Elimination of Unwarranted Traffic Signals and Signs

Conclusions

1. The use of unwarranted or poorly-timed traffic signals and of too many unwarranted traffic signs tends to create disrespect for such control and to increase violations of their indications.
2. Vehicle accidents result from such violations.
3. Every state should have a law vesting someone with authority, such as the Director of Highways, to regulate the installation and operation of traffic signals on the entire highway system of the state.
4. Before a signal is installed, a careful study should be made to obtain information relative to the need for signalization and to stress the need for uniform and standard signal equipment and operation.
5. No signs, the wording of which proves to be ambigous or of doubtful interpretation, should be permitted on the highways.
6. The proper location of warranted signs is very important. It should be carefully considered before any sign is erected.

Billboards and Encroaching Mercantile Advertisements

Conclusions

1. The billboard can be a distinct menace to safety if it is so located that it seriously distracts attention of motorists or obstructs the view on a curve as at an intersection.
2. Instances are common where billboards obstruct the view along curves or at intersections where a clear view is necessary; and also seriously distract the attention at such critical locations as underpasses, grade-crossings, and abrupt hill crests where concentration on driving is extremely necessary.
3. There is only one cure for the hazard—a big dose of public opinion crystallized in legislation.
4. It is now clear cut that the Legislature has the power of regulation of billboards and signs, and that such power is not an impairment of private and individual constitutional rights.

Recommendations

1. That the erection of advertising signs on the right-of-way of rural highways be absolutely forbidden.
2. That the use of luminous advertising signs, even if they be located on private property, be deemed as confusing to traffic at night and therefore be strictly regulated as to dimension, location and set-back.
3. That a united effort be made to secure adequate restraining legislation in all of the states, giving some department therein control over rural advertising signs within certain specified distances beyond the established highway right-of-way.
4. That a continued effort be made by next year's committee to gather all available statistics to further aid in the investigation as to the necessity of regulation of billboards and other commercial advertising.

TUESDAY AFTERNOON SESSION

October 15, 1935

JOINT SESSION WITH INSTITUTE OF TRAFFIC ENGINEERS

The session was called to order by William C. Kneelk, Chairman, Milwaukee Safety Commission, who presided and introduced the speakers as follows:

Protecting Foot Traffic on Rural Highways—Report of Committee on Pedestrian Problems

By E. B. LEFFERTS

Manager, Public Safety Dept., Automobile Club of Southern California, Los Angeles

That a serious pedestrian problem in need of attention does exist along rural highways is evident from a brief review of traffic accident records for the past few years. From 1931 to 1934, inclusive, pedestrians killed while walking along rural highways were recorded as the second greatest cause of motor vehicle pedestrian fatalities. The percentage killed in this way during those years varied from 13.1 per cent to 16.9 per cent, the latter in 1934.

The American Society of Municipal Engineers has spent considerable time and effort on this pedestrian problem, and your committee is indebted to that society for considerable data, some of which is summarized below.

Mr. William Phelps Eno, in his book entitled "Simplification of Highway Traffic," includes the 1933 report of the "Sidewalks Committee" of the American Society of Municipal Engineers, which includes the following:

"Many of our suburban and country highways are being improved for motorists Most of them are now unfitted for all other users It is no longer safe to walk, ride, or bicycle on roadways, especially at night. The entire width of some highways is taken up by the roadway, and on others what is not needed for roadway is left ungraded or so rough that it is useless for pedestrians, equestrians, or cyclists. There should be a sidewalk or reasonably well-made foot-path on one side at least of every highway and two sidewalks or foot-paths on important highways. On country roads where one sidewalk or foot-path is sufficient, the other side should be provided with a path for equestrians and bicyclists. The government should see that road engineers provide for all reasonable requirements of pedestrians before being allowed to proceed with their work. Justice demands that all users of our highways be considered."

The pedestrians' rights to walk along a rural highway where there is no sidewalk are clearly shown in numerous court cases. A further extract from the 1933 report of the Highway Sidewalks Committee of the American Society of Municipal Engineers says:

"The rights of the pedestrian in connection with country highways must be considered as co-relative with and of equal importance to the rights of the vehicular users of the highway. Prior to the advent of motor vehicles, roadways in the country districts provided a reasonably safe and comfortable location for the use of pedestrians and hence no need for separated walkways along the highways. The very term 'highways' has always included a 'way' for both pedestrians and vehicular traffic, but the legal and proper use by pedestrians has been practically, although not legally, taken away by rapidity of motion and congestion of the motor vehicles until the pedestrians' use of the highway is 'as good as his life is worth'."

The status of rural highway sidewalk legislation in 1931 is revealed in that year's report of the American Society of Municipal Engineers Committee which states: "Practically every state in the United States has enacted laws, whether by design or oversight, which do not authorize state expenses for walkways on state roads. Millions of dollars per annum are subscribed by practically every family of the country for the comfort and pleasure of the motorists, including every other accessory, such as grading, curbing, drainage, and bridges, but not one red cent for the safety and comfort of the pedestrian."

Also included in the 1933 report of the Sidewalks Committee of the American Society of Municipal Engineers, above referred to, is a pertinent reference from a speech of the President of the United States at the President's Conference on Home Building and Home Ownership, held in Washington, D. C., December 4, 1931:

"Modern conditions of automobile use of highways, both for the safety of the pedestrian and for the removal of one source of worry to the driver, require the complete elimination of the pedestrian from any paved travelway between urban centers. Especially is this true after sunset when headlights, frequently dimmed on account of approaching cars, fail to show the form of the pedestrian. The creation of footways on existing roads with their many miles and few homes cannot be left to the individuals dwelling on the road, but must come about through state, county, or township authority and be paid for by the taxes for the community. On new highways the cost should be included as an integral part of the highway, along with the grading, paving, draining, and planting."

From an address by Mr. Crandell Melvin, at the Annual Meeting of the New York State Bar Association, in January, 1934, the following sentences are quoted:

"Who is there among us who would not institute proceedings for insanity commitment of a mother who directs her children to reach the school house by walking on the rights of way of the main lines of our larger railroads? Yet you and I, and every other member of the legal profession, not only permit but sit idly by and fail to insist that any other place be provided for mothers, fathers, and children to walk except upon the paved portion of rural highways, upon which the usual speed of automobiles is far in excess of our crack trains on their own right of way, and where automobiles travel both ways, with frequency measured in seconds rather than hours."

Mr. Melvin's address incorporated the following statistics for the year 1931, as published by the Travelers Insurance Company: Number of pedestrians in accidents while walking along rural highways, 14,130. Number of fatalities in such accidents, 2,330. Number of persons injured in such accidents, 11,800. Since the courts generally place the value of an average human life at $10,000, in case of a fatal accident, and in case of a non-fatal accident assess damages averaging $2,500, we may easily estimate the total losses through the death and injury of these more thn 14,000 persons at more than 52 millions of dollars annually.

An outstanding fact developed in an analysis of the various circumstances involved in the occurrence of automobile accidents affecting pedestrians during 1932, prepared by the Travelers Insurance Co., showed that while 3.5 per cent of the pedestrians were involved in accidents while walking on the roadways, the deaths from these accidents comprised 15.6 per cent of the total. The rate of pedestrian deaths per pedestrian in accidents while walking on the roadway was 342.6 per cent worse than the average.

The 1935 report of the Committee on Automobile Accident Prevention of the New York State Bar Association contains the following paragraphs in relation to relative costs: "The cost of the construction of cinder paths along rural highways is not great, especially in comparison with the cost of highway construction. The average cost of a mile of concrete highway 20 feet wide, eight inches deep, including all excavation, grading, and structure, is between $40,000 and $50,000. A recognized and outstanding authority estimates that the average cost of a cinder path in New York State, two feet wide, would be only $400 per mile; a cinder path 3½ feet wide, $700 per mile; and a mixed cinder and asphalt path 3½ feet wide, $1,675 per mile."

The extent of rural sidewalk construction during 1934 was investigated by your committee, questionnaires being sent to the highway commissioners of all the states. It was found that less than 42 miles of rural highway sidewalks were constructed during 1934 while many millions of dollars were expended in construction of rural roads.

It is noteworthy, however, that approximately 53 per cent of the total mileage was constructed during 1934, which we trust is evidence of the endeavors of the various individuals, organizations, and societies to minimize the second greatest cause of pedestrian traffic fatalities; namely, while walking along rural highways.

Recommendations

In the analyzation of this vital matter, your committee believes further research should be conducted by future committees, studying this matter with particular consideration given to types of sidewalks that are revealed by field studies to be suitable from a standpoint of construction costs as well as utility and attractiveness to pedestrians.

Since the review of the answers to the questionnaires sent to all state highway commissions discloses that 17 of the 40 do not build sidewalks, and three specifically declare their state law does not permit construction of sidewalks along highways, your committee urges the enactment of the legal provisions recommended by the Highway Sidewalks Committee of the American Society of Municipal Engineers, and has appended to this report a resolution incorporating the legal draft developed by that organization and urges the adoption of this resolution at the business meeting of the Institute of Traffic Engineers and the Street and Highway Safety Section of the National Safety Council. It is recommended further that a copy of this resolution be transmitted to every state highway commission within the United States.

(Note: The resolution referred to in this committee report was passed as recommended at the business meeting of the Street and Highway Traffic Section of the National Safety Council and will be found reported in full as a part of the business of that session in this volume of Transactions See page 37.)

Planning Traffic for Easier Enforcement

By HOWARD F. ILGNER

Chairman and Engineer, Traffic Committee, Milwaukee Safety Commission, Milwaukee, Wis.

(The following is a summary of a valuable paper which contains the detailed experience of the city of Milwaukee in its successful fight for greater street and highway safety. Mr. Ilgner's original manuscript, accompanied by numerous illustrations, is on file in the Council library for additional study and reference.)

I have divided consideration of my subject into three primary divisions: (1) Operation of traffic control devices; (2) Allocation of street space; (3) Location of traffic control devices.

The proper timing of traffic signals plays an important part. Cycles which cause unnecessary delays to either vehicular or pedestrian traffic should be avoided as much as possible. Pedestrians, who should be guided by traffic signals as well as the motor vehicles, often are led to disobey such signals because of waits which seem to be or are unreasonable. Accidents in some instances have been reduced as much as 50 per cent by accurate timing.

Another important phase in the operation of traffic signals is inter-connections for progressive operation. Signals installed at reasonable intervals, properly timed and interconnected, will provide speed control 24 hours of the day. Motorists who continually use such streets sooner or later get tired of rushing and stopping, and find out for themselves that by getting into the orderly rhythm of a well-timed progressive system makes for easier and safer driving.

Considerable trouble has been experienced by motorists starting on the amber-green on the cross street while their own signal still showed red. The amber and green combination usually shows for a period of three or four seconds, giving the driver who "jumps the light" a chance to get out in the center of the intersection or beyond before the lights flash "green." To overcome this, we are experimenting with a short amber of approximately one second at the end of the red with encouraging results. This seems to create a tendency for drivers to watch their own signals instead of the cross street signals and has considerably decreased the "jumping of lights." The amber on the red, being approximately only one second in duration, is so short that it just above covers the reaction time that is required for the motorist to get ready to start, without any time to spare for mischief.

In much of the traffic control work in the past the pedestrian has been the forgotten man. The laws provide that a pedestrian stepping off the curb on the green light has the right of way over vehicles until he reaches the opposite curb, but in fact the pedestrian is often trapped in the roadway between lines of moving vehicles. Great care has been taken to tell the motor vehicle operator that the green is going to change to red, but the pedestrian generally has not been given an indication which is of much value.

In order to overcome this, special "walk" indications are being added to the vehicle indications. Although a complete stopping of all vehicular traffic and the display of a "walk" or other pedestrian indication in all directions is the 100 per cent safe way, we have preferred to use a pedestrian signal in combination with the green vehicle indication, the pedestrian indication coming on with the vehicle green and going off before the end of the vehicle green, so that a pedestrian stepping off the curb at the end of the pedestrian signal can reach the opposite curb in safety. This seems to be a fair balance between the rights of a pedestrian and the rights of a motor vehicle.

When the first "walk" signals were experimented with in Milwaukee, they were hooded and baffled in such a way that vehicular traffic could not see them to any great extent. We thought the additional signal might be confusing to motor vehicle traffic. However, in our latest experiments we have removed all the baffles and long hoods and the "walk" indications are in plain view of the motor vehicle traffic. This had a surprising effect on motorists making turns. It seemed immediately to bring to their minds the fact that pedestrians existed and had the right of way.

Traffic signals with "walk" indications were installed about six months ago at one of the busiest motor vehicle intersections of the city, and during this time there

was only one pedestrian injured; this happened because a pedestrian walked into an automobile. We feel that this installation has been very successful up to the present time with 90 per cent obedience on the part of adults without the presence of police officers. One of the largest schools in the city is located at one corner of this intersection and hundreds of school children use these crossing daily; they, of course, by special training, practically obey the signals 100 per cent.

As a matter of education to the motorist, signs reading "Motorists—Turn Cautiously, Pedestrians Have Right of Way" are installed on the traffic signals on the side facing motor traffic; and signs reading, "Pedestrians—Start Only While Walk Shows" are installed on the side facing the pedestrians.

At complicated intersections and on wide roadways channelization of motor vehicle traffic by means of traffic islands is a most important method of improving traffic conditions. The traffic islands used in Milwaukee are of low type construction, offering no great hazard to motor vehicles and yet commanding enough so that no motor vehicle driver would deliberately drive over them. The edges, or corners, of the islands are plainly marked by amber traffic markers which are illuminated at night. A series of center islands along a wide roadway generally have two such marker lights to indicate their existence and width, while triangular islands at street intersections generally have one light at each corner. These amber marker lights are right down on the islands, not up off the ground where they can be confused with other lights or obliterated by the glare of oncoming headlights. General illumination from street lighting or floodlights is not sufficient to overcome glare from oncoming headlights, even though such glare be small. A light source can only be effectively fought by another light source and the glare of headlights is here opposed by another light source which does not illuminate but is part of the object itself.

These marker lights have proved to be outstanding in effectiveness and there is absolutely no mistaking what they represent because they are used only for this one purpose and always in the same manner.

We have given the subject of traffic islands a great deal of study, realizing that it is a debatable subject. We believe, however, that our traffic islands provide a proper balance between the motor vehicle driver and the pedestrian in the matter of safety. In case a mistake is made by a driver, (which has happened) he may bump the traffic marker or standard or go over the corner of the island, but very rarely does he lose control of his car nor is he injured. Also, up to the present time no fatalities have occurred among pedestrians using these islands.

As an example of what has been done at some of our intersections to establish greater safety through channelization of the traffic by means of the islands and controls, perhaps a brief description of the intersection of North Story Parkway and West Wisconsin Avenue in Milwaukee may be of value.

Originally this intersection was one vast expanse of pavement which, due to its accident record and general hazardous nature, finally became known as "The Battle Ground." The roadway of West Wisconsin Avenue was 90 feet within the intersection, without any islands to break up this extreme width. Due to the enormous openings at North Story Parkway the actual width of the pavement was far in excess of 90 feet. At one time it was thought that with such ample space in which vehicles might maneuver, no trouble ought to develop; but there were two fatal accidents in spite of all the roominess which the intersection afforded.

In reconstructing this intersection, the principle of channelization was carried out in detail. In the center of both streets parkways were constructed extending well out beyond the line of intersection, and turning lanes were developed and so plainly marked that there is no longer any question as to where the vehicular traffic stream will flow and pedestrians no longer need to call a taxi in the event they wish to cross from one side of the intersection to the other. (Mr. Ilgner, in presenting his paper, showed striking lantern slides illustrating the difficulties overcome in this intersection, and these illustrations are part of his paper on file in the Council library.)

This intersection, although among the busiest in the city, representing the very gateway at the west end of the city, is operated on only a 35 second cycle. It should be noted that from the moment this intersection was reopened to traffic, it operated with 100 per cent success and to date has continued so to operate. Without the signals at the exact point of obedience where they tie in perfectly with the whole layout of the intersection, and the manner in which the space is allocated to vehicles and pedestrians, such results could not have been achieved.

In the matter of pavement markings at "stop" signs and at traffic signals we made a change which I believe is worthy of mention. Considerable annoyance was experienced by pedestrians at intersections, where cross-walk lines were painted in, when motorists persisted in stopping right on the near cross-walk line and in many cases going over it into the cross-walk area. We have now adopted a new pavement marking scheme at such intersections by providing an additional line or stop line about four feet from the cross-walk line. This space between the cross-walk line and the stop line has been named the avoidance zone. In connection with the stop line a short section of center line is added, forming a right angle, which gives the impression of being a sort of a hook to hold back the vehicles. The effect has been surprising. A very small percentage of the motor vehicles go over their own stop lines and practically none of them over the cross-walk lines, thus not only making it safer for pedestrians, but a great deal less annoying.

Some persons may feel that our street intersection layouts are complicated and confusing, but that they are simple and easily understandable was unquestionably brought out at the time they were placed in service, since each and every one of them was opened up without any police supervision whatsoever.

The success of these installations is in a large measure due to the fact that the limits of area under control at each intersection are clearly defined by the placement of the traffic devices. Whether control be by traffic signal or sign, in every case the traffic control signal or sign is placed at the point of obedience so that there absolutely can be no mistake. A second or running signal is also installed at the left-hand side at the location where it is of greatest value to the faster moving center lanes of vehicular traffic and to those making left-hand turns. In traffic control work this latter move is in general the most annoying and conflicting move with which we have to deal. Thus the traffic islands, combined with the installations of proper signs and signals at the most effective locations, have produced conditions which have made enforcement easier, with no chance of alibis.

The Driver's License Law Reappraised

A Study of Automobile Fatality Trends in Relation to Distribution of Population

By WILLIAM JUNKIN COX

Department of Engineering Mechanics, Yale University

For the last ten years or thereabouts, automobile fatalities in relation to the consumption of tax-paid gasoline have been increasing much less rapidly in the group of states that have had the driver's license law than in the other states of the Union. This fact has often been noted by persons urging additional states to adopt the licensing of motorists.

The first *detailed* exposition I have seen of fatality trends in relation to tax-paid gasoline consumption was prepared by the National Safety Council and appeared in "NATIONAL SAFETY NEWS" for August, 1934. Because it is the most detailed exposition, and therefore lends itself to analysis and dissection, I shall criticize that study in my subsequent remarks.

In this study the Council compares the experience of license law states with that of other groups of states selected principally on a geographical basis. Death rates per 10 million gallons of tax paid gasoline were computed for each year from 1926 to 1933, and then the rates for each group of states were reduced to index numbers with 1926 as a base so as to show the per cent change in the rates each year compared with 1926. The 1933 figure for license law states is 76, indicating a decrease of 24 per cent in the death rate. At the other extreme the southern states had a 1933 index number of 130, or a 30 per cent increase in the rate since 1926.

The natural conclusion was that the license laws are very beneficial, but such a conclusion is superficial. The divergence in fatality trends is the result of a more fundamental difference than the possession or lack of a license law. The trend in each group of states has doubtless been affected by many factors, which are present to a varying extent in the different groups. One of these factors is the possession

or lack of a license law. This particular factor may (the evidence afforded by fatality trends does not warrant the use of a stronger word) have played a minor part. But much the most important factor in establishing a divergence in trends of fatalities in relation to taxed gasoline consumption is *the distribution and density of population.*

There are three reasons why the distribution and density of population must be considered in this connection. First, in states with many inhabitants per square mile, gasoline tax rates can be kept much lower than in sparsely settled states. Secondly, the densely populated states, even with lower gasoline tax rates were able to raise funds for a much earlier development of modern highway systems than the sparsely settled states could accomplish. Third, states with large urban populations, when those populations live in highly congested cities, have a much greater total of accident prevention influences than are provided by license laws alone.

In the rural regions, even of the license law states, there is little or no local accident prevention work. In such regions, the influence of state laws, including the license law, should be much more apparent. In an appraisal of the license law, then, we should turn to the experience of the rural parts of states.

Fortunately, it is possible for us to do this. The U. S. Census Bureau, in addition to giving statewide fatality totals, divides these totals into fatalities in incorporated places of ten thousand population and over, and fatalities outside of such incorporated places.

These figures are not on an ideally perfect basis. Ideally, in studying the effect of state legislation, we should probably best confine our attention to that part of a state which excludes both the cities and the suburban area immediately adjacent to the cities, into which the effect of city accident-prevention efforts penetrates. The "rural" figures of the Census Bureau do partially exclude this suburban territory, because they are based on the *location of death*, rather than the *location* of the *accident* causing death. In a considerable number of cases, persons injured in accidents in the suburbs of cities are taken to city hospitals, where they die. Such deaths are classed as urban deaths. A considerable number of suburban deaths are therefore eliminated from the rural classifications. Other suburban deaths—those which occur instantly, at the place of accident—are charged to the rural territory. On the other hand, a few deaths which result from really rural, rather than suburban, accidents are charged to cities. But while the "rural" classification of the Census is not perfect, it is certainly the best available index to the increase in fatalities in those parts of the state in which the evidence with respect to the effect of license laws is most clear-cut.

For the license law states, deaths on a statewide basis increased 34 per cent from 1926 to 1933. In contrast rural deaths, as defined above, increased 53 per cent, or more than half again as fast. These figures exclude deaths from collisions with trains or street cars, in conformance with the National Safety Council study.

The next step in the analysis should be to relate this increase in rural fatalities to the increase in travel in the rural parts of the license law states.

The National Safety Council study assumed that increases in the total miles of travel in a state were proportional to increases in tax-paid gasoline consumption. For the license law states, this assumption was probably a little high, due to such factors as a general trend from four-cylinder cars to sixes and eights of a greater average weight, and to larger trucks and busses. However, probably gasoline consumption is a good enough indicator of statewide traffic for our purposes.

When we turn our consideration to the increase in traffic in the rural parts of states, an additional factor must be taken into account. Has *rural* traffic increased by the same percentage as all traffic within the state?

This question cannot be definitely answered. On the one hand, an increase in pleasure driving would tend to increase rural traffic more than urban traffic. On the other hand, automobile registrations seem to have increased more in urban than in rural areas. In New York City, for example, registrations increased by 39 per cent from 1926 to 1933, whereas in the remainder of New York State they increased by only 16 per cent. Moreover, the years in question have seen a large development of suburban areas, and a great increase in automobile traffic between such areas and the city. On the whole, there seems no reason to believe that there has been any very great difference in the rate of increase in rural traffic and the rate of increase of all motor vehicle traffic within the license law states.

If we now change the rural death totals and the gasoline consumption figures for this period of years into index numbers, with 1926 equal to 100, we shall have two series that can be compared and combined. For example, the 1933 index of rural deaths is 153 (indicating that there were 53 per cent more deaths than in 1926), and the 1933 index of gas consumption is 165 (or 65 per cent above 1926). Now if the index of deaths is divided by the index of consumption the result will be the index of change in deaths for a uniform volume of traffic—on our assumption that consumption is a fair measure of traffic in these states. For 1933 this index is 93, which indicates that deaths were 7 per cent below 1926 for a unit volume of traffic.

Similar indexes for the intervening years vary from 87 in 1932 to 101 in 1928, but the significant point is that for all years since 1926 the average was only 95. This is only one-third the reduction shown by the National Safety Council's figures based on statewide totals, and is by no means so large as to furnish a clear-cut indication that great advantages have resulted from the possession by these states of the license law.

However, even though the number of rural fatalities in relation to miles of travel in the license law states is seen to have decreased by only this comparatively small amount, *any* decrease would seem greatly preferable to the *increase* in fatalities in the "no-license" states. But let us look more closely at this increase.

In doing this, I propose to direct attention to the group of states which had the worst accident experience, according to the Council's study. This group comprises the southern states without a license law. The first thing to note, in making this comparison, is that shifting the study from the entire state area to the rural area has an opposite effect in the southern no-license states from that in the standard license law states. In these southern states, automobile fatalities have actually increased faster in the cities than in the rural parts of the states, instead of only about one-third as fast, as was the case in the license law states. The 1933 index of rural deaths is 148, while that for city deaths is 159.

After computing the indexes of rural deaths in the southern states from 1926 to 1933 the next step is to relate these rural fatalities to the increase in rural traffic. Here again, the situation contrasts with that in the license law states.

In the southern no-license states there appears not to have been so great a shift to very heavy, multi-tired trucks and busses as in the license law state. This conclusion is supported by studies of the U. S. Bureau of Mines which show that in 1931, city busses in the South Central states averaged 5.25 miles per gallon of gasoline, whereas in the New England states and the Middle Atlantic states they averaged only 3.53 and 3.63 miles respectively. Bus travel, of course, consumes a very small fraction of total gasoline consumption, but the same economic factors affect other classes of commercial vehicles as well, and should reasonably have had the same effect.

Prior to 1926 there was a great deal of road paving in the license law states, but relatively little in the southern states. Consequently, there was a much greater proportional increase in mileage of paved roads in the south from 1926 to 1933 than in the standard license law states. Now it is a well-known fact that a gallon of gasoline will produce many more miles of travel on a well-paved hard road than on a dirt road. Agg and Carter[1] found that an automobile operating on a regular schedule throughout the year, in wet weather as in dry (a rural mail carrier, for example) would require almost fifty per cent more gasoline during the year if his travel was on unpaved roads than if it was on pavement. Any pronounced shift of travel from unpaved to paved roads would therefore result in a considerable gain in the number of miles gotten out of a given quantity of gasoline. It would not be likely to result in a 50 per cent increase, because few persons have absolutely to disregard weather conditions in their travel. But for the entire group of southern no-license states, it would seem entirely possible that more than doubling the paved mileage should have shifted enough travel from soft to hard roads to have much more than counteracted any decrease in miles per gallon resulting from the change to more cylinders and heavier cars. It seems certainly within the bounds of probability to suppose that in the southern states miles-per-gallon for the average car

[1] "Operating Cost Statistics of Automobiles and Trucks," by T. R. Agg and H. S. Carter, Bulletin 91, Engineering Experiment Station, Iowa State College.

increased by one-fourteenth of itself (say from fourteen to fifteen) between 1926 and 1933. If not, there has been circulated a great deal of mis-information regarding the economic value of good roads.

In 1933, tax-paid gasoline consumption in the southern states was 117 per cent of what it was in 1926. If, in addition, each gallon gave 107 per cent as many miles of travel because of better roads, the total mileage supplied by the 1933 gasoline would be 117 x 107 or 125 per cent of the 1926 mileage. For the intervening years, total mileage from tax-paid gasoline consumption has been obtained by assuming that the increase in miles per gallon progressed at a uniform rate.

These new highways have not been built without cost, and to carry the cost, state and local taxes ranging from 4 to 11 cents per gallon have been put into effect. It can hardly be doubted that where taxes as heavy as these are levied, there must be considerable evasion. Most of this evasion, moreover, has developed since 1926. Prior to 1925, none of these states had more than a three cent tax. It is, of course, impossible to determine the extent to which bootlegging of any bootlegged article occurs, but many apparently well-informed people believe that the evasion of gasoline taxes has reached very considerable proportions in the states with high tax rates. Dr. F. G. Crawford, Professor of Political Science in Syracuse University, has made an extensive investigation of the whole field of gasoline taxation. He says, "Beginning in 1929, several new factors affected the (gasoline tax) situation. The rapid advance in rates made evasion profitable and bootlegging, which had been practiced on a small scale, was extended to a marked degree." Again he says, "Evasion of payment of the gasoline tax has become little short of a national scandal. * * * It is impossible to estimate the extent of evasion. Some writers place it as high as $100,000,000 a year."

The combination of high rates and small staffs to administer the gasoline tax would seem to tend irresistibly to tax evasion. In Alabama, where the state tax was six cents a gallon in 1933, and municipal and county taxes amounted to an additional five cents in parts of the state, administration of the gasoline tax law was carried out by four men, two in the field and two in the office. Ways of evading the gasoline tax are numerous, and under conditions such as those just outlined it is impossible to believe that a considerable amount of evasion did not occur. In the southern states, the average tax administration staff numbered about eight in 1933. On the other hand, in the license law states, although the tax rate was generally much lower and much less incentive to evasion therefore existed, the average number of administrators was about thirty. Pennsylvania had ninety-five.[1]

It is quite impossible to say to what extent gasoline tax evasion increased in the southern states between 1926 and 1933, but it is very easy to believe that in 1933 the increase (over 1926) in bootleg gasoline amounted to 9 per cent of the tax-paid consumption. (One gallon escaped tax for each ten gallons taxed.)

On this assumption, a new set of "traffic volume" figures were computed, based on the series already corrected for the shift to paved roads. For 1933 the index number of 125 was multiplied by 1.09 to correct for gas bootlegging. For earlier years the correction factor was gradually decreased, ending with zero in 1926. It is conceded that there is a good deal of uncertainty as to the exactness of this new series, but it would seem to be conservative. Moreover, it has this to confirm it. It indicates that the annual mileage of the average car has increased in the south by the same percentage as in the license law states.

Having thus obtained a series of figures that appears to indicate at least roughly the trend of rural travel in the southern states, the next step was to combine it with the series of index numbers of rural deaths to determine the trend of deaths per unit volume of travel. This was done, in the way already described for the license law states. The final figures show that while the experience of the southern states in 1929, 1930, and 1933 was worse than it was in 1926, it was better in the other years. The average figure for all years from 1927 to 1933 was the same as in 1926, namely 100. The comparable figure for license law states was 95, which indicates that the trend in those states has been only five per cent better than in the southern states.

[1] "The Gasoline Tax in the United States, 1934," F. G. Crawford, Public Administration Service Bulletin, No. 44.

There is sound reason to believe that the license law states have enjoyed the slightly better experience which these figures for the two groups of states impute to them. Very few serious automobile accidents occur on dirt roads, or ever have. On such roads, speeds are too low. The transition from dirt roads to pavement means not only more miles per gallon. It means higher speeds and therefore greater hazards. This is a situation that no license law could have modified. With or without such laws, there would have been speed increases and more accidents.

In the light of this fact, it may be seriously questioned whether the trends of rural fatalities in the two groups of states show any very noticeable accomplishment in accident prevention that can be credited to the licensing of motorists.

This fact is not an indictment of the principle of the license law. Rather it is a criticism of the type of administration that the law is apt to have. The license law gives the administrator broad power for making our highways safer places. But it takes a very great deal of moral courage to use those powers to the utmost. The general public is almost always apathetic. For more than rare, brief intervals, it cannot bring itself to insist on a very rigorous administration of any law. On the other hand, the minority which is made to feel the weight of rigorous administration of such a law can make itself very unpleasant to an administrator.

That the statewide regulation of motorists by state agencies can be made to accomplish great results (when the administration of state laws is both energetic and so conducted that it receives adequate public support), is clearly shown by the experience of certain ones of the license law states, considered separately from their fellows. In Rhode Island the average index of deaths per unit volume of rural travel since 1926 has been 64, compared with 95 for all the license states. The spread between the most successful of the license law states and the others has been many times as great as the spread between the average of the license law states and the average of the southern states without license laws. It appears that although state regulation of motorists has generally not been very effective, it *can* be made quite effective.

Considering these facts, I contend that it is far more important to secure an *adequate enforcement* of the license law in states which now have it than to try to extend the law to a few more states not particularly eager to adopt it.

(This is a condensation of Prof. Cox's paper. Copies of the complete paper can be had from the National Safety Council, Chicago.)

WEDNESDAY MORNING SESSION

October 16, 1935

TRAFFIC LAW ENFORCEMENT

The session was called to order by Lew E. Wallace, Superintendent of Motor Vehicle Division, Department of States, Des Moines, Iowa, who presided.

Report of the Committee on Enforcement and Police Activities

By JOHN P. SMITH

Deputy Commissioner and Superintendent of Police, Detroit, Mich.

1. *The Judicial attitude toward the poor violator:*

The judiciary, in the determination of a case, should not be influenced by class. If the offender is in such financial circumstances that he cannot pay a fine, a penalty

equal to the loss imposed on a man of financial means should be placed on him. Educational sentences for a certain class of violations are a satisfactory remedy. But, when one drives an automobile recklessly, or is under the influence of intoxicating liquor, there should be but one sentence, i.e. the maximum penalty, if found guilty, as prescribed by law.

While this may appear to be a drastic statement, the penalty should be commensurate with the results of his violation. Consider the several different angles:

(1) 45 miles an hour through a Stop Street; no automobiles on the through street and no law enforcement agencies present; the operator evades the issue entirely.

(2) Another operator driving 45 miles per hour through a Stop Street, striking an automobile on the through highway; no law enforcement agencies present; the complaint lodged by the officer is determined from the statement of witnesses and the position of the cars after the accident.

(3) 45 miles per hour by another operator in the same type of accident; one of the passenger's limbs pinned in the door resulting in a compound fracture not sufficiently serious to cause permanent disability. The greatest charge to be placed against the operator is "Reckless Driving." However, if infection sets in, necessitating the amputation of a limb, the charge becomes "Felonious Reckless Driving."

(4) In the same type of accident where a death occurs, the charge is then either "Negligent Homicide," or "Involuntary Manslaughter."

In all the cases, the primary act is identical and as the potential possibilities causing a serious accident are the same, it is only just to assume that the operator should be penalized accordingly. This committee firmly believes that those operators who drive a car in the aforementioned manner should be given the maximum sentence, or the law revised to make such sentence mandatory.

In minor violations, or when dealing with habitual offenders, the revocation of their operator's license and license plates is a form of punishment that would be applicable to any individual regardless of financial circumstances. The Judiciary can place the offender on probation and can specify the surrender of both operator's license and license plates during probation. Such surrender could also be made to extend for a longer period in addition to a fine. If a defendant fails to comply with this order, it would be considered a violation of his probation or sentence and the Court could then impose an alterrative penalty.

This committee recommends that the efforts of all members be concentrated, as far as possible, to the passing of a law in their respective states, granting the judiciary the power to revoke both the operator's license and license plates upon conviction of major violations.

It is further recommended: That the financial circumstances of the defendant appearing before the Traffic Court be considered before imposing a fine. Where imposition of such fine creates a hardship for defendant's dependants, the fine should be waived and compulsory attendance at a Driver's School be substituted, where possible.

When the defendant is a repeated major violator, the operator's license or license plates should be revoked for a period commensurate with the type of violation and defendant's previous record

Regardless of financial circumstances drunken drivers should suffer the maximum penalty provided by law, including the revocation of their operator's license.

2. *Opportunity of Traffic Judges for safety education:*

If all efforts to educate the adult person in traffic safety would bear the same ratio of success that safety education has with the school child, our difficulties in solving the accident problem would be minimized considerably. A small proportion of our adult drivers appear to be laboring under the delusion that the traffic laws deprive them of certain constitutional privileges. Although they may have pleaded guilty, they did not believe that their particular case jeopardized the public health, safety or morals of the community; in fact, that it did not even constitute a nuisance.

The failure of individuals to observe the fundamental principles of safety is caused by the absence of lasting mental impressions. The most permanent form of education is obtained when the individual is orally impressed, in front of a group of people, with the possible consequences arising from an act committed by him, and the ideal location for such effective impression to be gained is in the Court room.

However, this opportunity is often lost, due to the fact that in many of the Traffic Courts the proceedings are conducted so quietly that it appears to be a confidential trial, rather than one open to the public. Often spectators seated close to the judicial bench cannot hear the conversation between Judge and defendant. This inspires lack of confidence and doubt in the minds of the spectators as to the sufficiency of the fine or sentence imposed.

To dispell this idea, dangerous both to the individual and the public, it is considered advisable that spectators, as well as defendants, be impressed with the importance of obeying the traffic laws and with the severity of the consequences when these laws are ignored. This can be accomplished only when the Judge interrogates the defendant in a clear and concise manner comprehensible to the entire Court room. This Committee has no doubt that when a Judge questions the defendant and pronounces sentence in the aforementioned manner that a lasting impression will remain with both spectators and defendants.

Therefore, it is recommended by the Committee: That all members direct their efforts toward developing Traffic Court procedure to a point that will permit both defendants and spectators to comprehend the entire proceedings.

That the Judges aid in the safety educational program through their administration of the Court. One example of such educational work by the Court is the provision of necessary facilities for broadcasting important traffic cases over radio.

3. *Safety Contest:*

The public appears to be somewhat callous to the mounting traffic toll and this attitude is reflected in the newspapers. Deaths by automobiles have become so commonplace that they are no longer considered of sufficient importance for the front page. This attitude of the press and public, plus the stress placed upon the apprehension of major crime violators by Police Departments, is often the underlying cause of the apathetic attitude displayed by the average police officer toward the prevention of traffic accidents. This is fundamentally wrong; and all Police Departments, regardless of size, should instill in each individual member of their forces the necessity for the same careful application of effort toward the prevention of accidents as they do in the prevention of crime.

One of the most effective means to accomplish this end is through the Inter-Precinct Safety Contest. This contest permits, through educational methods, a better understanding of the traffic problem on the part of both the Police Officer and the public, and a spirit of co-operation is created between them. Cities in which contests of this type have been conducted experienced a keen competitive spirit among police superiors and the men of their commands.

By concentrated study of the accident problem and accident causes in each police precinct or district, the various types of accident hazards can be marked and classified, together with the actions of the persons involved. Through a study of the location of a group of accidents and their causes, a more intelligent enforcement of the major traffic regulations having a bearing on traffic conditions in each of the accident concentration locations can be obtained. By instructing police officers in the importance of enforcing the traffic ordinances and why it is necessary to use discrimination in the different types of offenses, the concentration of accidents will gradually diminish.

It is the opinion of the Committee that: A contest of this type is one of the most outstanding safety ideas advanced. It creates a wholesome competitive spirit among police officers and provides an excellent medium to bring about closer co-operation between the Police Department and the public.

It is recommended that this type of contest be conducted in all communities over 50,000 population. When the city is not divided into Police Precincts, it should be separated into patrolled districts or beats. All officers should be responsible for accidents occurring in their respective districts.

What the State Police Can Do in Traffic Law Enforcement

By COL. H. NORMAN SCHWARZKOPF

Superintendent, New Jersey State Police, Trenton, N. J.

This subject must be approached on the presumption that state police have all the personnel necessary, all the communication facilities necessary, all the transportation necessary, and all of the co-operation that is necessary from the public. This, of course, would be an ideal situation.

Surveys made to determine the causes of accidents all agree that the greatest cause is the driver behind the wheel. Why is it that when an otherwise decent citizen, with all of the qualities of a gentleman, and esteemed by his friends for his courtesy and consideration, so often changes into a motor-maniac when he gets into an automobile? Is it because the sense of power which he gets from an energy producer of 80 or 90 horsepower is so great that it stifles his normal attributes; or is it that the joy of traveling at high speed dulls his other perceptions? If all drivers could be educated to act, or forced to act, as gentlemen who are complying with the accepted regulations of traffic in a common sense manner, if they would apply the same rules of courtesy and consideration in behavior on the streets and highways that they do in their other phases of human activity, there would be no need of safety campaigns.

Education will not produce this result. Psychologists have not offered us the remedy. So we must approach the problem from a different angle. No normal person would wilfully violate the law in the presence of a police officer who was there for the purpose of apprehending violators and accomplishing their punishment. Probably you were out driving last Sunday, and as you were riding saw a speck on the horizon which you recognized as that of a police officer; and without thinking, merely in response to his presence, you lifted your foot from the accelerator and drove along a little slower, even though you may have been well within the speed limit when you first saw him. I know that you do this, because I do it myself. This brings each of us to an immediate realization of the preventive effect the uniformed officer exercises on the road, and how we have reacted to it. It is not because we are gentlemen, nor because we want to be courteous or considerate, nor for any other reason except that we recognize the authority of the law and react to it.

If on our main traveled highways we could have a state trooper on patrol, constantly in view of the traveling public, all drivers would naturally apply all of the rules of social behavior and forget their motor-mania. In order to make the situation even more ideal, by adequately lighting the main traveled highways the effect of uniformed troopers would be extended through the hours of night, which, statistics show, are the most dangerous hours of travel on the highway.

Now picture all of these minions of the law in communication with a co-ordinator who, from a position of vantage high in the air, is reporting conditions all along the line, points of congestion, reasons for stoppages, recommendations for travel along parallel routes by diversion of traffic, and other things of importance. Two-way communication between the ground troops and the observer in his airplane assures a constantly co-ordinated plan. As long as traffic is moving there is no problem, it is when a part of it is stopped that trouble begins. Now we will go one step further and show these troopers reporting conditions half-hourly to their troop commanders, who send a consolidated report to a commercial radio station, which in turn broadcasts the information to the traveling public who have radios in their cars, and thus secure the co-operation of the traveling public in the co-ordination of the traffic plan. So here we have the ideal setup where we have eliminated the hazards of the personal equation, co-ordinated the flow of traffic and obtained the co-operation of our public. Accidents, zero.

But what can the state police do with the facilities available? In New Jersey our entire state police, including the executive and administrative department, supply department, identification bureau, detective bureau, teletype bureau, statistical bureau, safety patrol bureau, license bureau, automobile bureau, and the uniformed troopers on the road consists of 242 men; which leaves us actually a little over 100 men at any one time available for patrol. These men cover an area of more than

7,000 square miles, including more than 1,535 miles of state highways and 4,069 miles of county highways, all paved arteries of heavy traffic. Yet the organization earnestly applies itself to the solution of the traffic problem. Some of the things listed in the ideal situation are put into practice so far as possible now. For instance, for more than eight years we have been controlling traffic from the air at large gatherings, and under particularly heavy or dangerous circumstances. We have no airplanes in the department, but by borrowing or hiring planes we have been able to make a limited, but successful application of the control of traffic from the air. Successful experiments have been conducted in two-way radio communication from ground to air, and amazing results have been obtained.

Station W O R over the recent Labor Day holiday extended fine co-operation to us by broadcasting, at frequent intervals, reports of road conditions, so that the portion of the motoring public who had radios in their cars were in the position to keep themselves well informed as to the traffic situation. This station is now contemplating putting in a permanent service for the state police and the public.

Realizing what a vast territory we have to cover, the state police inaugurated a system of traffic patrols. In these patrols a group of eight to ten troopers cover a stretch of dangerous highway of 50 to 60 miles. Each trooper is assigned his proportionate share and patrols back and forth. This traffic patrol may stay in one location for two to three hours, and move to another location for two or three hours, and then to a third, so that in a single day a patrolling and preventive effect will have been inaugurated over several hundred miles. Traffic checks at these times discover mechanical deficiencies, warnings to the public bring an educational effect, and a serious deterent to crime is accomplished.

We use warnings in our department as a means of educating the public as to the traffic laws and motor vehicle laws, and the hazards resultant from disregard of the laws and rules of courtesy. Last year we made 17,000 arrests for motor vehicle violations and issued 105,000 warnings.

We carry on other educational activities, particularly through our safety patrols. There are nearly 300 schools in the rural sections of the state with almost 100,000 children that are coming under the direct protection of state police safety patrols. In this safety patrol movement our aim is to teach good citizenship, to teach the children to respect authority, exercise authority, learn the rules of social conduct, the sacredness of public obligation and duty, and the necessity for living the Golden Rule in our practical association with one another. While this is a course in good citizenship, an immediate effect finds itself in safety: in seven years not one child under the protection of these safety patrols has been either fatally or seriously injured. So far as traffic goes, these children only exercise authority over other children and not over the traveling public.

We also furnish instructors for other police departments, lecturers for fleet driver schools, for civilian driving classes, for C. C. C. camps, Boy Scouts, etc.

Another activity is the application of first aid; every trooper in our organization has passed the Red Cross examination. A number of the men are rated as instructors, one having the highest instructor's rating given by the Red Cross out of Washington, carries on first aid, life saving and resuscitation instruction, not only in our own department, but with police and fire departments, ambulance corps and civilian groups throughout the state. This instruction and influence is being extended throughout the school and civilian activities.

An important service to other state departments is rendered by the state police in bringing to their attention hazardous conditions, impassability of roads, highway obstacles, the need for directional and danger signs, and other information.

A Safety Bureau in the Police Department

For the most competent handling of traffic law enforcement, Col. Harold Fowler, First Deputy Commissioner of Police of New York City, suggested that a safety bureau be established in the Police Department, independent of the uniformed men. There should be close inter-departmental cooperation, however. One of the first steps in coping with traffic law enforcement, he said, is to "size up the political situation, not from the standpoint of playing with it, but from the standpoint of abolishing it." Since traffic law enforcement is largely a matter of education, he suggested that intensive safety instruction be given all officers and patrolmen who contact the public, whether they are directly connected with the Traffic Bureau or not. The Police Department can cooperate with civic agencies, schools, Boy and Girl Scouts, and other organizations which might promote safety on the streets. Between crime calls, squad cars can apprehend traffic violators, help untangle traffic tie-ups and perform other similar services. The Police Department can also study danger points and make spot maps to assist traffic engineers of the city in their work.

The Police and the Court

By HON. HARRY H. PORTER

Judge of Municipal Court, Evanston, Ill.

Evanston is a city of 65,000, situated immediately north of Chicago and is the gateway to the great North Shore, the shopping center of at least 100,000 people. A tremendous volume of traffic flows daily over our highways.

Our Court is a court of specialized jurisdiction, limited in criminal prosecutions to cases below the grade of felony, jurisdiction confined to the corporate limits of the city. We have divided the Court into two branches, one devoted to the trial of criminal and quasi-criminal cases and the other exclusively to the trial of civil actions.

Our volume of business has not warranted a separate branch court for handling traffic cases only, but we have done the next best thing in providing by general order that two days in each week—Mondays and Thursdays—shall be devoted to the trial of traffic cases and one day per week, Wednesday, to the trial of traffic *accident* cases exclusively.

I have personally handled, during the past six years, some 70,000 traffic cases, including traffic accident cases, and from this experience I have formed certain conclusions which I should like to submit here. I admit frankly that the efficient administration of the traffic laws is a problem as complex as human psychology itself and I am afraid that only experimentation with different policies is apt to teach us a great deal.

Today, however, traffic perceptibly slows at our gates, our automatic signals and stop signs, and even our parking regulations, are more or less scrupulously observed: and with it all there has never once been breathed a charge that Evanston has been in any way unreasonable in the matter of traffic law enforcement. This result is achieved, undoubtedly, because of a very definite policy of enforcement and a genuine cooperation between the various law enforcing bodies.

Morale of Law Enforcing Bodies

No system of law enforcement is destined to success if there is something in the system which is calculated to destroy the morale of the law enforcing bodies or any of them: and no police department can be worth while whose morale has been destroyed. Morale can be destroyed or seriously impaired by political manipulation, and the civil service laws are by no means an effective safeguard, but even more true is the fact that a ruined morale is certain to result from a lack of genuine cooperation and coordination of effort between the police department and the Courts.

I am afraid that some of us, particularly those judges who sit in the Courts of our larger cities, are apt to sin unconsciously in this respect by a failure to see and understand the psychology of the police officer. This is due, in large part, to shifting assignment of Judges to various branch Courts at the hands of the Chief Justice, and to the fact that the police departments are of a size which are calculated to afford only occasional contact between a given police officer and a given judicial officer.

Our own department of 103 men has given me an opportunity to know these men fairly intimately. I have given hours of my time to teaching classes of them in the criminal law and in giving them an insight into the psychology of the bench;

I make a practice of taking time out after Court sessions and explaining to them individually the weaknesses of the cases they have just lost and how to correct them. When we feel that they are trying to convict an innocent person we tell them so, and point out where their mistake lies. When someone whom we are sure is guilty is acquitted by reason of a lack of proper evidence, we take time to go into the matter and find out just where the Accident Bureau is at fault, if it is at fault. If we are able to discover the difficulty we explain what the legal difficulties are and why it was necessary to discharge a person whom we, ourselves, believed to be guilty. Over a period of time the members of the Accident Bureau have thus absorbed a great amount of legal theory and practice.

This may be an unusual practice for a judicial officer, but it pays unusual dividends in increased court room decorum of the police and in a well ordered and intelligent technique in the presentation of their cases in Court.

Let no one misunderstand; we are emphatically opposed to any Court of justice making a prosecuting agency of itself, and I am not sure that this unusual practice of ours has not caused us to "lean over backwards" to a degree against the State and in favor of a defendant on trial on a traffic charge. This is probably the result of expecting more than average performance from our better than average trained police officers. When a police officer leaves a court room understanding thoroughly why he lost his case, most of the battle for morale is won.

It should be understood that the mere riding of a motor bicycle is, in itself, a hazard and when a police officer is required to risk death at 75 miles per hour to apprehend a 60 or 65 mile speeder, in fairness and in justice he has a right to assume that, if proven guilty, the courts will cooperate in the interests of public safety to the extent of imposing a reasonably adequate punishment. Failing in this, because of a wrong policy of administration, because of politics, or for whatever other reason, the Courts will reap for the public a harvest of ruined police morale.

The conclusion is inescapable, that to achieve real results in traffic law enforcement, all of the law enforcing agencies, police, prosecutor and the Courts, must cooperate.

"Fixing" of Traffic Arrest Tickets

The subject of "fixing" of traffic arrest tickets is a delicate one, but it is plain hypocrisy to blind one's self to actual fact. A well known police official once made the remark:—"The reason we have crooks and gangsters is that you people fix your automobile traffic tickets". This statement may on the surface sound absurd to you, but I remind you that it is only a step from parking violations to speeding, to drunken driving, to larceny, to burglary, to robbery while armed, to murder.

In the matter of "fixing" there is no middle ground—either the situation must be wide open or very tightly closed. I convinced myself long ago that if the situation is closed tightly so that one politician is not able to accomplish things where another cannot, everyone is quickly satisfied and you begin to make great inroads upon the traffic accident problem, and your judicial institutions are held in greater respect and esteem than ever before.

I admit that political pressure in our city is not so great as in many others which are larger, and the type of moral courage necessary to end a vicious practice is less than it would be in some other localities. The remedy is probably life appointments for judges instead of election, but in the end moral courage must play the important part.

The Arrest Ticket System

It has been customary in most cities for the police to issue a ticket to the offender at time of arrest, requiring his appearance in Court. Some five years ago we experimented with this system in Evanston for about six months. We kept an accurate record of the defaults and found that 60.73 per cent of those persons to whom tickets were issued failed to appear in Court and that our own residents were no better in this respect than non-residents. The percentage will vary with different localities, but in almost any locality the issuance of the courtesy ticket to the motorist is an inefficient practice. Granted that when warrants and capiases against the defaulters were issued, we were able to apprehend nearly all of them, think of the economic loss to the taxpayers when, with our small volume of business, it takes the full time of twelve bailiffs to serve the process. In a much larger city than ours, it may require the services of 100 or 200 men. I am advised by our Bailiff's office that an average of two trips is required to apprehend one defaulter, and in some cases as many as 15 to 18 trips are necessary.

To rectify the difficulty, a general order was entered requiring that all offenders, except in the case of illegal parking, be taken forthwith into custody and that all offenders be required to post a cash bail, real estate bail or an authorized motor club bond card to effectuate their release, except that a bona fide resident, able to identify himself as such, might be released upon his own personal recognizance.

Immediately the change was felt. This procedure alone has contributed in no small degree to a drop in traffic accidents and eventually to a drop in traffic arrests. The policy did not meet with general approval at first but was clung to tenaciously and to-day is well settled. The traffic offender is now sure that the law enforcing authorities mean business and that traffic violations are no longer a sport but an extremely anti-social thing.

I believe that it will not be long before Illinois adopts a personal driver's license law. If this is done, I should like to see the following suggestions incorporated:

First: Every person accused of a violation of the motor vehicle laws (except for certain specific offenses of exceptional gravity, such as tampering with motor vehicles, etc.) shall have the right to post, in lieu of all bail, his driver's license. The section of the law should be mandatory upon the officer requiring bail but only permissive or optional, so far as the accused is concerned.

Second: A uniform form of receipt for the license, printed by the state, should be issued by the officer taking bail, which receipt should state the trial date on the face thereof, the same to be written *in ink*. In case the accused is stopped by an officer who demands to see his driver's license the receipt shall operate to pass him up until the trial date, but *not thereafter*. Any extensions or postponements should be endorsed by the minute clerk on the back of the receipt and over his signature and the seal of Court.

Third: Upon default in Court the Court shall enter an order cancelling the driver's license.

Fourth: Upon petition filed and due cause shown, after a hearing the Court may order the license restored.

Fifth: Proper penalizing sections for fraudulent issuance, possession and alteration of the receipts should be included.

This type of legislation would encourage the practice of actually taking traffic violators into custody instead of issuing traffic arrest tickets, because it would furnish a convenient form of bail for the public, since the driver's license is required to be carried on the person of the operator. It would from the law enforcing standpoint reduce the defaults in Court to a minimum, because cancellation of the license to drive would be the penalty for default. It would eliminate or reduce to a minimum the practice of fixing because the person accused would be very careful to whom he delivered the receipt for his driver's license. Failure to accomplish on the part of the fixer would result in a cancellation of license which could not be set aside. Racketeering with cash bails in rural communities, which we hear so much of nowadays, would be practically eliminated because there would be few cash bails to racketeer with.

Delay in the Administration of Justice

The great ally of the guilty defendant is delay. Time goes on, witnesses scatter and in many cases die, facts become hazy, interest in prosecution is lost, and in general, there is a miscarriage of justice.

We had tried to speed up the trial of traffic cases, and to keep witnesses from losing interest. We advised our prosecutors not to subpoena witnesses for the state so as to bring these witnesses into Court the first time an accident case was called, because we found that somewhat less than 8 per cent of defendants were ready for trial. Ordinarily a defendant will request a postponement upon the first time up because he desires to employ counsel, investigate for witnesses and for other reasons. Witnesses are accordingly subpoenaed for the second time the case is called for trial, and in this way there is less loss of time and a general better feeling toward the law enforcing authorities.

We found, however, that defendants learned that the easy way to delay the trial of cases was to demand trial by jury. Our volume of business did not warrant keeping a jury on hand at all times, which is an expensive proposition, and we were required to put all jury cases upon a jury calendar. This calendar took an average of six months for a sufficient number of cases to accumulate to make it economically efficient to call a jury. When the jury was called and these jury cases were reached for trial some 86 per cent of them waived a trial by jury, and submitted the cause to the Court.

We found the remedy through the state legislature, which has authorized the borrowing of jurors already drawn by other courts of record at the county seat. To-day when a jury demand is made we impanel a jury the following morning, having borrowed it from the Criminal Court of Cook County.

Traffic cases demand two things from a court in order to operate as effective deterrents to further massacre upon our highways; (1) speed and (2) certainty of punishment for the guilty offender.

The Courts in my judgment should do all in their power to speed the administration of justice. It is not too much to say that half a loaf in record time is better than a whole loaf too late. An innocent person accused of crime has a right to have himself cleared speedily as well as the state has a right to have a guilty one convicted speedily. One of the greatest contributions which can be made by the Courts toward lowering the accident rate in America is to speed up the administration of justice.

Punishment of the Guilty Offender

The purpose of punishment is not revenge but deterrence. No punishment is well placed which does not strike directly at the guilty offender. An example of what is meant by this is the typical offender between the ages of 16 and 21 years; who lives with his parents at home and operates the family car. In cases of this type fines are ineffective because they glance off the offender and usually penalize the innocent.

The personal driver's license law with its revocation feature is the greatest asset to the Courts in striking directly at the offender. We, in Illinois, who are interested in the traffic accident problem hope that this beneficial legislation will not be long delayed.

In the meantime, we have met this problem by remanding the guilty offender of the type just mentioned to probation, including a condition against operating any motor vehicle during the probation period. It is difficult, of course, to keep track of the offender and to learn whether probation has been violated, but driver's license laws are open to somewhat the same objection. This same system has been used in Evanston to prohibit physically unfit persons from operating motor vehicles with some success.

First Offender and Repeater

Less than two weeks ago I heard a prominent traffic judge make this remark publicly—"If I could distinguish in my Court between the first offender and the repeater, I would concentrate upon the repeater and give the first offender a break."

I have an infinite respect for this man because he has shown rare moral courage upon all occasions and is pursuing a course which he conscientiously believes will materially assist in lowering the accident rate. However, I insist that this is not a good traffic policy. *In our city we have made it a practice of concentrating upon all offenders.*

I submit to you that the time to encourage a respect for your traffic laws is the first time an offender has been summoned into Court. Teach him respect for the law at this time by a fairly stiff penalty and you have cut him definitely from the ranks of the repeaters.

The great difficulty with the American public to-day is that the appalling loss of life upon the highways due to automobile traffic has not struck home, and this is due in part to the fact that the Courts have not taken a stand calculated to bring home the magnitude of the traffic violation.

WEDNESDAY BUSINESS SESSION

October 16, 1935

The meeting was called to order, in the absence of the General Chairman, by Vice-Chairman William C. Knoelk, Chairman, Milwaukee Safety Commission, Milwaukee, Wis. Reading of the usual minutes was formally dispensed with. The following reports of committees were then presented:

Developments in the Field of Traffic Accident Record Keeping During the Year 1934-35

Report of Committee on Accident Records

By W. W. MATTHEWS

Director of Safety, Bureau of Highway Patrol and Safety, Department of Motor Vehicles, Harrisburg, Pennsylvania

1. The Accident Situation

According to present indications the traffic accident toll will be about the same in 1935 as it was in 1934. For the first eight months of this year motor vehicle fatalities were only a fraction of one per cent less than in the corresponding period of 1934.

2. Cities Which Cooperate in Sending Reports

A considerable increase has occurred in the number of cities preparing monthly summaries of motor vehicle accidents. For August 1934, 208 cities sent reports to National Safety Council headquarters, whereas in August 1935 there were 262 reporting cities.

3. States Analyzing Accidents

Several states have shown increased interest in accident analysis during the past year. *Colorado* has started the preparation of monthly summaries beginning with January 1935. In *Illinois* a compulsory accident reporting law went into effect July 1 and the State Motor Vehicle Department has its accident reporting arrangements complete and will shortly start issuing monthly summaries. In *Minnesota* the monthly analysis of motor vehicle accidents which was started in 1934 has been continued and elaborated. In *Ohio* monthly reports started last year have been continued and expanded in scope. These reports are unique in that they are entirely rural, excluding all municipalities. *Utah* has started preparation of reports, putting into effect its compulsory reporting law.

4. Publishing National Data

The 1935 Edition of Accident Facts, the Council's annual statistical report was considerably enlarged and improved. A special edition was prepared for motor vehicle accidents only and was widely distributed. In addition to the annual report, the monthly summarized data appearing in PUBLIC SAFETY has been expanded so that considerably more information about the national accident situation is available currently.

5. Cooperation with Other Organizations

Mr. Walter Matthews, chairman of this committee, is also chairman of a similar committee in the American Association of Motor Vehicle Administrators. The Motor Vehicle Administrators at their recent convention in Chicago accepted a comprehensive report from the Accident Research Committee, which will serve to

strengthen the work of this committee by its official approval of uniformity in accident record keeping among the various states.

6. New Method of Analysis

An interesting development of the past year has been the development of what may be called the "two-direction" method of analysis. Up to this time, most summarizing of motor vehicle accidents has been done on the basis of single actions of automobiles and pedestrians. It is now believed that a much clearer picture of how motor vehicle accidents occur can be obtained by classifications which show what both vehicles were doing in the accident. For example, the proposed new tables will show how many accidents occur at intersections when one vehicle is making a left turn and the other is going straight. It is anticipated that forms to provide for this new information will be distributed prior to the first of the year and interested cities and states can try out the suggestion.

1935 Headlighting Committee Report

By R. N. FALGE

Research Engineer, Guide Lamp Corporation, Anderson, Ind.

Experience over a long period has proved that substantial and lasting improvement in headlighting conditions involves the cooperation of those who design and build lamps, who install them on vehicles, who make laws and enforce them, who drive behind the lamps and have to meet them, and who are responsible for servicing them. The real headlighting problem is that of standardizing on a system of lighting control which all of these various interests can honestly support and help to put into practice.

The single beam headlighting practice, which is still specified by law in various states, requires that the main beam be so aimed as to compromise between glare and road illumination. This would be ideal if it worked. In practice, the obstacles which the driver must see at a distance of several hundred feet ahead, to drive safely at the legal speeds when he is alone on the road, are only slightly below the level of an oncoming driver's eyes. Also loading the rear seat in the more numerous short wheelbase vehicles raises the beam as much as six feet at a distance of three hundred feet ahead. A slight rise in the road disturbs the aim even more. Consequently, no compromise aim is possible which may be expected to be satisfactory to both the driver behind the lights and the drivers he meets.

The multiple-beam practice, specified in the latest revision of the Uniform Vehicle Code, states that headlamps shall provide at least two beams, one aimed high enough to reveal obstacles at a distance of 350 feet ahead, another aimed to avoid glare, the driver to be responsible for using the proper beam. When the beams are correctly adjusted and used this system incorporates all of the elements needed to satisfy both the driver behind the lights and the other users of the highways. It is sanctioned by those who design and build lamps, and those who install them on vehicles, as evidenced by the fact that all cars produced during the past seven years have been equipped with multiple-beam lamps. It should meet with the approval of service men since it permits them to adjust lamps in such manner as to please their customers. The only question in the minds of law makers and enforcement officials is whether motorists generally could be taught to use their beams properly. Experience in localities where drivers are encouraged to change to the lower beam when meeting provides ample proof that there is little to fear from this standpoint. It is apparent then that the multiple beam practice incorporates all of the elements needed to gain the support of everyone concerned.

In 1933, the National Safety Council went on record in favor of the multiple-beam practice and agreed to advocate adoption of this practice in the Uniform Vehicle Code and in all state laws, supplemented by adequate enforcement. It agreed to conduct an intensive educational campaign designed to encourage proper adjustment and usage. It assumed the responsibility for leadership in this field.

The problem now is to so direct our efforts as to reduce the multiple-beam system to actual practice on our roads all over the country at the earliest possible

date. The lamps themselves are of excellent design, thanks to the efforts of the automotive industry in cooperation with interested technical societies and enforcement officials responsible for state approvals. More than three-quarters of the cars on our roads are equipped with multiple-beam lamps capable of being serviced and adjusted in such manner as to provide fairly satisfactory results on the road. A recent improvement, which in no way replaces the need for the required upper and lower beams, is the added country meeting beam, aimed high on the right and low on the left, thus making possible distant visibility without glare. This part of the problem may be considered as well in hand. Other phases of the problem are legislation, enforcement, service and driver education.

The foundation was laid for constructive and substantial improvement in the legislative situation in years to come, when the National Conference on Street and Highway Safety incorporated the multiple-beam practice in the Uniform Vehicle Code in 1934. The active support of the National Safety Council was most helpful in bringing this about. In 1934, the National Safety Council approved the new Uniform Code headlighting provisions and agreed to use its influence to promote their adoption by the various state legislatures. They were brought to the attention of members of the American Association of Motor Vehicle Administrators last fall. Progress in securing their adoption during the general legislative sessions earlier this year was rather disappointing. Pennsylvania is the only state which incorporated them in its law. Bills introduced in other states were sidetracked, presumably because of the pressure of other matters. It is hoped that more pressure will be brought to bear during the sessions in 1936, thereby paving the way for general action in 1937. Meantime, experience in Pennsylvania should help to prove the advantages in the multiple-beam practice.

Careful observation has indicated that legislation without adequate provision for enforcement is relatively ineffective. In parts of the country where there is no enforcement, motorists do, as a rule, use their lower beams to avoid glare when meeting. They would do a better job if encouraged by active enforcement. In these same parts of the country, motorists exhibit very little interest in lamp efficiency and adjustment, so little, in fact, that very few mechanics know how to service lamps properly. Experience indicates that motorists will be glad to take advantage of expert lamp service when it is offered by service stations and they realize its advantages. Enforcement appears to offer the quickest method of creating this demand.

To satisfy the motorist, the service station must do a good job. A good job involves adequate equipment and a trained operator. The real headlighting problem is that of devising ways and means to induce service men to learn how to service lamps accurately and completely.

The brightest spot in the headlighting picture is the recent trend toward state and municipally operated inspection stations. The Evanston station is an excellent example. Inspection is based on the Uniform Vehicle Code specifications. Thorough inspection involves quite a list of items. Lamps must be bolted securely in place. Lenses must not be cracked or broken and must be right side up. Lens plates must be straight, up and down. Lenses, marked "right" and "left" must be so installed when viewed from the driver's seat. Multiple-beam lenses must carry the same name as that on the lamp body. All bulb filaments must light. Reflectors must be clean and bright. Electrical circuit resistance must be low. Beams must be substantially in focus. Beams must be correctly aimed, sideways and up and down. Switches must turn on the proper filaments. Evanston officials report that all of these items can be properly checked within the minute or so available for each car.

All of these inspection operations are fairly simple and straight forward, except those which apply to beam aim. It is here that inspection officials will have to exercise good judgment in selecting aiming limits which will insure safe lighting on the road. The Uniform Vehicle Code specified that the upper beam from multiple-beam headlamps shall be of sufficient intensity and so aimed that it will reveal obstacles at a distance of 350 feet ahead. This means that some portion of the high intensity area in the beam must reach the object, both when the vehicle is loaded and unloaded. Evanston aiming limits are based on the assumption that the obstacle will be revealed if some part of the upper beam "hot spot" is aimed straight down the road at the lamp center level for all conditions of load. This calls for very close limits in the case of the short wheelbase five passenger cars which constitute about 60 per cent of the vehicles on the road. The upper beam hot spot usually is from

seven to ten feet deep at 350 feet ahead. On the other hand, the beam raises as much as seven feet at 350 feet ahead when the rear seat is fully loaded. In other words, if the lamps are aimed so that the upper edge of the "hot spot" is horizontal when the vehicle is empty, quite often the lower edge of the "hot spot" will be horizontal when the vehicle is fully loaded. To insure safety at legal speeds, lamps on these vehicles must be aimed very accurately. For other types of vehicles, where beam aim is less affected by loading, somewhat wider limits are permissible.

The trouble with such close limits is that they will pass a relatively small percentage of the vehicles on the road, so few that motorists might be inclined to object. Evanston has solved this problem by dividing approvals into two classes. Vehicles which meet the above requirements receive an unqualified approval. Vehicles outside these wider limits are rejected. As Evanston officials put it, if the vehicle receives an unqualified approval, we say to the driver "Your car is in good condition—if you have an accident, it will be your own fault and not the fault of the car." If the vehicle receives a qualified approval, we say to the driver "Your car barely meets the legal minimum but it is not really in good condition and we advise, for your own sake, to have it fixed." If the vehicle is rejected, we say to the driver "Your car is in such bad condition that we cannot permit it to be operated on the streets of this city—you must have it fixed at once and bring it back for another inspection."

The issuance of two classes of approvals has an excellent moral effect on both the driver and the service mechanic. The driver knows that if he has a night accident he may have to explain to the judge why he was operating with a qualified approval. The service mechanic knows that every one of his jobs will be checked and that very few of his customers will accept a qualified approval. This forces him to learn how to adjust lamps to meet the higher standard. State and municipally operated inspection stations look like the real answer to the service problem.

Nation-wide efforts to impress upon motorists the need for proper headlamp maintenance and adjustment and the need for using the meeting beam when passing other vehicles, still look like something to anticipate in the future, after the legislative situation has been straightened out. It is not feasible to broadcast the suggestion that upper beams be aimed high enough to reveal obstacles at a safe distance ahead, so long as that practice is prohibited in some states. Neither is it in the interests of safety to recommend that the lower beam be used for meeting in states where laws specify that the upper beam shall be aimed low enough to avoid glare. The single-beam and the multiple-beam systems conflict basically to such an extent that suggestions must necessarily be so very general that they are of little value.

Inspection stations and competent service stations provide very excellent mediums for localized educational efforts. Personal efforts could be supplemented to very good advantage by a simple folder, properly illustrated, giving the individual motorist full information on the subject.

Recommendations

1. That the Council continue to promote actively the adoption of the Uniform Vehicle Code Lighting Provisions by Legislatures in all states.
2. That the Council actively promote well equipped inspection stations, divorced from service.
3. That the Council recommend to the American Standards Association which has assumed the responsibility for inspection station aiming limits:
   (a) That they base their limits on the lighting provisions in the Uniform Vehicle Code.
   (b) That they provide for two classes of approval, full and qualified.
   (c) That they consider the effect of wheelbase lengths as well as loading in arriving at aiming limits.
4. That the Council prepare for general distribution to motorists by inspection stations and service stations, a leaflet which points out the advantages to be gained by efficient lamp service and which instructs the motorist how to use his beams to best advantage.
5. That the Council recommend to the automotive industry that future headlamps incorporate, in addition to the conventional required upper and lower beams, a meeting beam which is aimed high on the right and low on the left, and which is essential for pedestrian safety when passing on country roads at modern speeds.
6. That the Council recommend to the automotive industry that all future headlamps be so designed that beams intended for use when meeting other vehicles provide relatively high illumination on the road surface on the right hand side as a means for encouraging drivers to use the proper beam when meeting.
7. That the Council rewrite this report in popular form, supplemented by suitable illustrations, and submit it to the various trade journals and other publicity mediums for publication.

E. B. Lefferts, chairman of the Committee on Pedestrian Problems, submitted a Resolution on Highway-Walkways referred to this meeting by the joint session of the Street and Highway Traffic Section and the Institute of Traffic Engineers, at which the Resolution had been presented as a part of the report of the committee. The Resolution was formally adopted, as follows:

Resolution

WHEREAS, the very term "highways" always has included a "way" for both pedestrians and vehicular traffic, and

WHEREAS, national traffic accident statistics disclose that for the past several years pedestrians killed in traffic while walking along rural highways rank second in the causes of motor vehicle-pedestrian deaths; and

WHEREAS, it is known that highway commissions of certain states are prohibited by state law from constructing highway sidewalks; and

WHEREAS, it is known that many lives and much human suffering could be spared by the construction of highway sidewalks; now, Therefore,

BE IT RESOLVED, that the Street and Highway Traffic Section of the National Safety Council strongly recommends that all states adopt the suggested draft relative to powers conferred upon state highway commissions included in the 1935 report of the Committee on Pedestrian Problems and which is quoted herewith. (This is identical with the recommendations of the Highway Sidewalks Committee of the American Society of Municipal Engineers):

1. "In addition to the powers conferred upon the (State Highway Commission) it shall be lawful, and the (Commission) is hereby authorized, directed, and empowered to construct paths or sidewalks and curbing along state highways and other roads and highways, subject to the jurisdiction of the (Commission) from any moneys available to said (Commission); and further is empowered in connection with such construction, as aforesaid, to enter into agreements with counties and other municipalities to share in the cost of such construction, and thereafter of the maintenance and reconstruction of such paths, sidewalks, and curbing so constructed."
2. "From the time of completion of adequate highway sidewalk construction as provided in Section 1 above, all pedestrians are directed to use such sidewalks, and it thereafter shall be a misdemeanor for pedestrians to use roadways and shoulders thereof provided for vehicular use except to the extent that such use is necessary for crossing the roads and then in accordance with laws and rules covering such crossing of the highways."

The Nominating Committee, consisting of Messrs. Theodore M. Matson, Chairman, John P. Arnoldy, W. F. Irvin, S. V. Lynch, W. B. Martin, J. W. A. Bollong, and C. R. Stroup, recommended amendment to the by-laws of the Street and Highway Traffic Section by striking out upon the list of standing committees in Article VII, the Committees on Publicity, Enforcement and Police Activities, Traffic Engineering, Rural Highway Hazards and Pedestrian Problems, leaving as the specified standing committees of the section those on Annual Congress Programs and Accident Records. It was voted to adopt this amendment.

The Nominating Committee then presented its slate of 13 names to constitute the Executive Committee of the section for 1935 and 1936, together with the two past general chairmen, ex officio, and the Secretary appointed by the Managing

Director of the National Safety Council. This slate of officers was elected by the members present. (The list of new officers will be found immediately following the list of officers who served during 1934 and 1935, preceding the detailed Transactions of the Street and Highway Traffic Section in this volue.)

WEDNESDAY AFTERNOON SESSION

October 16, 1935

The session was called to order by W. J. Davidson, Technical Director, Sales Section, General Motors Corp., Detroit, Mich., who presided.

Demonstration of Effect of Alcohol on Driver Reactions

By DR. H. A. HEISE

Milwaukee, Wis.

The purpose of the demonstration was to indicate that amounts of alcohol too small to produce obvious intoxication do affect drivers. The most convincing experiments would have to be made in actual automobiles on the street, but the difficulty of doing so before an audience, and the dangers involved, make this out of the question, although such experiments have been carried out under controlled conditions. As a substitute, therefore, a series of simple tests was arranged to represent some of the elements of driving. These tests were first given at the beginning of the meeting, after which the subjects retired to consume predetermined amounts of alcohol and returned at the end of the meeting to repeat the tests.

The testing of the subjects was done in the presence of the audience to demonstrate certain methods which are actually employed in obtaining scientific data concerning the effect of alcohol on drivers of automobiles.

While the methods demonstrated were scientific, the results of the tests cannot be construed as scientifically conclusive, because of the small group of subjects and the fact that in the thirty minutes available none of the drivers could be given the tests enough times to establish his average performance, because giving such tests in an auditorium before an audience has, in itself, a substantial and unmeasurable effect on the performance of those taking them, and because the remainder of the program caused frequent interruptions and confusion.

Out of a group of men sent for the purpose by the Commissioner of Public Safety of Louisville, six adult male volunteers were chosen as subjects.

Four Tests of Alchoholic Influences

While Dr. Heise explained the significance of the tests and their nature, the actual tests were being given by four people assisting him. The first two tests were quite simple, the last two more complicated.

Test No. 1—*Reaction Time* was made with the "reactometer" developed by the Aetna Life Insurance Company. It measured to the nearest one-eighth of a second the time elapsing between the appearance of a red light and the time that the "driver" could move his foot from the accelerator and begin to apply pressure on the brake. The score was the average of five trials, and the impairment or improvement after drinking was calculated as a percentage change in the score.

Test No. 2—*Card Sorting* required the subject to sort a shuffled deck of cards according to suits, his score representing the time taken. Improvement or impairment after drinking was indicated by the percentage of decrease or increase of these times.

Test No. 3—*Typewriting* required the subject to copy about 200 words including two sentences each containing all of the letters in the alphabet. The time required was measured and the number of errors counted. Improvement and impairment were measured by the percentage change.

Test No. 4—*Eye-Hand Coordination* was measured by an aiming test in which the subject thrust a metal stylus into a series of holes of decreasing size in a metal plate, which indicated by electrical contacts whether the aim had been accurate. The thrusts were made in time with a metronome. The score was the number of the smallest holes successfully penetrated. Impairment or improvement was indicated by the relative areas of the holes. Each subject made five trials.

Following the first series of tests, the six subjects were given "cocktails." Two received drinks which contained no alcohol, two received two ounces of 100 proof whiskey, and the remaining two received four ounces. Approximately an hour and a half elapsed before the second set of tests were given, and in the meantime, specimens of urine were obtained from three of the subjects.

As might be expected from the small number of trials, there was considerable variation in the results obtained.

The reaction time test showed an improvement for some men, an impairment for others, but no distinction between those who had had drinks and those who had not.

In the card sorting test, all of the subjects showed impairment probably because of the great confusion which prevented concentration while they were taking the second test. No differentiation was discernable between those who had had alcohol and those who had not.

In the typing tests, the drivers who had not had drinks showed an improvement whereas those who did have drinks showed an impairment in every case. A particularly interesting highlight in this connection was the fact that after drinking most subjects became faster in the typing test but the number of errors increased to such an extent as to more than offset the advantage in scoring gained by the added speed. This reaction—greater speed, less care—is one encountered all too often following motor vehicle operation after ingestion of alcohol.

All Drivers Showed Impairment

In the hand-eye coordination tests, all drivers showed an impairment. The drivers having had no alcohol, however, showed only small impairments, whereas those having had alcohol all showed greater impairments.

The specimens of urine were analyzed for the purpose of correlating this experiment with the demonstration of the court trial of an intoxicated driver.

Although no scientific conclusions can be drawn from such a small series of tests, the methods used in determining the effects of small amounts of alcohol upon the mental and physical reaction of individuals were demonstrated. In the simpler tests, which correspond roughly to those usually applied to detect intoxication (for example, walking a straight line), the subjects who had been drinking were able to pull themselves together well enough to give a creditable performance. However, in the more complicated tests (typewriting and hand-eye coordination) which required more delicate controlment, there was some differentiation and those more nearly represent the situations involved in critical driving.

None of the subjects would be considered under the influence of alcohol by physical examination alone and the percentage of alcohol found in the urine was less than that found in obviously intoxicated persons. It appears, therefore, that there can be little doubt that even small amounts of alcohol produce demonstrable deleterious changes in the driver which make him less able to cope with situations requiring good judgment and accurate reactions.

Driver Fatigue—Its Importance and the Remedy

By J. STANNARD BAKER

Fleet Engineer, National Safety Council

The first stumbling block in studying the subject of fatigue as related to traffic accidents is the fact that we do not know what fatigue is or how to measure it. It is a general term used to mean weariness, drowsiness, because of remaining awake past a habitual bed-time, muscular or mental exhaustion due to prolonged activity, or any one of a number of other conditions which may cause a driver's efficiency to decrease.

In exploring this field, we first ask how many accidents are caused by fatigue, and by referring to the available statistics, we find two items in the ordinary tabulations which will shed light on the matter: first, accidents in which the driver was reported to have fallen asleep, and second, those in which extreme fatigue was noted. *The former constitute about one per cent of all accidents; and the latter appear to* be about half as numerous. There is reason to believe, however, that at least twice as many, and possibly five or six times as many accidents occur when drivers fall asleep as are reported

Driver asleep accidents are frequently not reported for the following reasons:

1. The driver or his companions or both are ashamed to attribute the accident to this cause and blame it rather on faulty highway, faulty car, or on other drivers.
2. The drivers or passengers do not know what happened.
3. The driver is killed while alone in the car, and the true circumstances never do develop in the report.

Hence the driver-asleep accidents are not adequately represented on reports accumulated by state motor vehicle departments. This statement is corroborated by the fact that the percentage of such accidents turns out to be higher where the tabulations are based upon the careful investigations of official investigators rather than reports made by drivers.

Not all accidents in which the driver is reported to be asleep are due to fatigue A similar effect is created by small amounts of carbon monoxide which cause gradual poisoning. Monotony is another condition which will put to sleep some drivers who have not been at the wheel anywhere near long enough to suffer from appreciable fatigue. Driving on smooth highways at night in the country in a modern closed car is such an uneventful experience that it is likely to induce slumber. Small amounts of alcohol, heavy eating and warm weather may also create physical conditions resembling fatigue which result in sleep on the part of the drivers.

Many fatigue accidents also occur which are not the result of a driver falling asleep. In fact, they are probably more numerous than the present statistics will show although it is doubtful whether sufficiently accurate reporting will ever prevail to give us a true picture of this condition.

It has been clearly demonstrated by psychological experiments, and by investigations of fatigue in industry, that quickness, accuracy, strength, vision, judgment, and other personal characteristics are impaired by fatigue, and that this impairment is extremely serious when the fatigue is severe. It is only when the driver has been on the road a frightfully long time and excuses his accident by saying he was tired out that the fact is likely to appear in the tabulation from which we are obliged to gather our information concerning the causes of automobile accidents.

From the figures on driver-asleep accidents some interesting facts are clear. Such accidents are most numerous between 3 and 5 a. m. for private cars and between 5 and 7 a. m. for trucks. They are least numerous at noon and at about 8 p. m. Driver-asleep accidents are much more serious than ordinary accidents; for the same number about twice as many result fatally. This is probably because drivers strike fixed objects or other vehicles without any attempt to reduce by braking or to minimize the collision by swerving A larger percentage of truck drivers are involved in driver-asleep accidents than passenger-car drivers. Driving excessively long hours is a common practice on American highways; but starting trips after considerable periods of wakefulness (occasioned by work or even waiting) is equally important in producing dangerous fatigue.

Legislatures or public utility commissions have passed rulings in 42 states limiting the hours of driving for commercial vehicle operators. These laws have had practically no effect in reducing the accidents, however, because except in a few isolated cases, they have received no enforcement. In one state, Delaware, the power of the secretary of state to suspend driver's licenses was effectively employed by assuming that drivers on duty over a certain period were physically unfit, and forthwith suspending licenses until a rest period had been completed.

Our inventors have also been busy. A score of devices have appeared on the market for rousing drowsy drivers. They range all the way from radios to special electrical devices. Chemicals and drugs to be taken internally as stimulants are on sale at many filling stations and wayside eating places and though effective for a short time usually result in a more sudden and severe onslaught of fatigue.

Pet methods of keeping awake are almost as numerous as the drivers who stay too long at the wheel. One will pick up hitch-hikers to talk to them while another will carry an onion in the pocket of the car so that dry eyelids may be effectively irrigated

All of these devices are intended to do away with the symptoms of fatigue, and are no remedy for it. Although they may keep the driver awake, they do not restore exhausted faculties to normal. The only effective remedy is rest. A relatively small amount of this will often help wonderfully in case of emergency. A good practice to prevent monotony and carbon monoxide from being the cause of so-called "fatigue" accidents is for drivers to leave the car for a few minutes at least every half hour.

Drowsiness is a danger signal for this kind of accident Its suppression is worse than neglecting a knock in the engine, a flat tire, poorly adjusted brakes, or a disconnected horn. Fatigue accidents are nearly all preventable. No other type of automobile accident gives such an unmistakable and insistent warning of impending danger. They do not come upon the driver unawares like a child running from behind a parked car, or like the failure of a steering gear, or a blow-out.

Discussion of Driver Fatigue

Dr. Andrew H. Ryan, consultant in industrial hygiene, Chicago, who has conducted a long series of experiments on the fatigue effects of driving, for the Dodge Brothers Corporation, presented some new data.

For several months ten drivers were given certain tests before and after a long day's drive. The tests included postural steadiness, vascular skin reactions, hand and eye coordination, visual acuity, complex reaction and mental addition. The impairment in the driver's ability before and after a day at the wheel was calculated, and a measurable loss of efficiency of performance was noted after a day of automobile driving.

In the course of the experiments four of the drivers had fairly serious accidents. With remarkable similarity, these drivers showed unusually poor performance on the morning tests on the days on which they experienced accidents, especially in the errors made in the complex reaction tests and in hand and eye coordination.

This experience also indicated that road accidents are more apt to happen after the onset of fatigue. This may account for the accident rate increases generally observed in the late hours of the day. The accident experience in connection with these fatigue tests indicated that the most hazardous period for drivers who start out on the road at eight o'clock in the morning is between 7:45 p. m. and 6:15 a. m., after continuous driving of 250 to 300 miles. The drivers were standardized to approximately 300 miles, of which about 40 miles were city driving.

Inspecting Vehicles for Safety

By DAVID BEECROFT

Bendix Products Corporation, New York City

There are two major systems of vehicle inspection in use. The oldest is the Pennsylvania system, in which the motor vehicle department appoints what are known as official inspection stations, where vehicles are inspected twice a year. These stations are selected from automotive repair shops, garages, fleet owner stations, etc., and provided with official signs that designate them as such. They are also provided with complete instructions covering every detail of inspections.

The newer system may be designated as the Delaware system, in which the state purchases its inspection equipment and operates the equipment by its own testers or inspectors. The state has five separate sets of testing equipment, some of which are permanently located in Wilmington, and others moved from place to place to meet the convenience of the motorists. The Delaware system has the advantage that nearly all vehicles are inspected on the same equipment, which should mean a more uniform standard of inspection.

There is a third system of inspection known as the California system, very similar to the Pennsylvania. California has not an official inspection of each vehicle, but the law authorizes the California highway patrol to make inspection of vehicles and to remove from the highway any vehicle found to be unsatisfactory for safe travel. California authorizes official stations for inspecting brakes and headlights.

Although eight states, California not included, have had vehicle inspection programs for a number of years, none of them can point to any commensurate reduction in accidents, notwithstanding the earnest endeavors of the authorities to carry out the best enforcement possible. Some of the large population states cannot show a fraction of 1 per cent reduction in accidents.

It would be unfair, however, to condemn vehicle inspections because measurable results cannot be shown, as there might have been in these states a measurable increase in accidents if the inspection program had not been in force. The inspection programs have been responsible for a more complete system of accident reporting. More minor accidents have been recorded. It must also be recorded that vehicle mileage has been increasing, vehicle speeds have been stepped up and other factors such as prohibition repeal have had their influences. Highway improvements and increased vehicle speeds have brought the driver face to face with a new set of driving conditions in which the *judgment* of the driver has become an immeasurably greater factor in highway safety than it was under the regime of poorer highways and lower speed vehicles.

In the Delaware system, where the state owns and conducts its own inspection, vehicles are given inspections of brakes, lights, steering, mirrors, reflectors, windshield wipers, license tags at a rate as high as 80 vehicles per hour, perhaps higher. A careful inspection is made, but there are many factors that enter into the safety of a motor vehicle that are not inspected and cannot be inspected if such a speed is maintained.

Take as an example the inspection of brakes: The test measures the braking capacity of each wheel and indicates the ratio of equalization between the brake capacity on the right side of the vehicle as compared with the left side. This is not enough. There are several important factors connected with braking systems that influence emergency brake application that cannot be correctly measured in such a test. There should be a visual inspection of the entire braking system, which would include examining for broken spring leaves, loose or missing spring clips, loosened spring bolts anchoring the spring to the axle, worn shackle bolts, loose wheel bearings, excessive grease on brake drums and mounting plates. Spring sag is another important factor that effects the steering of a car at speed on the highway and also influences the behavior of a car in a sudden brake application.

The position of the brake pedal with maximum brake application should be noted and if there does not remain at least one inch of additional travel before resting on the floor boards, an adjustment should be required.

Vehicles with mechanically actuated brakes should be inspected for ascertaining if all connections are secure, no cotter pins missing, and all parts securely attached to the chassis.

Vehicles with hydraulically actuated brakes should undergo a visual inspection of hose and lines carrying the fluid for actuation as well as inspecting for leaks of fluid from the line. A recommended test is to hold the brake pedal depressed for one minute and note if there is any additional pedal depression during that minute. Such would indicate a liquid leak.

Commercial vehicles with air brakes, in addition to a stop test, should have a visual inspection of all parts of the brake system and a final test to see if the air system is tight, and will retain the air pressure set by the governor for a fixed period.

Commercial and passenger vehicles fitted with vacuum power brakes should have a visual inspection and also a test to ascertain if the vacuum system is adequately functioning.

If official inspection is going to be relied upon to maintain that measure of safety that was built into the vehicle, or reasonably approach it, then we must be thorough in our inspections. If speed of inspection is permitted to dominate then we are not achieving the end we should set out to attain.

Under the Massachusetts-Pennsylvania system a much more thorough examination is called for, the thoroughness depending largely on the capacity and integrity of the service station. Pennsylvania has a most thorough outline of inspection instructions for its service stations, as has Massachusetts, but too frequently reports tell of the instructions not being carefully followed.

Where a state has two inspections per year, it is imperative that the inspection be such that the owner who pays for (not in all states) and is subjected to the inconvenience of the inspection, is entitled to know what variations due to wear are found and should be corrected before his vehicle is approved.

One criticism that has been used against the state-owned inspection stations is that they are not always adequately manned and that local politicians control the appointment of many of the attendants who do the inspecting. This is unfortunate and should not be countenanced.

What reduction in highway accidents can be expected as a result of adequate vehicle inspection?

First let us turn to published statistics by different states in which an honest effort is made to attribute to the vehicle, the driver, the pedestrian, the weather and the highway, etc., the cause of the accident. Some attribute as high as 10 per cent of accidents due to defects in parts or adjustments of the vehicle.

Pennsylvania in the first 6 months of 1935 in a total of 38,326 vehicles laid the blame on 3,670 vehicles or 9 per cent and reported 91 per cent in apparently good condition. Pennsylvania is one of the states earliest in the inspection movement.

In the first 6 months of 1934 Pennsylvania, out of a total of 39,475 vehicles involved in accidents, records 5200, 13 per cent defective or in need of adjustments or repairs. Of these, 2936 were due to lack of tire chains and skidded. The skid may have been due to lack of correct equalization of brakes on opposite wheels. In the same period punctures and blowouts accounted for 355, yet tires are rarely given the inspection that is warranted if inspection is to mean safety.

Michigan reports during July, 1935, that of 2172 vehicles in accidents, 2074 or 95 per cent showed no defects. The figures for June showed 95 per cent of the vehicles with no defects. I do not accept these figures as the last word in accuracy, as we do not know who made the inspection of the vehicles involved in accidents nor do we know how thorough the inspection was.

California in its report for the years 1932, 1933 and 1934 in determining the cause of accidents records that the driver was involved in 82 per cent of them in 1932; 82 per cent in 1933, and 83 per cent in 1934. Here are some of the acts of omission or commission laid to the driver:

Violated right of way	7,104
Excessive speed	2,983
On wrong side of road	2,492
Drove off roadway	2,298
Slowing down or stopping	1,329
Improper turning	1,417

Improper passing	1,023
Reckless driving	1,354

The pertinent question is: What relation may these acts of the driver bear to vehicle condition and vehicle inspection? We are compelled to invade the realm of conjecture, but we have measurable justification for doing so.

For example: 2,298 drove off the roadway. This may have been aided by lack of steering gear adjustment and delicacy as built into the vehicle. It may have been due to a sagged spring interfering with the roadability of the car at speed. Much driving on the wrong side of the road may be due to steering defects that set up a tramp or wander that has to be constantly corrected by the driver.

Accidents due to slowing down or stopping mean rear end collisions and these may be caused by extra good brakes on the leading vehicle and poor brakes on the following vehicle, or due to a failure to signal, or just plain lack of attention by drivers.

This driver and car participation in accidents leads me to make the major statement of this paper:

Motor vehicle inspection possesses the potentialities of being a most considerable factor in accident reduction, providing the possibilities within its scope are adequately realized and providing that an inspection program, drafted to utilize and develop these potentialities, is completely executed.

The average concept of what constitutes a program of motor vehicle inspection will have to be definitely broadened before the reduction in highway accidents hoped for can be realized.

The requiring of every owner or operator of a motor vehicle to present the vehicle for inspection periodically provides a face-to-face contact between the regulatory staff and the drivers that is indispensable. This contact is the cornerstone for injecting into the consciousness of the driver the intent and earnestness of the authorities in their quest for greater safety and also of impressing (convincing, if possible) the driver that he or she, as well as the vehicle, is a dominant factor in this safety crusade.

Vehicle inspection carried out today puts the vehicle on the spot, to borrow a popular phrase, but vehicle inspection if it is to realize the possibilities for good that it possesses, must also put the driver or owner on the spot.

The following is quoted from an opinion of the S. A. E. Committee that has made a broad study of this question:

"More direct supervision of, sympathetic instruction to, and contact with drivers by enforcement officers are essential and the most favorable opportunity for this is afforded at vehicle inspection time. Important as the direct mechanical results of inspection may be in the reduction of accidents, they must be far surpassed by the moral effect of the contact between the inspector and the driver if inspection of the vehicle is to be justified. This is because the great preponderance of accidents are caused by the personal element as represented by drivers and pedestrians."

How can we put the driver on the spot at the time of vehicle inspection?

A brake reaction time test of every driver is possible and very feasible. Many thousands of such tests have been made by insurance companies and by research departments of several of our colleges. These tests show that the average time required for an operator to remove the right foot from the accelerator pedal and get it onto the brake pedal and start depression of the brake pedal approximates .5 of a second. With many drivers it is much higher, reaching 1 second. A driver with slow reaction time can be made conscious of this fact and should be further impressed with the importance of exerting greater care and driving more cautiously.

Ability of a driver to withstand headlight glare is another easy factor to determine; adequate instruments to measure this have been developed. Tests with glareometer have shown that a person's ability to withstand glare diminishes directly as age increases.

A driver should be required to present his accident record at each inspection, and if certain registered drivers are not present at the inspection, they should be required to come in personally. This is not feasible in states that have no driver registration requirements.

It appears certain that many highway accidents are due directly to faulty judgment of the driver, such as failure to judge distances and speeds of oncoming vehicles in passing. Frequently accidents cited as "cutting in" accidents are really due to lack of judgment in estimating vehicle speeds and road distances. The "cutting in" is really to avoid colliding with the oncoming vehicle.

THURSDAY MORNING SESSION

October 17, 1935

The session was called to order by Burton W. Marsh, Director, Safety and Traffic Engineering Dept., American Automobile Association, Washington, D. C., who presided.

When and How Automobiles Skid

By R. A. MOYER

Associate Professor of Highway Engineering, Iowa State College, Ames, Iowa

To the question, "When and how do automobiles skid?" the average motorist would, no doubt, readily reply that automobiles skid on slippery roads and that they may skid either sideways or straight ahead. But, how slippery must a road be before it is dangerous? Can a car skid dangerously on a dry road surface? What effect does breaking or accelerating on curves have on the tendency to skid? Why do drivers occasionally lose control of cars traveling at high rate of speed? Is a certain amount of skidding inevitable or if it isn't, what can be done about it? These are questions which experienced drivers would have difficulty answering correctly. It was in an attempt to answer these and other related questions that the Iowa Engineering Experiment station started a research project four years ago, which it has been my good fortune to direct and which has yielded a large amount of interesting and useful information for highway engineers, automotive engineers, tire manufacturers, traffic engineers, and others who are interested in highway safety.

Scope of the Investigation

The wide scope of this problem may best be shown by enumerating the more important items which were investigated: The importance of skidding as a cause of highway accidents was determined from a study of highway accident statistics. The skidding characteristics of new tread and smooth tread tires on wet and dry road surfaces were measured at speeds ranging from 3 to 40 miles per hour. Tests were run on 30 different road surfaces, comprising practically every type of road surface in common use today. Tests are also run on mud-, snow-, and ice-covered surfaces with and without tire chains. The effects of variations in wheel load, tire pressure, condition and type of tire tread, surface moisture, temperature and cleanness of the surface were investigated. The brakes of 2,134 cars were tested to determine the maximum braking effort which they provided. Stopping distances and skidding hazards when braking on typical road surfaces were determined. The frictional requirements to prevent skidding sideways on curves were established by driving at speeds ranging from 10 to 70 miles per hour on representative highway curves using cars with standard front axles, cars with "knee-action" and also a car equipped with low pressure balloon tires. From the experience of driving on curves and from a theoretical analysis of the action of a car on a curve, the natural path of the car, which is also the safest path, was definitely determined. The curve design standards recommended as a result of this study if used in new highway construction should provide greater comfort and safety than is possible on existing curves.

It is evident from the above list of the phases investigated that the study of the skidding of automobiles is by no means a simple matter but on the contrary quite involved, with many variable factors which complicate the study. However, an exhaustive study of the effects caused by the many variables provided explanations for skidding tendencies of cars which can be understood by any experienced driver and it is my purpose now to discuss briefly the more significant results of the investigation.

Highway Accident Statistics Related to Skidding

Highway accidents statistics as collected and reported by police departments, state motor vehicle departments and by insurance companies indicate that skidding accidents constitute about five per cent of all highway accidents. While this appears to be a small percentage, the fact that 2,112 people were killed and 52,928 injured in 1930 in skidding accidents, indicates more clearly the importance of this type of accident. But there is another angle to skidding accident statistics which merits consideration and that is the extent to which skidding contributes to accidents reported under other headings. In the usual annual reports there is no way of telling in what percentage of the accidents reported, skidding was a contributory cause. Generally the driver has some warning when an accident is impending. He is very likely to slam on his brakes, make a sharp turn and trust to luck that by doing this he can avert the accident. If the frictional requirements of the road, the tires, or the brakes are not adequate to carry out these operations, a collision may occur or the driver may lose control of the car. The importance of skidding as a contributing factor in highway accidents is, therefore, considerably greater than is indicated by the usual accident reports. In a special investigation on this point by Erwin, Wasey and Company, Inc., New York City, N. Y., 1934, it was found that in 24 per cent of the accidents reported in the State of Connecticut in 1933, skidding was a contributing factor. This investigation and an analysis of accidents in Iowa further revealed that the majority of skidding accidents occurred in the four winter months when wet, snow-, and ice-covered roads, which constitute the most hazardous road surfaces, are most common. Hence, since the study of highway accident statistics revealed that skidding accidents are far more common in the winter than in the summer, efforts to reduce skidding hazards in the winter and to keep drivers informed concerning safe driving practices on slippery roads should be rewarded with a substantial reduction in accidents during this period. Furthermore, since skidding is a contributing factor in so many accidents both winter and summer, knowledge of the causes of skidding and of methods of reducing skidding should prove to be very valuable to all persons interested in highway safety.

Skid Tests on Various Road Surfaces

Probably the most important part of our testing program was the determination of the variations in slipperiness of 30 different road surfaces tested in the wet condition. The wet condition was made the subject of special study because it is the most hazardous condition of the road which may be attributed to the type of materials and method of construction used in building the road. Although surfaces covered with mud, snow or ice are far more slippery than corresponding surfaces in the wet condition, the slipperiness under these conditions should not be attributed to the material used in the construction of the road, but to the mud, snow or ice covering it.

In describing these tests and in the interpretation and application of the test results the term *coefficient of friction* best describes the slipperiness of the surface or the skidding resistance which the surface can provide. The coefficient of friction may be defined rather simply as the ratio of the force causing the tires to skid, to the load on the tires. If the force is equal to the load the coefficient is unity (1.0) and if the force is only two-tenths of the load the coefficient is two-tenths (0.2). The former value (1.0) is very nearly the maximum which may be obtained between rubber tires and road surfaces and is an indication that the road is as safe against the hazards of skidding as it is possible to make it. The latter value (0.2) is definitely indicative of a slippery and hazardous surface condition.

In the tests of the 30 surfaces and of the various surface conditions, a specially constructed trailer was towed by a high-speed truck equipped with a sprinkler system. The force, in pounds, required to cause the tires to skid was measured with a ruggedly constructed yet remarkably accurate, integrating type of dynamoter designed under the direction of the author by two graduate students, Mr. Donald Berry and Mr. Earl Allgair.

The coefficient of friction for the various surfaces and surface conditions was measured for two types of skidding, one in which the tires were skidding straight ahead, and the other in which the tires were skidding sideways. The former is encountered when braking on a slippery surface and the latter simulates the skidding effect on curves. The arrangement of the test equipment used in the side skid tests proved to be very useful in providing data required to compute the frictional requirements or the skidding hazards of cars going around curves at different speeds.

The curves in Fig. 1 are typical of the results obtained in the tests on the different surfaces. An examination of the curves will disclose a wide range of values for the various surfaces from a maximum of 1.0 to a minimum of 0.2. A significant characteristic observed on all surfaces except gravel and cinders was the marked decrease in the coefficient of friction with an increase in speed. In other words all surfaces except gravel and cinders increased in slipperiness with an increase in speed. On the gravel and cinder surfaces the coefficients remained about the same or increased slightly with an increase in speed, largely because the wheels plowed into the gravel more deeply as the speed was increased. It should not be assumed from these tests that gravel surfaces are safer than other surfaces at high speeds, because the coefficients of friction for dry gravel were only one-half to two-thirds as high as those obtained on the dry hard surfaces and, furthermore, there is considerable variation in the firmness with which the gravel is packed. Loose gravel pebbles act as ball bearings under the tire causing variations in the skidding resistance which makes it difficult to steer the car.

The *tests on the bituminous road surfaces* provided the largest variation in coefficients of friction obtained among all of the surfaces tested. These surfaces, popularly known as "black top" are generally thought of as dangerously slippery when wet. The results of the tests on several bituminous surfaces substantiated this belief. However, the tests on the majority of bituminous surfaces in the wet condition provided coefficients of friction which were appreciably higher than those of any other type of road surface tested, and it can now be said without fear of contradiction that "black top" surfaces *can be built* which are as free from the dangers of skidding as any road surface in common use today. This was an important "discovery" since there are thousands of miles of rural highways and millions of square yards of city streets paved with "black top" and a certain percentage of these surfaces are known to be dangerously slippery when wet.

Why "Black Top" Road Surfaces Are Slippery

It was only natural that the large variations in the skidding resistance of the bituminous surfaces aroused our interest and that a careful study was then made to find an explanation for the results obtained. An analysis of the samples taken from the various bituminous surfaces indicated that there was an excess of asphalt (or tar) on the surfaces which were slippery when wet. This excess asphalt finished to the top of the road forming a smooth glazed finish. On the surfaces which showed a high resistance to skidding there was no indication of an excess of asphalt, road-oil or tar. Examination of these surfaces under a low power microscope revealed that sharp sand or finely crushed rock particles were held in place by the weaker asphalt cement and that the tops of these sand particles were uncoated with asphalt. For this reason these surfaces were said to have a sandpaper like finish. Under the action of weathering and the wearing action of traffic a renewable "sand-paper" finish was maintained on these surfaces. This was possible because there was no excess bitumen present in the mix, and with traffic slowly wearing off the sand or gritty aggregate held in place by the moderately weak asphalt or tar cement, a new layer of sharp sand or fine stone par-

ticles was exposed from which the thin film of asphalt or tar was quickly worn off by traffic.

Another important characteristic observed in connection with the non-slippery surfaces was that the aggregate exposed to the surface consisted of hard silica sand, quartzite or trap rock chips. These materials are harder than steel and will retain their sharpness under the wearing action of traffic longer than certain soft friable limestones, shales, and similar types of rock sometimes used as cover stone on bituminous roads. The reason for the slipperiness of all surfaces when wet is due to the lubricating effect of the water. If the water can be squeezed out, reducing the thickness of the film to a point where it loses its lubricating effect, the slipperiness of the surface will likewise be greatly reduced. If it were possible to eliminate all of the moisture between the tire and the road, the surface would have the same skidding characteristics when wet as when dry. The test results on certain surfaces indicated that this was very nearly true at low speeds. However, as the speed increased it was not possible to squeeze out the water as effectively and the lubricating effect caused the surface to increase in slipperiness as the speed was increased.

The above explanations of the causes of the differences in the slipperiness of bituminous surfaces applies equally to the other surfaces tested. The *coefficients of friction for the portland cement concrete* were remarkably consistent and although there was considerable difference in the surface finish of the pavements tested, the results of corresponding tests were very nearly the same in all cases. Concrete pavements have generally been considered as having a resistance to skidding when wet equal to or greater than that of any other type of pavement. Our tests indicated that this was not true since higher coefficients of friction were obtained on certain bituminous types than on the concrete surfaces. This difference may be explained by the fact that the cementing material in the concrete pavements is as hard or harder than the aggregate which it holds in place, whereas in the bituminous types the cementing material is relatively weak. The action of traffic will wear off, to a certain extent, the grittiness or sharpness of the aggregate held securely in place by the portland cement in the concrete, and will develop a fairly smooth textered surface. Thus, it is not possible to maintain continuously the same sand-paper like finish on concrete pavements as it is on the bituminous types. However, concrete surfaces can always be depended upon to provide a moderately high resistance against skidding whereas bituminous surfaces may be dangerously slippery if the proper methods of construction and maintenance are not used. In other words, concrete roads everywhere are so uniform as far as skidding is concerned that the average driver knows what to expect on these roads whereas "black top" surfaces are likely to be so variable that drivers should drive with caution on such roads at least until they get the "feel" of the road and know just what they can do on it.

Certain surfaces such as *wood plank, steel traffic plates, and ordinary asphalt plank* were found to be as slippery when wet as icy surfaces. These materials are generally used on bridge floors, where skidding accidents are far more dangerous because of the restricted roadway. They are so slippery that they should not be used under any conditions on our highways unless they are covered with some type of surface treatment which will provide a sand-paper like or gritty surface finish. Public officials should recognize their obligation to the public in providing surfaces which are not slippery, because the court will award damages to the injured party if it can be proved that the public officials responsible for the surface were grossly negligent in permitting the slippery condition to exist and did not give adequate warning to the motorist concerning the slippery condition.

Tests on Mud-, Snow-, and Ice-Covered Surfaces

Since accident statistics, in Iowa, for example, show that 82 per cent of all skidding accidents occur during the four winter months, it is reasonable to conclude that mud-, snow-, and ice-covered surfaces were responsible for this increase. For this reason an extensive series of tests were run on these surfaces, with the tires equipped with various types and sizes of tire chains.

The results clearly indicated that mud-, snow-, and ice-covered surfaces constitute the most hazardous road conditions which the motorist is likely to encounter. Ice or sleet was found to be particularly slippery, coefficients ranging from 0.05 to 0.20 having been measured. A driver venturing out on a freshly formed icy surface with a car not equipped with tire chains is inviting all kinds of trouble. The crown of the average city street introduces enough slope to cause the car to slide into the curb unless the driver can straddle the crown line and stay in the center of the street. The car cannot climb a grade steeper than 3 or 4 per cent and will slide down, and be completely out of control, on grades greater than 5 per cent. Motorists have discovered that this type of ice condition is very rare and they find that they can control their cars on the usual icy street if they drive carefully. Ice is usually dry or rough or it may have a certain amount of dirt or grit on its surface. This type of ice will have coefficients ranging from 0.15 to 0.20, which are 3 or 4 times greater than ice at its worst and it is on such ice that the average driver develops enough confidence to venture out on ice without chains, however slippery the ice may be. This confidence is likely to receive quite a jolt when the driver strikes a stretch of very slippery ice. It is then that you will hear the driver report than for "no reason at all" his car skidded end for end. How foolish drivers are to venture out on a road when the margin of safety is so small! Rather than spend $5 or $10 for a set of chains and taking the time to put them on his wheels, the average motorist will take the chance of breaking a wheel or two, bending a fender, smashing the headlights, or if he is the reckless type of driver who likes to drive fast just for the thrill in it, there is no telling how serious the accident may be. Why are chains no longer popular? Largely because the average motorist has discovered that it is possible to skid on ice with chains apparently as easily as without them. The results of our tests with tire chains partly support such a contention, since the coefficients of friction with the tire chains ranged from 0.2 to 0.4 as compared to 0.05 and 0.2 without chains. In other words the increase in resistance to skidding, due to the chains, was not very great. However, the significant fact in these tests is that the lowest coefficient with the chains was 0.2, as compared to 0.05 without chains. If a coefficient of 0.2 or higher is available, it is possible for the careful driver to control his car at all times, whereas on a surface with a coefficient as low as 0.05 the best driver cannot go far without skidding. Of course, if the driver of a car equipped with chains tries to take street intersection turns on ice at the customary speed or if he slams on his brakes in the customary manner, he might as well not have chains because chains simply cannot provide the friction necessary to carry out these operations without skidding. Occasionally chains may give a driver a false sense of safety. Thus, last winter during a period when the Iowa roads were covered with a glaze of ice, drivers of buses equipped with chains were trying to maintain schedules by driving at speeds of 40 to 45 miles per hour weaving in and out between cars and trucks which were traveling at speeds of 10 to 20 miles an hour. Bus companies must accept the fact that schedules cannot be maintained when the roads are slippery except at great risk. The maximum safe speed on ice for cars, trucks or buses equipped with tire chains is 30 miles an hour on rural highways and 15 miles an hour on city streets if the same margin of safety is to be possible as exists on dry surfaces with maximum speeds of 50 miles per hour and 25 miles per hour respectively.

In regard to the type of tire chains which are most effective in the prevention of skidding, it was found that chains to be effective must cut into the ice continually. To obtain this condition it is necessary to use chains with a closer spacing between cross chains than the standard 6-inch spacing if tire sizes smaller than *6.00 inches* are used. For tire sizes of 6.00 inches and greater the standard four-link chains (6-inch spacing between cross chains) are satisfactory. With too many cross chains between the tire and the ice, the pressure on each cross chain may not be sufficient to cut into the ice. The chains will then act as steel runners and the resistance to skidding sideways will be considerably reduced.

It will always be difficult to get drivers to equip their cars with tire chains and the safest procedure to protect all motorists on ice is to sprinkle sand or cinders treated with calcium chloride over as much of the road as is practical. The calcium chloride will hasten the process of embedding the gritty material in the ice. If it is not used, the sand or cinders will blow off the surface on a cold windy day. The application of sand or cinders is especially desirable at intersections, on hills,

and on curves where the skidding hazards are greatest. This treatment will raise the coefficients to values which are higher than can ordinarily be obtained with tire chains and it is well worth the cost involved. Highway maintenance men should be ready to act promptly when slippery ice or snow covered roads occur and by so doing they should make possible a substantial reduction in winter accidents.

Exhaustive tests indicated that snow free from ice is not nearly as slippery as ice, coefficients were found to range from 0.2 to 0.55. The danger here, however, is that the transition from snow to ice may take place very quickly. It is not unusual for a wet snow to freeze into ice almost immediately under the action of traffic and thus be as slippery as ice. While it is possible to drive safely on snow free from ice, it is far safer if the car is equipped with tire chains. Sand and cinders applied as soon as the snow starts to pack will be very helpful to prevent skidding of all vehicles.

It is generally known that mud on pavements causes them to be slippery. The surprising feature of our tests was the discovery that mud-covered pavements can be as slippery as ice-covered pavements, coefficients of 0.2 having been measured for this condition. The only remedy here is prevention, by removing the source of the mud. The placing of gravel, shale, sand, cinders or crushed rock on the shoulders and at the approaches to all pavements would not only correct this dangerous skidding condition but would, at the same time, provide greater road widths for use in emergencies.

Relation of Tires to Skidding

Many tests were run with different types and sizes of tires at different tire pressures and with variable loads on the tires. The tests showed conclusively that at speeds greater than 15 miles per hour, tires with treads worn smooth are more slippery on wet surfaces than tires with a non-skid tread design. The tread design provides grooves and channels for the water as it is being squeezed out between the tire and the road surface. The sharper edges of the tire also squeegee the water from the road surface at the point of contact. This squeezing and squeegee action provides a more intimate contact of the tire with the road, thus eliminating the lubricating effect of the water and the slipperiness caused by it. In the 1934 Massachusetts Highway Accident Survey, it was found that of 80,000 vehicles observed, 38 per cent of the front tires and 26 per cent of the rear tires were worn smooth with the fabric showing in about 3 per cent of the tires. Our tests showed that these motorists have worn away about 30 per cent of the skidding protection on wet surfaces which they could have had using tires with a non-skid tread. It is reasonable to believe that a large number of skidding accidents, not to mention blowouts and other tire troubles could be avoided by the use of tires with a good non-skid tread.

While there may be differences due to the tread design, they were so small that we could not determine them in our tests. We did find, however, that the larger of two tires with the same tread design provided the higher coefficient of friction. This is true because the total frictional resistance increases with an increase in the contact area of the tire. The recent trend in tire design which provides for wider tread widths and larger tire sizes, should add appreciably to the skidding resistance of the newer tires.

The load variation tests revealed that the coefficient of friction decreased slightly with an increase in load on the same tire. It is important, therefore, that overloads on truck tires be avoided if a high resistance to skidding is to be available. However, the tests indicated that heavy trucks and buses should be able to resist skidding or should be able to stop as quickly as cars, if they are equipped with the proper size tires and adequate brakes.

The pressure variation tests showed that there is an optimum pressure, above or below which the resistance to skidding will decrease. The tire pressure should not be so low as to cause the tire to become flabby and accentuate side sway of the car on curves, nor should it be so high as to reduce the area of contact of the tire. It is better to keep the pressure slightly above the recommended minimum because under-inflated tires generate more heat and our tests showed that the skidding resistance decreased with an increase in temperature.

The Relation of Brakes to Skidding

Faulty brakes and the improper use of brakes are the cause of more skidding accidents than any other driving operation. The frictional requirements when braking are greater than those which must be met in other driving operations and since the requirements are frequently so close to the maximum which the tires and the road surface can provide, either the front or rear wheels will start to skid. When the average driver discovers that his car is skidding on a curve or on a slippery road, his first reaction will be to step on the brake, which instead of correcting the skid will help it along and make it worse. Unequal distribution of the braking force at each wheel will seriously affect the steering of the car in emergency stops. If the brakes on the left side exert a force 40 per cent greater than the brakes on the right side, the car may suddenly swerve over into the lane of oncoming traffic in an emergency stop, particularly at high speeds.

That variations in the distribution of the braking force is an important consideration was indicated by the fact that of 2,134 cars tested, 31 per cent had brakes with 40 per cent more braking effort on one side than on the other. Cars have been observed to stop suddenly on dry pavements skidding end for end for the reason that all the braking force was delivered by one wheel and the car merely pivoted about that wheel. A car with brakes in excellent condition, adjusted to develop the same coefficient of friction at each wheel under emergency stopping conditions, should be the aim of every driver and every official in charge of motor vehicle inspection. If a car may be said to carry "life-preservers," the brakes come closest to them of any safety equipment on the car, and yet how inadequate the brakes on the majority of cars and trucks are! Practically one-half of the 2,134 cars tested had faulty and inadequate brakes.

The average coefficient of friction which the brakes of these cars could develop was 0.51, whereas on practically all dry road surfaces and on many wet surfaces coefficients of 0.8 to 1.0 can be developed if the brakes are powerful enough. We would be much farther along in highway safety today if the manufacturers of cars and trucks had placed greater emphasis on the development of more powerful and more dependable brakes instead of more powerful and faster motors. Brakes have been improved in many ways during the last five years by the use of larger and stronger housings and larger braking areas, by insulating brake linings against dirt and grease, and by improving the mechanism to provide smooth uniform braking action on all four wheels, but there is still room for improvement in all of these items.

There are two additional improvements in brakes which, if they could be perfected, would greatly improve the braking action and eliminate many skidding accidents which are caused by our present braking system. One of the characteristics of the present brakes is that the braking force at the front wheels bears a fixed ratio to that on the rear wheels. Now it is a well-known fact that as the brakes are applied the car tips forward and a part of its weight is transferred from the rear wheels to the front wheels. The harder the brakes are applied the greater the weight transfer to the front will be. With a fixed braking ratio, the variation in weight transfer accompanying different stopping rates is certain to cause either the front or rear wheels to lock in an emergency stop. Under these conditions if the rear wheels lock, leaving no friction available to resist skidding sideways, the rear end may suddenly swing sideways on a slippery surface and continue to skid end for end with the driver powerless to control the skid once it starts. If a high braking ratio is used, the front wheels are likely to lock when the brakes are applied on a slippery surface. A car with front wheels locked will skid straight ahead and again the driver loses steering control. However, if the front wheels lock and the car is skidding straight ahead a good driver may regain control of the car by quickly releasing the brakes. Side skids are usually too far along when the rear wheels are locked for the driver to regain control in this manner. For this reason locking the rear wheels is more hazardous than locking the front wheels and until we have a better braking system it is better to design brakes and to adjust brakes with a braking force 1.5 to 2 times greater on the front wheels than on the rear wheels. From this analysis of our present braking system it may be seen that the two improvements urgently needed in brakes are first, a variable braking

ratio which will permit an increase in the braking pressure on the front wheels corresponding to the increase in load on the front wheels as the stopping rate is increased; in other words, the coefficient of friction developed at each wheel should be the same for all rates of stopping to obtain the greatest *comfort and safety* when stopping; second, a device to prevent each wheel from locking when the brakes are applied, especially on slippery surfaces.

Unfortunately, there is a limit in the extent to which brakes can be improved for the purpose of reducing stopping distances and the limit is the available friction which the road surface can provide. The average maximum coefficient which the brakes of the cars tested in 1932 could provide was about 0.5 and the average maximum rate of stopping 16 feet per second per second. If the tires, road surfaces, and brakes could be improved to provide an average coefficient of 1.0 or double that available in 1932 the maximum rate of stopping could likewise be doubled, making it 32 feet per second per second. While such a rate of stopping would, no doubt, prevent many collisions, it would be rather rough on the passengers in the car because they would have to resist being thrown out of their seats by a force equal to their weight. Some form of safety belt apparently would be necessary under those conditions. On practically all dry road surfaces today, such a stopping rate is possible and roads are rapidly being constructed and reconstructed to make a high emergency stopping rate possible even when the surfaces are wet. It remains for the automobile manufacturers to show the public that they can build brakes into cars which will be dependable and will provide the maximum stopping rate which can be obtained on our best road surfaces without skidding or without great discomfort to the passengers in the car. Then, and only then, can they justify selling cars to the public with the high top speeds which characterize our 1935 cars. It should be recognized that safety lies in maintaining low stopping distances and that stopping distances vary approximately as the square of the speed. Thus, to provide the same stopping distance at 60 miles per hour as at 40 miles per hour requires brakes about 2½ times more powerful. The manufacturers have not provided an increase in dependable braking power anywhere near that which these figures indicate should have been provided and until they do provide it, the present top speeds of cars should be considered as decidedly unsafe.

Driving on Curves and Skidding Tendencies on Curves

When driving a car on a curve at low speeds, the driver experiences no difficulty in negotiating the curve, but as the speed is increased the difficulty in keeping the car on a fixed path increases until finally a speed is reached when complete control of the car is lost and the car will skid or slide off the curve. There are many reasons why a car may skid on a curve but the average driver is inclined to attribute the skidding to the slippery condition of the surface. Of course he also knows that driving at excessive speeds will cause him to lose control of the car, particularly if the surface is slippery. The present trend of driving at high speeds makes it important that the facts be known in regard to the behavior of cars on curves and particularly that the effect of variations in speed be known. With this purpose in mind, cars known to have different operating characteristics on curves were driven at speeds from 10 to 20 miles an hour on three representative curves. From measurements of steering angles and rear wheel slippage, the important characteristics of the behavior of these cars on curves were determined.

Steering Angles. The results obtained in the measurement of the steering angles of the various cars proved to be most enlightening in determining possible causes of skidding on a curve. Instead of obtaining a constant steering angle (that is, a fixed position of the steering wheel) on a given curve with cars of the same length wheelbase, as one might expect, the steering angles were found to vary considerably with an increase in speed. Variations were also found for the same car, depending on the load distribution and tire pressure used. Three typical steering conditions (Fig. 2) were observed in the tests of steering angles. Two of these conditions should be considered as unstable or likely to prove more hazardous than the third condition which may be considered stable or as safe in regard to steering control as it is possible to make it. A fairly common unstable condition was that in which the steering angles increased approximately as the square of the speed until a speed

was reached where a further increase in the steering angle was no longer effective in holding the front wheels on the curve. For cars with this type of steering control, the front wheels will slide off the curve first until the speed is reduced to the point where steering control may be regained. Another unstable condition not so frequently encountered was that in which the steering angles increased only slightly with an increase in speed up to a certain speed beyond which the steering angles decreased approximately as the square of the speed until a speed was reached where a further decrease in the steering angle was no longer effective in keeping the car on the curve. In this case the rear wheels of the car would slide off the curve first and unless the driver had anticipated this action the car would very likely have gone into a spin and might have rolled over. This is probably the most hazardous steering condition because the average driver would, no doubt, lose control of the car once the rear end skid started. The stable condition is obtained when the steering angle increases with an increase in speed to a point where the ride is so uncomfortable that the driver logically expects the front wheels to slide off the curve as they must at some speed. However, in this case, the speed is much higher than in the other two cases. Furthermore, a reduction of speed will again permit the driver to regain control of the car.

There are many factors which cause variations in the steering angles but the control of these factors lies largely in the hands of the motor car manufacturers. Thus, the most important factors which will ordinarily cause variations in the steering angles are the use of side sway stabilizers, at the rear or the front of the car; the use of the independent front wheel suspension, popularly known as "knee-action," instead of the standard front axle; variations in tire pressure particularly the use of low pressure tires, and variations in load distribution, front and rear. The radical changes in these features during the past few years have created many new problems in steering control and have made it necessary for motor car manufacturers to develop designs in which safe and dependable steering control may be assured. The 1936 cars should be much safer in this respect than the cars of the past two years.

Wheel Slippage and Slip Angles. In the discussion of the variations in steering angles it was pointed out that for stable steering control the steering angles should increase with an increase in speed on a given curve. The explanation for this action lies in the fact that when driving on a curve a centrifugal force is set up which tends to cause the car to slide off the curve. To counteract the effect of this force, highways are banked on curves and a gravity force is introduced which opposes centrifugal force. The centrifugal force, however, increases as the square of the speed while the gravity force due to banking a given curve is the same at all speeds. Therefore there is only one speed at which the centrifugal is exactly balanced by the gravity force. A car traveling slower than this speed will tend to slide down to the inside of the banked section and a car traveling faster will tend to slide to the outside of the banked section. These characteristics are quite evident when the road surface is very slippery, as when covered with ice. In this condition drivers will generally drive slower than the speed for which the curve was banked with the result that the car will slide down toward the inside of the banked section. It is for this reason that curves on highways in sections of the country where ice forms should not be banked steeper than that provided by a slope of one foot in ten feet.

It is possible, of course, to make a turn safely on a flat surface where no gravity force is available to counteract centrifugal force. This is possible because the friction between the road and the tires is adequate to keep the car on the given curve. When driving on a curve at a speed for which the curve is banked, no friction to resist skidding sideways is necessary and both the front and rear wheels occupy their normal position with respect to the path of the car. However, on a turn where friction is necessary to keep the car on a fixed curved path, both the front and rear wheels must be turned at an angle with the line of travel of the car. The angles so developed are known as slip angles and provide the necessary side thrust in the form of friction between the tires and the road to counteract centrifugal force. It is this frictional force which makes it possible to drive at speeds considerably greater than that for which the curve was banked.

Since the rear wheels are held in a fixed position with respect to the body of the car and cannot be turned as can the front wheels, it is necessary to slide the entire rear end of the car out on the curve as the speed is increased. This position

of the rear wheels develops the slip angles and the friction required to hold the car on the curve and is particularly evident when observing racing cars going around curves. The rear wheels in this case swing several feet outside of the front wheels and develop large angles with the line of travel. Racing cars exaggerate the action of sliding or skidding on curves. The average driver can easily visualize a racing car skidding or sliding around a curve but he doesn't realize that his car takes a curve in the same way except in a more *modified* form depending on the speed at which he tries to make the turn. The significant feature of the results of these tests is the magnitude of the slippage as the speed of the car is increased. The trend in slippage on curves as related to speed according to this study indicates that the slippage at speeds of 80 miles an hour or more is so large even on flat curves that the most skillful driver will have difficulty steering the car.

The most hazardous situation when driving on a curve at moderate speeds develops when the surface is slippery particularly when it is wet, mud-, snow-, or ice-covered. These surfaces can provide frictional resistance much the same as dry surfaces and up to a certain speed the car acts much the same as *on a dry* surface. However, when a certain critical speed is exceeded the necessary friction to keep the car on the curve suddenly vanishes, with the result that the car starts to skid. The results of tests to determine the increase in friction or side thrust which accompanies the increase in the slip angles formed by the wheels, clearly indicate how sharp or sudden this change may be. It is this sudden change in frictional resistance which the average driver fears. Actually a certain amount of friction is still available and only in cases where the driver enters the curve at too fast a rate of speed or where the slippery condition develops *suddenly, should* skidding on a curve be hazardous. Unfortunately, many drivers step on the brakes from force of habit as soon as the skid starts, and instead of stopping the skid this is likely to make it worse. While skidding is generally caused by driving at excessive speed for the road condition, the *control* of it is largely a matter of steering control combined with wise and moderate use of the throttle rather than an attempt suddenly to reduce speed. Applying the brakes creates an unstable rear wheel condition, whereas use of the throttle produces a driving force at the rear wheels which has a steadying effect on the steering of a car. Even racing drivers who take every possible advantage of speed, will slow down when going into a curve but will "gun" the motor as soon as the car is safely on the curve, accelerating rapidly as they leave the curve. When going into the curve the braking action causes the rear wheels of the racing car to skid outward on the curve and in this way the driver gets the car turning in the direction of the curve faster than he could if he maintained a uniform rate of speed. In fact, the skillful racing driver swings the rear wheels out by such an additional amount that he can "gun" the motor, and the accelerating force which is thus created controls the rear wheel skid and brings the car off the curve at a high rate of speed with approximately no steering effort at all. The majority of accidents on curves involving either racing drivers or drivers in general are caused by entering the curve at an excessive rate of speed. If the driver can get the car safely on the curve, he should have little difficulty in controlling the steering of the car around the curve, particularly if he can keep a steady foot on the throttle and have the benefit of a driving force to counteract the effect of at least a part of the centrifugal force which tends to pull the car off the curve.

Path of Car on Curve. Until recently all curves on rural highways and turns at city street intersections were designed as simple arcs of circles connecting two tangents or straight lines. Highway engineers assumed that cars could easily follow such curves, and, as a matter of fact, at the speeds prevailing 10 years ago that was generally true. Today, however, speeds have increased to the point where drivers are experiencing difficulty in steering their cars around the curves. The difficulty is not so much that of steering with respect to the frictional requirements of the front and rear wheels as previously discussed, but rather it is the problem of changing the direction of travel from a straight line to a fixed curved path. The difficulty is largely due to the fact that it is impossible to change from a straight line to curve of fixed radius instantaneously. In other words, on the straightaway the steering wheel must be in one position while on the simple circular curve it occupies an entirely different position requiring as much as a half turn of the wheel. If the driver attempts to make this change in position very suddenly, particularly at high speeds, he finds that he will either swing the wheel too far, and cut over into the lane of approaching traffic, or he may not turn far enough and drive out onto the shoulder. To correct this error in steering is very difficult considering the speed at which this condition arises, with the result that the car weaves in and out on the curve in a very uncertain path. If the driver is fortunate enough to keep away from any obstacles, he may finally drive safely off the curve onto the tangent. While this type of driving should be classed as reckless, it may also be attributed to poor curve design because if the change from the straight line to the curved line had been made gradually instead of nearly instantaneously the driver would have had little difficulty in getting onto the curve. The highway engineer should use transition curves, which have been a necessity on railroads for many years, in making the change from the tangent to the fixed path of the curve. Spiral or transition curves have uniformly varying radii which permits the driver to change the position of the steering wheel gradually until the beginning of the circular curve is reached. At moderate speeds the average driver can develop a transition curve within his own traffic lane but when trying to make a turn at a speed which is higher than that for which the curve was designed, he is liable to get into trouble. This is particularly the case at street intersections designed in the "horse and buggy days" where the driver may swing far over into the lane of approaching traffic. If the curves at intersections were designed with a spiral approach or with a curve of larger radius this serious traffic hazard would be eliminated. Practically one-half of our traffic accidents occur at intersections and it is reasonable to believe that by constructing intersections permitting easier turns and more space in which to maneuver the car, a definite reduction in accidents at such locations should follow. Another distinct advantage of such a design is that it is possible to foresee what type of turn the driver of the car approaching the intersection is likely to make. Thus, if the driver intends to make a right turn he can keep the car close to the curb, and if he is going straight through the intersection he will keep the car in the center lane and if he intends to make a left turn, he should start turning from the center of the road before he enters the main portion of the intersection provided he does not interfere with approaching traffic. It is the uncertainty of traffic movement which makes our present intersections so hazardous. The proposed design should remove this uncertainty.

A study of the way racing drivers handle their cars on curves is again useful in determining critical speeds on curves and should help to clarify the principles which should govern in the design of curves. The margin between victory and defeat on a race track lies largely in the speed possible on the curves and the skill with which the driver can handle his car on the curves. On the Indianapolis Speedway, speeds on the curves will vary from 90 to 100 miles per hour as compared with 120 to 130 miles per hour on the straightaway. On the usual dirt track the speeds on the curves will range from 40 to 60 miles an hour as compared with 70 to 90 miles an hour on the straightaway. It is apparent that the drivers will take the curves as fast as it is possible to take them and the margin of safety on the curves therefore is very small. Probably the phase of driving on curves which requires the greatest skill is the ability to make the change from the straight line to the fixed curved path in the shortest possible time and with the least amount of weaving, in getting onto the curve. The best measure of this ability is the determination of the rate of change of acceleration when entering the curve. It is significant that the maximum rates of change of acceleration obtained on the Indianapolis Speedway are in close agreement with those obtained on the dirt track at the Iowa State Fair Grounds at Des Moines, with values of from 5 to 6 feet per second per second per second having been obtained on both tracks. If rates of acceleration of 5 to 6 feet per second per second per second provide the low factor of safety known to exist among racing drivers, it would seem that the spiral transition curves for use on rural highways where the drivers are not especially skilled in driving on curves, should be designed with a factor of safety of at least 3 or a rate of acceleration of two feet per second per second per second. The same factor may be obtained by reducing speed and it is surprising to discover how small a reduction in speed is necessary to provide a sizable factor of safety. Thus,

on a curve on which a racing driver might drive 60 miles an hour, reducing the speed to 40 miles an hour would provide a factor of safety of 3. But just as reducing speed increases the margin of safety, so will an increase in speed rapidly cause the margin of safety to vanish. This is one of the deceptive characteristics of speed which the average driver and even the most skilled drivers have difficulty in sensing. The changes in the behavior of the car are far different when increasing the speed from 70 to 80 miles an hour than when increasing the speed from 30 to 40 miles an hour. The time is rapidly approaching when we can no longer depend on the driver's judgment in regard to the effect of speed, because speed is so deceptive. Quiet and smooth running cars have greatly contributed to this deception and one of the pressing problems confronting the automotive engineers and traffic engineers today is that of devising methods whereby the driver can be kept conscious of the speed at which he is traveling and the requirements which he must meet in bringing the car to a stop or in making sharp turns when traveling at high rates of speed.

Driving Hazards Created by Speed — What is a Safe Speed?

There is probably no phase of highway safety concerning which there is so much difference of opinion and so much confused thinking as there is in regard to the hazards created by speed and in deciding what speed restrictions shall be placed on drivers. The researches discussed in this paper have provided the basic facts which should clear up many of these questions. It seems fitting, therefore, in closing that the more significant results of our studies which have some bearing on speed be restated and that, where possible, conclusions in regard to safe speeds and proper speed restrictions be given.

It should now be evident that the control of the car, particularly the ability to stop and steer it, depends on the amount of friction available between the tires and the road surface. These frictional requirements follow certain definite laws which are inviolate. On any given surface, the frictional forces required to stop the car or to hold it on a curve will vary as the square of the speed, thus these forces must be 4 times as great at 40 miles an hour and 16 times as great at 80 miles an hour as they are at 20 miles per hour. The friction available, particularly on wet surfaces, decreases with an increase in speed so that the friction available at 50 miles per hour may be only half that available at 10 miles per hour. On any given surface, therefore, a speed is attained where the frictional requirements exceed the friction available with the result that a dangerous skid is almost certain to develop. On wet surfaces skidding may frequently occur at speeds as low as 30 or 40 miles an hour, depending on the extent of the use of the brakes, the sharpness of the turn, the type of road surface, condition of tires and the skill of the driver. On dry surfaces, skidding as it is commonly thought of is rare, since with a larger amount of available friction, higher speeds are possible and skidding manifests itself in the loss of control of the car, generally loss of steering control. On dry surfaces loss of steering control may develop at speeds of 60 miles an hour or more depending on the factors previously mentioned.

Effect of Surface Roughness on Control of Car. Roughness or waviness of the road surface will greatly reduce the available friction between the surface and the tires as the speed of the car is increased because uniform contact between the tires and the road surface is not possible under these conditions. The surface roughness or waves will cause the tires to bounce and if the waves in the surface are long enough and the speed great enough, the entire car may "take off" after hitting the crest of the wave (Fig. 3).

Sir Malcolm Campbell waited for weeks at Daytona Beach for a perfectly smooth surface, because waves in this surface providing a variation of 2 inches in 100 feet, and which could not be detected by the eye, were sufficient to lift his 6-ton car off the surface at speeds of about 250 miles per hour. It was surface roughness which made it impossible to drive at 300 miles per hour at Daytona. Only when he drove his car on a lake of salt which was perfectly level did he achieve his ambition of driving 300 miles an hour. It is interesting to know that the "Bluebird" had large fins to help steer it and that at 300 miles an hour the friction was so great that it caused a blowout and burned up his tires. Campbell is

the only man who has driven at a speed of over 200 miles per hour on a straight track, 500 feet wide, without losing control of the car. The high speed runs by Campbell are important since they represent the ultimate possibilities in speed under ideal conditions. His runs were made with a very low factor of safety and they indicate possible factors of safety required for various driving conditions.

On certain sections of the Indianapolis Speedway the slight waves in the surface, before the reconstruction now under way, were sufficient to lift the driver out of his seat and to raise the car off the surface at speeds of 100 miles an hour. Under these conditions the skill of the driver was taxed to the limit in maintaining control of the car when it landed and it is possible that the surface roughness contributed very largely in the death of the 27 drivers and mechanics killed on this track. A significant point here is that these drivers were among the most skillful in the country, driving cars in excellent mechanical condition on a track 60 feet wide, and yet we have today thousands of drivers who try to drive on similar curves on our state highways with traffic lanes only 10 feet wide at speeds of 70 and 80 miles an hour. The facts are that it is impossible to drive at such speeds on the curves of our present highways without greatly endangering other traffic. To make speeds of 80 miles an hour safe for a selected group of drivers will require smooth road surfaces, curves with spiral transition approaches, and roadways on which all passing and crossing hazards are eliminated. There is no road in this country of any considerable length which can meet these specifications and until such roads are constructed, driving at the top speeds of cars as they are now produced should be considered highly dangerous. It is true that there are long stretches of straight roads in the west and middle west where the danger is not as great as in the more congested areas of the east, but a speed of 80 miles an hour is very deceptive and few drivers operating at that speed realize the dangers involved. Even on a good road surface, with excellent brakes, an expert driver cannot stop the car safely in less than 500 feet after he first recognizes the danger, or if the driver desires to overtake a car traveling 70 miles per hour in the face of an approaching car traveling at 80 miles per hour, a clear space of about one-half mile is necessary. Many drivers are prone to take a chance passing a car when the clear sight distance is less than that and will "cut back" into line so sharply that the car makes a turn sharper than most highway curves with the result that the driver may lose control and cause a collision or turn over in the ditch. This type of driving again indicates the need for devising a traffic control system which will remove much of the element of chance so common in our driving today. Engineers in all lines of work build structures with a *factor of safety consistent with the risk* of failure involved, yet in our highway safety work, engineers are very prone to determine safe driving speeds without any regard for a factor of safety. Our present experience in automobile accidents indicates that driving cars with little or no factor of safety is certain to lead to dire consequences. The average traffic engineer and the average driver should recognize the fact that the law of averages holds true and is as certain to be enforced as the law of gravity. The factor of safety should be raised by eliminating hazardous road surfaces, by improving the braking and steering mechanisms of cars, by educating drivers and by standardizing speeds according to zones where drivers will clearly recognize what the safe speed in the given zone or district should be. To promote the greatest safety a uniform speed for all vehicles in a given zone or district or in a given location is a guiding principle which traffic engineers should always consider when solving problems involving speed. Many accidents could be prevented if this principle were carried out in the control of traffic. The continual overtaking of cars on two lane highways, the excessive use of brakes and the accelerator lead drivers into all kinds of braking and steering difficulties. Speed variations of from 20 to 80 miles per hour are common today on all rural highways. It is interesting to note that on open level stretches of road, truck speeds are not very much lower than car speeds. Our tests indicated that it should be possible to build trucks with stopping ability on level grades very nearly equal to that of the average passenger car. The slow speed hazard created by trucks is largely confined to grades steeper than 3 per cent and this hazard should be eliminated by building 4-lane highways on such grades as soon as funds can be provided for such construction.

The speed distribution survey studies indicate that the safety of a large volume

of traffic is jeopardized by 5 per cent of the traffic operating at speeds under 35 miles per hour and another 5 per cent operating at speeds above 55 miles per hour. If traffic could be regulated to maintain uniform speeds of about 45 miles an hour on open level stretches of road, many of the hazards created by our present lack of a speed control plan would be eliminated. A similar speed control system should be provided on curves and in built-up or residential districts and also in a possible future 4-lane super-highway development. With rigid motor vehicle inspection, drivers' examinations, and an efficient motor patrol, speeds of 45 to 50 miles per hour should assure a reasonable factor of safety on our present main highways free from hazards. On hazardous sections of road the graduated speed reduction plan as used in Michigan is recommended. This plan provides for posting the road with reduce speed signs at 5 or 10 miles per hour intervals until the speed permitted in the danger zone, such as sharp curves, builtup sections, etc., is reached. The maximum safe speed on curves may reasonably be established as that speed for which a useful coefficient of friction to counteract centrifugal force on the given curve shall not exceed 0.10 according to the formula, $V = 15R(f + e)$, where V is the maximum safe speed in miles per hour, R is the radius of the curve in feet, f is the coefficient of friction (use recommended value, $f = 0.10$), and e is the superelevation or banking of the roadway in feet per foot.

Twenty-five miles per hour in residential districts and 15 miles per hour in business districts are reasonably safe speed limits for these locations providing the driver recognizes additional hazards which are present in these areas and which require speed reductions below these limits.

In regard to possible future super-highway developments for high speed travel, the results of this investigation indicate that it should be possible to build highways and cars which would make possible safe maximum speeds of 80 miles an hour. However, the cost of such highways might prove to be prohibitive since right-of way widths would probably have to be increased to 200 feet or more; traffic would be segregated in two two-lane roadways, one for each direction, with parting strips possible 50 feet wide between them. Access to these roads would be at intervals of 10 to 20 miles only. No highway or railway crossings at grade would be permitted. The road surface would have to meet a higher standard of smoothness than that provided on existing roads and it would have to provide a uniform high resistance to skidding which our researches indicated are possible. The curves and grades would be designed to provide a *uniform factor of safety* of 3 or 4 to meet the frictional requirements for operating at the maximum permissible speed established for this class of highways. There would then be no sudden shifts in the design standards or in the slipperiness of the road surface demanding sudden changes in speed which are the cause of many skidding accidents today

The operating costs in road tests up to 60 miles an hour indicate that the cost of driving a car at 60 miles an hour is about double that at 40 miles an hour and at 80 miles an hour it is probably 4 times that at 40 miles per hour. Company cars of many large corporations are now controlled by governors permitting a maximum speed of not more than 50 miles an hour. The Dayton Power and Light company reports a reduction in operating costs of 30 per cent since this speed control device was installed in their cars. The reduction in accidents and in time lost by accidents which should result from this speed reduction should more than repay the company for the possible saving in time obtained by driving at high speeds. There are many factors which indicate that it may prove far cheaper and possibly equally safe to take to the air when speeds of 60 miles an hour or more are desired. This was forcibly demonstrated in the recent land and air speed record runs, in which a 2500 horsepower motor was required by Sir Malcolm Campbell to average 300 miles an hour on land, whereas only a 1000 horsepower motor was needed by Howard Hughes to average 350 miles per hour in the air.

It is true that the American people demand speed and they will, no doubt, continue to demand speed in every form of travel. However, that is no reason why engineers and traffic officials who are responsible for the development and control of high speed travel should fail to recognize the fundamental laws of safety providing reasonable factors of safety or that they should fail to coordinate their efforts in promoting safety. The efforts of the National Safety Council and the National Safety Congress to accomplish these ends are to be commended.

Speed (Velocity) and Accidents
Report of Committee on Traffic Engineering

By ARNOLD H. VEY

Traffic Engineer, State Department of Motor Vehicles, Trenton, N. J.

Our conclusions on variations in speed of pleasure vehicles traveling in the rural sections are based on speed studies made on highways in the states of New Jersey, Rhode Island, Michigan and Connecticut.

Similar speed surveys for residential streets were also secured in four jurisdictions, these including several municipalities in New Jersey averaged together, and the cities of Minneapolis, Providence and Knoxville.

Summarizing our factual data, it is determined that the average speed of passenger vehicles when traversing rural districts under favorable weather and pavement conditions approximates 40 miles per hour. For residential areas, the average speed of passenger vehicles, under similar conditions, equals approximately 26 miles per hour.

A further analysis indicates that between 50 per cent and [illegible] per cent of the passenger vehicles, when traveling rural highways, operate at speeds between 35 and 45 miles per hour, and further that only about 10 per cent of the thousands of vehicles checked operated at speeds higher than 50 miles per hour.

In the case of residential areas, between 60 per cent and 70 per cent operated at speeds between 20 and 35 miles per hour, while only 10 per cent reached speeds higher than 35 miles per hour.

It is true that these conclusions are based upon exceedingly small samples, when considering the country as a whole. It is felt, however, that the results of these studies are probably more or less indicative of the driving practices of the average driver under comparable conditions and for the present, at least, may be considered as approximately correct.

It is further determined that speed laws and speed signs, particularly when the limits are low, are not necessarily obeyed, even by the majority, unless enforcement measures are sufficiently great to cause general observance. The average driver has a tendency to operate his vehicle at a moderate speed, depending upon conditions, and when in his opinion speed laws or limits seem too low, he will not hesitate to violate them unless caused to do otherwise.

Unfortunately, your committee has been unable to obtain sufficient facts to determine scientifically the relationship between speed and accidents. The studies made by the committee did, however, bring out specific opinions.

The statement is often made that "speed causes most accidents." It is true that "speed" at any rate must be considered as an element in highway accidents, for if vehicles were not moving they naturally could not collide. If, therefore, by the word "speed" we mean excessively high rates of speed (50 or more miles per hour), a statement such as the above is incorrect.

If, on the other hand, by the word "speed" we mean too fast a speed for the conditions then existing, or let us say, "haste," there is considerable truth to the statement. Regardless of whether the direct cause of the accident was one or more of several violations of the rules of the road, such as failure to grant right of way, passing improperly, turning improperly, driving recklessly, etc., the fact remains that if the drivers concerned were not in such haste and therefore took time to be safe, the accident would have been less likely to occur. This applies at speeds of 20 or 30 miles per hour just as well as at 50 or above.

It is also true that as the speed or velocity increases, so does the potential energy, for the hieher the speed the worse the accident. What part, however, excessively high speeds (50 miles per hour or more) play in accidents, your committee has been unable to determine. In other words, what percentage of accidents and fatalities concern the 10 per cent of motorists who drive over 50 miles per hour?

The answer to this question, of course, determines the usefulness of the compulsory use of governors or some such similar device on automobiles.

Although at present sufficient facts are not available to substantiate our belief, your committee is of the opinion that the compulsory use of governors on automobiles will not affect accident rates or even deaths to the extent that may be believed, unless

the maximum governed speed is made unreasonably low. There are many factors to be considered on both sides in a matter such as this, and until adequate scientific studies can be made to determine accurately their value, your committee strongly recommends against legislation requiring the use of governors or similar devices.

Your committee does not endorse permissible high rates of speed on any highway or at any time, but it is felt that for the present, at least, other methods of curtailment of such speeds should first be exhausted.

Only a small minority demands or practices excessive speeds. For those motorists who either infrequently or habitually drive at too fast a speed for conditions, or in other words too great a haste, continued enforcement, together with education, will prove effective.

There is great need for uniformity not only in the speed laws of the country but in their application and it is recommended by your committee that research studies be continued on this subject to the end that proper and adequate speed laws may be devised which are not alone basically uniform but meet the common-sense driving practices of the average driver.

Training the Changing Family of Traffic Officials

By ROGER L. MORRISON

Professor of Highway Engineering and Highway Transportation, University of Michigan, Ann Arbor

When we speak of education as one of the three "E's" of traffic control, along with engineering and enforcement, we usually have in mind the education of the general public-school children, parents, drivers and pedestrians. It is equally important, however, that those responsible for engineering and enforcement, in other words the family of traffic officials, should be educated in traffic matters, because, contrary to what appears to be a widely-held belief, such knowledge is not spontaneously acquired through election or appointment to office.

Our family of traffic officials is a large one, made up of those who make the laws, those who enforce the laws, those who punish law violators, and those who make the scientific studies which are vitally necessary if the other three groups are to function efficiently. This last branch is also responsible for the physical factors in the traffic problem, such as control devices.

The law-making branch of the family includes the state legislators and members of city councils; the enforcing branch includes state police, city police, and county sheriffs; the "punishing" branch includes traffic judges and prosecuting attorneys; and the engineering branch includes primarily traffic engineers, but indirectly also highway and automotive engineers. State commissioners of motor vehicles, or other licensing authorities, are important traffic officials but their places in the classification vary in the different states.

It is evident that all the members of this greatly diversified family cannot be given the same kind of training, nor do they need the same training.

For instance, those who change most frequently are the law-makers. We know that good laws and ordinances are fundamental to efficient traffic control. Therefore the law-makers are a vitally important branch of the traffic family. Evidently it is out of the question for them to be trained in every activity upon which they must legislate but, as a matter of fact, law-makers do not, as a rule, actually make the laws. Of course, they make some laws but I think it is safe to say that ordinarily they merely enact (or defeat) legislation proposed by others.

Thanks to ten years' efforts by the National Conference on Street and Highway Safety, and cooperating organizations, ready-made legislation is available which provides a legal foundation for efficient traffic control. Therefore, about the only training needed for the law-making branch of the family is to convince the state senators and representatives that they should pass the five Uniform Acts framed by the Conference and to convince the city councilmen that they should pass the Model Traffic Ordinance. More training would be desirable because minor traffic matters must be continually passed, but, if the Uniform Acts and the Model Ordinance were adopted all over the country, half the battle against death, destruction and delay on the highways would be won.

Passing by, for the moment, that branch of the traffic family which is engaged in the direct control of vehicles and pedestrians, we may consider the training of those engaged in punishing violators. It is with considerable hesitation that one undertakes to discuss the traffic education of judges and prosecuting attorneys. These gentlemen have usually had extensive educations and many years of experience, so that further training might be considered unnecessary. However, both judges and prosecutors are elected officials, often with little previous experience in handling traffic cases, and frequently serving comparatively short terms, so that even they may have something to learn about the complicated subject of traffic control, as related to court procedure.

To say that they may need such training, and to say how they should obtain it, are two different matters, while to have them recognize the need and seek the training is still another matter. It is often apt to happen that those who have the least need for additional information on traffic matters are the most likely to seek it. For instance, some of the most distinguished traffic judges and prosecuting attorneys frequently attend meetings like the National Safety Congress, while their less able and less experienced colleagues do not consider it worth while to do so.

Some judges, apparently feeling that traffic violations are unimportant, dismiss too many offenders, or punish them too lightly, thus seriously handicapping the work of the police. I know of at least one case where such an attitude was entirely changed when the local police officials interested the judge in safety work. Statistics showing the relation between the number of convictions of traffic law violators and the number of traffic deaths, in various cities, can be brought to the attention of the judges and should have some effect upon those who are too lenient.

It is hardly necessary to add that many judges are ardent and effective workers for traffic safety and give valuable assistance in the training of other traffic officials.

So far as the engineers are concerned, the first college instruction offered in traffic control was included in a course given by Professor Blanchard at the University of Michigan during the winter of 1920-1921. The course was entitled "Highway Transport Legislation and Traffic Regulations." The first instruction which could be called traffic engineering was given by Professor McIntyre at the University of Pittsburgh about 1923 as part of a highway transport course. The University of Michigan offered, in 1924, a two-hour course called "Traffic Engineering and Its Application to Street Design and City Planning." So far as is known, this was the first separate course in traffic engineering ever given. In 1926 the Erskine Bureau for Street Traffic Research was established at Harvard University under the direction of Dr. Miller McClintock.

Three years ago a survey of traffic engineering education was made by the Institute of Traffic Engineers and at that time it appeared that the Universities of Michigan and Wisconsin and the Missouri School of Mines were the only institutions offering separate courses in traffic engineering, though Harvard was outstanding in the traffic engineering instruction given through the working out of research problems. The Polytechnic Institute of Brooklyn had given a course in traffic engineering which was later grouped with another course for administrative reasons. The University of Pittsburgh and about fifteen other institutions were placing especial emphasis on traffic engineering in connection with highway work, and about ten others were reported as giving more or less incidental instruction in traffic matters. Traffic research problems had engaged the attention of faculty members in a few colleges not offering traffic engineering instruction to students.

Since this investigation was made, in 1932, interest in traffic engineering education and research has increased, an example being the extensive traffic survey recently made under the direction of the Massachusetts Institute of Technology, but just how many more colleges are now offering instruction in traffic engineering is not known.

As a result of eleven years' experience, the University of Michigan now offers a two-hour course in general traffic engineering and another two hour course in traffic surveys. In the latter course the F.E.R.A. Survey Manual is used as a guide for a number of brief field problems, and a large collection of survey reports is available for reference. Both courses are optional and are open to seniors and graduate students.

I may add that the results of the Institute of Traffic Engineers' educational survey, together with a list of subjects suggested for inclusion in a traffic engineering

course, and a list of suggested research projects have been published in pamphlet form by the Institute and copies may be obtained from the secretary.

Of course many city engineers and others are finding themselves engaged in traffic work without having had an opportunity to study any traffic engineering in college. For such men it is desirable to provide training opportunities similar to those to be described for enforcement officials. In fact both groups may well undertake many of these activities together.

The training of police officials and officers in traffic work involves, first of all, recognition of the fact that such training is needed. Progressive enforcement officers, all over the country, from police commissioners and chiefs right down through the ranks to alert and ambitious patrolmen, do recognize it. Splendid evidence of this was given last year when, in addition to the traffic division officials of the Detroit Police Department, fourteen of their patrolmen, if I remember rightly, attended the National Safety Congress at Cleveland on their own time and at their own expense. This spirit was also typified by a young traffic officer in Dallas, Texas, who wrote asking me for a reading list of traffic control literature. When I sent it he promptly replied that he had already obtained and read everything on my list and wanted more.

Unfortunately there are many other police officials, particularly in the smaller cities, who do not believe that any special training is necessary, and this is even more true of many of the elected officials who hold the police department purse strings and control its policies. This attitude was indicated by the mayor of a medium-sized city, the president of a mayors' organization who said that "traffic control is merely a matter of common sense." According to that viewpoint, any good sensible farmer could quickly solve the traffic problems of a large city.

Absurd as that man's statement was, it represents the sincere belief of a great many mayors and aldermen whose cooperation is needed if traffic officers are to receive any training which costs the city money. Perhaps when the average city gets a little farther away from the poorhouse it will be easier to sell the city fathers the idea of spending a little money to make their traffic officers more efficient.

The science and art of traffic control have developed rapidly to their present stage and are still developing. Successful methods of handling certain traffic problems have been worked out and are well-known to many traffic officials. Solutions of other problems are continually being found, or at least old methods are being improved. The proper training of those in charge of traffic control consists of first teaching them what is already known and then keeping them advised of new developments.

The ideal training would be for every traffic officer to have a schooling of perhaps a month, or several months, preferably at a university. Instruction would be given by members of the law and medical faculties, as well as by those from the engineering faculty, and leading police officials, traffic judges, and traffic engineers would give lectures and demonstrations based upon their long practical experience. This is not an idle dream but a plan similar to one which was in successful operation for about fifteen years, first at Columbia university and then at the University of Michigan, for the training of highway engineers. The dream part comes when one begins to imagine that, under present conditions, there would be a large number of men taking the course.

The best education now available for traffic officers is attendance at the annual Safety Congress and the excellent traffic schools held at Evanston after the congresses. Attending national meetings, however, is especially difficult for men living in distant states, and it is desirable that the enforcement officers of each state should have an opportunity to get together and discuss their common problems. Such a plan has been adopted in Michigan.

Ever since 1915 an annual highway conference has been held at the university. During the first twelve years the programs occasionally included a paper or two on some highway safety subject but no effort was made to attract police officials to the meetings.

In 1927, however, one whole afternoon session was devoted to safety subjects, with a traffic judge and a police official included among the speakers. Similar sessions were held at the next two meetings and then in 1930 and 1931 a whole day was given to traffic subjects, the attendance of enforcement officials having increased from year to year. In 1932 the plan was adopted of having a joint session of the highway engineering and traffic groups in the morning of one day, with traffic subjects of interest to both groups, and then having separate sessions in the afternoon. This increased the attendance of highway engineers on the traffic-control day and the plan has been continued since then.

There are many traffic problems affected by Michigan laws and regulations which are of vital interest to this group but which would, of course, never be discussed in a national convention. The local speakers include state and county police officials and sheriffs, state and county highway and traffic engineers, traffic judges and prosecutors, automobile club officials, and others.

In addition to the local speakers, many eminent traffic authorities from other states have addressed the meetings. The proceedings are published and make valuable reference books.

Judging by our own experience, I believe that similar conferences should be held in every state, and the universities have a great opportunity for additional public service in that connection.

To those who may be considering the holding of such meetings I would say that three things appear to be required for success. One is a promoter, or group of promoters, willing to do a great deal of work in making the necessary arrangements; the second is the cooperation of various organizations; and the third is enough money to finance the meetings.

In Michigan the cooperating organizations are the university, the State Highway Department, the County Commissioners' and Engineers' Association, the State Police, the Traffic and Safety Directors' association, and the Sheriffs' association. In more prosperous times all the financing was done by the university, but now the small appropriation has to be helped out by registration fees of $1 for the traffic sessions or $2 for the entire conference. The printing of the proceedings is the largest expense item.

At present the main effort toward traffic accident reduction is a barrage of speeches, articles, posters, etc. telling how serious the situation is and pleading with the drivers and pedestrians to be more careful. This is very desirable, and more or less effective, but it is unfortunately true that certain persons who cause a large portion of the accidents are the least likely to be influenced. The states, counties and cities are clearly slurking an important part of their responsibility as long as they fail to provide adequate training for the family of traffic officials.

THURSDAY AFTERNOON SESSION

October 17, 1935

PUBLIC EDUCATION

The session was called to order by Wm. C. Knoelk, Chairman, Milwaukee Safety Commission, who presided.

Report of Committee on Public Education

By FRANK C. BERRY

Manager, Safety Department, Minneapolis Automobile Club, Minneapolis, Minn.

We have accepted the basic principle that education is imperative in bringing the public into a proper understanding of what its conduct must be in this motor vehicle age. We have agreed: that the first requirement of this education effort is

that it must arouse the interest of the child, adult, driver, pedestrian; create a realization of the seriousness of the accident problem and the need for their personal interest and participation; that the second requirement is a compulsion to inform the driver and pedestrian as to the specific things he needs to do.

It must be apparent that we have not in any wise succeeded in doing either of these two fundamental things as yet. The past year has witnessed the first encouraging signs that the great American public is shaking off its lethargy.

Educational work in this field must cease to generalize. It is the essence of futility to continue to admonish drivers and pedestrians to be careful. Rather must we inquire as to just what care consists of. What are safe and reasonable speeds under variable conditions of roadway, environment and hazards? How about reaction time and stopping distances at various velocities? What is a prudent and reasonable speed maximum in an ordinary built up area? Is there one, or will just exercising care suffice? Surely these are vital questions, the essence of sound premises on which adequate education must be based.

With all our educational efforts today, many persons supposedly skilled in the technique of safe driving still drive just as fast as ever under hazardous conditions and otherwise; their speed about town may be upwards of 35 or 40 miles per hour, and as a consequence they are practically as dangerous as ever. Their training has dealt only with the minor phases of this problem.

This is a plea that we recognize at once the importance of the inordinate and excessive speeds generally indulged in today as the crux of this traffic accident problem and take steps to make it the business of this Section to reverse much of the practice of the past in educational work, to the end that the relative importance of speed as the leading cause of traffic accidents be immediately recognized and the attack concentrated at this front.

There seems to be a general agreement that our high schools should assume the major responsibility for educating the youth in preparation for adaptation to the motor age. This means nothing less than compulsory high school training in this field. It is insufficient that it be made an optional or extra curricular subject.

Inter-district contests in traffic enforcement and traffic education have met with generally good results. They are to be recommended.

Traffic schools for violators, if efficiently organized and conducted by skilled instructors, covering a well arranged course of at least ten hours, appear to have accomplished enough to warrant confidence and respect.

Schools for juvenile violators have had experimental trial and apparently have met with merited success.

The major problem today is, how to educate the average adult driver?

It is our belief that the public as a whole is incompetent to decide on what is a safe speed for conditions. It seems reasonable to presume that in the near future we will find it necessary to zone the entire pattern of highways for permissible maximum speeds.

Adult education in this field is gravely needed but the manner of accomplishing it is not easily to be found. Some success has been had with well organized schools for adult instruction in safe car operation but as yet there has been insufficient progress along this line to indicate any definite trend.

Compulsory inspection of motor vehicles is gradually becoming established throughout many sections of the country. It is reasonable to expect that within a few years periodic inspection will have become generally compulsory. A splendid opportunity exists at the time a motor vehicle owner is having his car inspected to perform an effective piece of educational work through the personal contact afforded and also through the medium of well prepared safety literature which might well be distributed at this opportune moment. Your committee recommends that serious consideration be given to the question of the promotion of educational effort to go hand in hand with compulsory inspection.

Peace officers as a whole are inadequately prepared for their duties which involve traffic regulation and enforcement among other things. This "provision" has lagged grievously and has entirely failed to keep pace with the needs of a highly organized and complicated social pattern. Therefore, your committee wishes emphatically to recommend that all peace officers be subjected to intensive training and tutoring as a prerequisite to proper fitness for their performance of duty. Judges and magistrates could perform their functions to better advantage by familiarizing themselves much more thoroughly in the technical fundamentals of the science of safe car operation.

Previous educational committee reports have dealt extensively with the public educational possibilities afforded by the movies, the newspapers and the radio. Many developments have taken place in all these fields and inasmuch as this material is well classified and available through the medium of the National Safety Council, your committee feels that further comment is unnecessary.

The Federal Government has seen fit to spend approximately fifteen million dollars during the past year or two, making traffic surveys, and we feel that if further appropriations are to be made of this character that the field of public education in traffic safety might ask for similar appropriations with equal justification.

Since today we have more and better ways of spreading information among a great mass of people than the world has ever before possessed, it would appear logical to assume that these media of mass education should be employed to the end of safeguarding life and limb upon our streets and highways. That this is not being done, except as charity makes possible, should be self-evident to all who are interested in the prevention of automobile accidents.

Therefore, it is the sense of this committee that public opinion must be created which would be favorable to the setting aside of some part of public funds for use in safety educational endeavors. In this objective, all advocates of automobile accident prevention should be willing to lend their assistance, so that within the immediate future, safety education can be lifted out of its present state of pauperism.

Attention of the public should be directed to the apparent success which has greeted the city of Milwaukee as a result of the organization of the Milwaukee Safety Commission. Due to a lack of coordination by the various agencies promoting public safety in Milwaukee, the Mayor in the fall of 1918 set up, as a regular city department, the Milwaukee Safety Commission, composed of fifteen members appointed for three years. The membership on the Commission is a purely honorary appointment—no salaries, except the executive personnel.

The Commission is financed through the regular city budget, the same as any other city department. The original budget was $2,000; in 1935 the budget was $22,500.

The Commission acts as an advisory body to all city departments on matters of public safety.

The Traffic Engineer and his staff are independent of the Commission, but all his work must pass or be approved by the Commission.

All educational work in the schools is carried out directly by the Commission.

The Commission includes within its membership city officials, professional leaders and private citizens. The original appointees are still on the Commission with two exceptions, both due to death of the members in question.

The Commission conducts commercial drivers' schools each year with an attendance of over 3,700 commercial drivers. Another school for women drivers is conducted in the spring of each year with an average attendance of over 1,100 women. Monthly safety bulletins are sent to all luncheon clubs and all P. T. A. groups. Daily releases on matters of safety are given the local press and a constant program of public safety is conducted throughout the year.

How to Reach the Public on Traffic Safety Over the Radio

By JOSEPH S. EATON

Program Director, Station WHAS, Louisville, Ky.

The personnel of properly conducted radio stations should be fully conscious of their responsibilities to a community. We employees of WHAS have been schooled in this business of serving our community. Inasmuch as our station is, in the broad sense of the word, a gigantic speaker addressing millions of people, we must be ever alert to public necessities and community welfare. Radio listeners look to their

loud speaker for educational, religious, and civic guidance. Without boasting, I feel that we are succeeding in assisting in a spiritual and educational way. In civic matters because of lack of organization, we oft times find ourselves in a whirl. We work hard to cooperate with the various civic organizations but we never have completely felt that we have utilized our facilities, in the public's interest, to the fullest extent. If the safety organizations in their respective communities have established an objective and are willing to cooperate with the radio stations in the preparation of material they possess, then certainly results can be obtained.

Unfortunately, many people labor under the impression that all one need do is to step before a microphone and start to talk and that listeners everywhere will tune in to hear what he or she may have to say. This emphatically is in error. People will listen only to that which is interesting and plain, ordinary, colorless talks of five, ten or fifteen minutes are absolutely a waste of time and energy. It is so easy to turn the dial to something of more general appeal.

Mr. Rodenheber, of The Louisville Safety Council, feels very close to WHAS in that he can come to our studios, talk with us, advise with us what he would like to do and how he proposes to do it. We have definitely decided that to curb the traffic accidents in this community, it is going to be necessary to resort to a bit of trickery, some showmanship or some flash which will act as a vehicle for conveying the traffic accident messages. No message is of value unless you have listeners.

When preparing radio material, therefore, prepare it with the idea of listener interest, and let there be some elements of showmanship injected into it. The Traffic Court is a show in itself, usually put on by four characters, the offender, the judge, the prosecuting attorney and the complaining officer. Certainly a lot can be done to keep down accidents with that sort of a radio broadcast. If, in a community, there are certain intersections that have proved hazardous, why not request the radio station to place microphones at this dangerous corner and inform the public of what is to transpire there. Broadcast over the Police Radio a call for cars to respond to an imaginary traffic accident. Let the cars arrive and then let the officers discuss over the microphone, some of the elements of traffic conduct and public safety. The sirens, the street noises, and all of the many elements of everyday metropolitan life will make of this a good show and will eventually produce traffic consciousness on the part of the listener.

Another possibility is for the Safety Council to get the cooperation of some local dramatic club or art society and ask them to prepare some five and ten minute dramatic episodes in which traffic plays the villain and let some public-spirited person be the hero or heroine. Inject into these dramas the sound effects of cars careening around the corner, screeching tires, the howling of brakes, the crashing of two vehicles head-on and the various occupants giving vent to their emotions, prior to and following these disasterous moments. I grant that this is all showmanship; but after all, if people will not awaken to their own individual civic responsibilities by persuasion, sensible argument and discussion, then let us resort to trickery to impress them with the dangers, liabilities, the tears, the broken hearts and all of those things which accompany traffic accidents.

Visual Safety Education

By SERGEANT RAY SULLIVAN

Michigan State Police, East Lansing

I have been a State Police officer for eight years. I have had the good fortune to be employed in several phases of police work—the greatest part of this time, however, in safety education. For the past five years I have been employed in public relations work spending most of that time on safety education. I worked diligently on this for a time organizing patrols, talking to the children and building exhibits but this field necessarily had to widen in our department. We had to represent other things.

I talked on police radio, on criminal identification and other subjects and built exhibits on the work of the department as a whole, including the subject of safety

education. During that time I gave chalk talks, exhibit lectures and demonstrations and we built more exhibits and then began to distribute literature.

As this effort became established and known to the schools of the state as well as other organizations, the demand grew. I am happy to say that from 40,000 people a year my audience has grown to more than 150,000 a year including nearly all of the larger high schools in the state as well as many clubs. This list requires a year and a half to complete. Add to this five or six hundred people a year attending our exhibits as well as thousands of pieces of literature on various subjects. This division of work I call public relations for good reasons, and in it safety education, of course, plays an important par

Visual safety educa[tion] my assigned topic today, but the real topic supporting all my material is public relations, that term so important to police officers in all fields of work. Public relations—the thing which we must not for a moment forget, whether we are engaged in enforcing the criminal laws of the state, riding motorcycle, directing traffic or employed in a record bureau. Public contact determines our success as a police officer.

I wonder if better public contacts wouldn't do a great deal more for safety. I wonder if we don't sometimes lose or wholly disregard the citizen's view on these problems, leaving with him only the feeling that an injustice has been done. The policeman's action is prompt, his judgment is founded on experience, he knows the dangers and the countless accidents which prompt his actions, but the citizen may not. He may not understand the seriousness of his act. The gruff unexplaining police officer turns the affair into a personal matter or grievance, and the real safety lesson is lost.

Regardless of our seriousness, regardless of our efforts in providing and enforcing safety regulations we are still police officers, guided and ruled by that ever-present unwritten law of the policeman that, "You can not enforce a law beyond public sentiment," and traffic laws are most surely included with all other laws with which police officers are concerned. For instance, I can understand how a well-meaning citizen may constantly violate a certain traffic law because he sees no earthly reason for it. To him it is ridiculous and its enforcement is a farce. He may be arrested probably without gaining any particular respect for the law or its enforcement. But suppose that through some experience he comes to learn the reason for the law. He discovers the dangers and learns to fear the consequence of such action. He is finally impressed with the necessity for the law. Then he disapproves of others who commit the offense. He sets an example and finds it as easy habitually to observe as habitually to violate. To gain real support for any effort we must build up interest, yes even better, enthusiasm. We must constantly strive to hold the public view along with the policeman's.

Our problem of safety is first of all one of education. Men in the field of safety education have developed various methods of "putting it over." As a whole, however, the material is so often repeated that it has become truly "threadbare." Few people are willing to see a moving picture twice or to hear a story too often repeated, and yet they are expected to be impressed by the same safety story year after year. A great difficulty, no doubt, is that the problem is entirely too apparent to all to command interest. All right then, let's dress it up. Let's add color and human interest to it. I truly believe that there are countless ways of doing this within the reach of all who will spend the required effort. Let us consider the possibilities in visual ways. There is a great appeal in visual things. Anything in pictures, anything done with the hands, a surprise, a suspense, a good laugh—all bring in your points.

After all everyone thinks in terms of pictures. As you talk, their imagination must supply the lacking visual picture. A photograph, a picture, a diagram or a model will clear their minds, will lead your audience. Color, life and action will lend interest and conviction. This is especially valuable in working with children, whose experiences and associations are not broad.

One time I carried a little black box in my pocket and announced that I wouldn't take part in the program but that it would all be done by my little helper, whom I had brought along. They looked all around the room for this invisible fellow, and I pulled the box out of my pocket. I announced to my amazed group of youngsters that my helper was inside the box, where I carried him to keep him

out of trouble. I thereupon produced a heavy stick of soft chalk and drew Felix the Cat. I then put Felix through many hazards, teaching my safety lessons to the delight of the children. It was quickly picked up by the press, and I nearly got the nickname of Felix. One paper announced that the Bird man would be at the school in the morning and the cat man in the afternoon. Nearly a year later a boy recognized me at the county fair and called to his buddies, "Come quick, here's Felix's uncle." I have a book of newspaper clippings on this stunt, some from other states, and here are several: "Sullivan and Felix visit School." "Artist Trooper Brings His Lieutenant Felix the Cat to Teach Safety." "Felix Risks His Nine Lives Daily to Teach Safety."

I've been asked, suppose you can't draw? Well—here's one that got a laugh and I heard about it for a long time. Three quickly executed circles in one continuous line, each smaller than the first, a few more lines, a crooked tail and we have a magnificent pig or road hog. A policeman may think he's been on this job too long when he starts making paper dolls, but here is one without chalk. A block of wood, pipe cleaners, a little bending and presto! a good safety lesson. Make four or five different ones and leave them at the school when you go, the impression will be more lasting.

Here's a story—"Once I watched a lady crossing a street, etc." Yes, the picture goes with it and the title if you want to know, is "Seven Good Ways of Causing a Really Worthwhile Accident." Surely I am not treating this very seriously, but ridicule will get my point home

So far so good, but how are we going to handle statistics? Let us try this Here is a thermometer made from a piece of presswood covered with black cloth. The glass and the bulb are cut out of wood and painted red. A sliding ribbon is placed over the column and numbers are fastened on from a calendar sheet. It costs little and aids materially. This clock dial will show the dangerous times of day graphically, or these blocks will represent causes of accidents on a percentage basis and when added will present a startling total visually. These are simply a few suggestions and I hope helpful ones but after all this is simply a means.

To consider safety education we must realize first of all that it is a public problem as well as a police problem and the public must have a share in its solution.

Organizing a State for Safety

By A. V. ROHWEDER

Supt. of Safety and Welfare, Duluth, Missabe & Northern Railway Co. and Chairman, Minnesota Public Safety Committee, Duluth, Minnesota

Since June first, 1934, Minnesota has achieved a definitely increased measure of statewide safety, particularly in the way of traffic accident reduction by the use of a contest, the same means that has enabled the railroads of the United States to be in the foreground of accident reduction work.

So real has been the desire for the "best showing" as to traffic accident record in Minnesota that an instance is on record of a municipality putting night and day nurses, and the best resources of its hospitals and doctors, in charge of a motorist injured two days before the close of a contest period to insure, if possible, that his death did not mar a twelve month no-fatality record and deprive the city of a Governor's Safety Trophy. Two other municipalities, separated but by a line, sent out engineers because of the intricate question involved in circumstance of a motor vehicle striking a street car on one side of the dividing line and, so it was claimed, being driven across by the force of the impact into the territory of the other municipality. Deaths occurred from the accident. Counties ask correction of records because accidents from which deaths resulted had taken place outside their boundaries, and cities submit records to show that deaths occurring in their hospitals were the result of accidents happening elsewhere.

Development of this "accident consciousness" upon the part of the people of the counties and towns of Minnesota has been a major objective of the Minnesota Public Safety Committee—of which I have been chairman since its organization on

May 18, 1934, at a statewide conference called by Governor Olson. We secured C. H. Zealand, who had served for many years as executive secretary of the Minnesota Safety Council, as director of our public safety program. The cooperation of the president of the Minnesota Safety Council, Colonel Frank W. Matson, and of L. P. Zimmerman, state emergency relief administrator, was most valuable.

First an Advisory committee was set up. Among its members are the governor of the state; the attorney general, secretary, auditor, treasurer; the president of the Minnesota safety council; heads of important departments of the state; the presidents of the state bar association, newspaper association, the police association and various farm organizations.

Meetings of the Advisory committee, held monthly, are alternated between St. Paul, Duluth, and Minneapolis. The attendance is excellent despite the fact that members must pay their own expenses. The Advisory board determines the policies and activities of the state safety program and supervises the work of the staff members.

Following the formation of the Advisory board came the organization of 32 city and 85 county public safety committees. The cities are over five thousand or greater population. The counties in which Minneapolis and St. Paul are located are cared for by the public safety committees of these cities. Membership upon the city public safety committees includes the mayor and other officials, engineers, superintendents of schools, and heads of civic organizations. Membership on county committees includes the sheriff, commissioners, engineers, officials of the smaller municipalities, and representatives of farm organizations.

In Minneapolis, St. Paul, and Duluth the public safety committees (which are organized on the standard plan of the National Safety Council) have the benefit of the services of paid safety directors.

Upon the city and county committees devolves the duties of reporting the occurrence of traffic accidents to the state committee, of investigating locations showing marked accident frequency, of extending accident prevention interest into the schools, homes, industries and organizations of the community, of making recommendations to the constituted authorities, and of giving recognition to outstanding accident prevention services, such as that of school patrols, boy scouts, automobile clubs, and law enforcement agencies.

Based on information furnished by the local committees, and on the official records of the division of vital statistics of the state department of health, standings of the cities and counties are compiled each month and distributed. Both the cities and the counties are divided into three groups according to population to make the ratings more equitable and more interesting.

So far standings are based solely on the number of traffic fatalities in proportion to population. It is not yet practicable to include personal injuries. It is the hope that the next session of the legislature will make the reporting of personal injuries a legal requirement. Then, these, too, will have part in giving a city or county its rating.

The awards by Governor Olson of six bronze plaques, three for cities and three for counties having the highest standings for the year of 1934, was a material factor in arousing the interest of all communities. The governor has made an offer of like awards for the present year. The presentation of these plaques, in February, served immeasurably in stimulating activity upon the part of the communities.

Were I to make but a single recommendation for organizing a state for safety it would be to put a competition into the plans. If there be need of substantiation of this conviction I could point to nothing better than the National Traffic Safety Contest of the National Safety Council in which every eligible city of Minnesota is participating. The competitive program of counties and cities in Minnesota was developed for the Minnesota Public Safety Committee in conference with Mr. Lew R. Palmer, vice-president of the National Safety Council

While our committee is a non-official organization, its Advisory board embraces the heads of many departments of the state, and the cooperation that has been accorded by these departments has been a material factor in the successful accomplishment of our undertakings. With the aid of the State Emergency Relief administration, and certain departments, we have been enabled to produce and distribute 80,000 copies

of a traffic safety manual designed for use in schools. Through the cooperation of the State Highway patrol and local public safety committees, safety booths were established at 62 county fairs and the Minnesota State Fair. The newspapers and the radio companies have rendered service in the development of a safety consciousness. Safety posters have been put up on schedule in more than ten thousand locations throughout the state.

To the leadership of its governor—to the cooperation of other state officials, and local and statewide organizations too numerous to mention—and particularly to the directors and officers of the National Safety Council, Minnesota owes whatever measure of success in its endeavors for accident reduction it has been its good fortune to have achieved.

FRIDAY MORNING SESSION

October 18, 1935

THE DRIVER WHO HAS BEEN DRINKING

The session was called to order by R. J. Catlin, Aetna Casualty and Surety Co., Hartford, Conn., and Vice-President for Public Safety, National Safety Council, who presided.

How New York State Deals With the Drunken Driver

By CHARLES R. HARNETT

New York Commissioner of Motor Vehicles, Albany, N. Y.

Since the creation of a statistical unit in the Bureau of Motor Vehicles of our state early in 1925 up to August 31st of this year, a total of 22,288 drivers have lost their licenses to operate motor cars on our highways for driving while intoxicated. Under our statute a court conviction is necessary to sustain the revocation of a driver's license. Upon such court conviction, unless the sentence is suspended, the justice, or if he has failed to act, the commissioner of motor vehicles must revoke the driver's license for a minimum period of at least six months.

In our state justices of the peace do not have authority to revoke drivers' licenses. They are authorized to hear such cases and to convict and impose penalties of a penal nature in keeping with the offense, which in our state is a misdemeanor, but the transcript of their action in each case must be forwarded to the commissioner of motor vehicles who immediately revokes the driving license. The power of suspension or revocation is vested in the following: magistrates or judges in a city or village of the first class, supreme court and county justices as well as judges of a court of general sessions, the superintendent of state police and commissioner of motor vehicles or his authorized deputies. But, neither the superintendent of state police nor the commissioner of motor vehicles, can revoke a license for driving while intoxicated unless the individual has been convicted before a court.

When a person is arraigned on a charge of driving while intoxicated he usually demands a trial by jury because he hopes to secure consideration from one or two of the jurors or hopes for a disagreement. He prefers not to trust to the judgment and fairness of the sitting judges. I am sorry to say that all too frequently, even though the evidence is convincing, the defendant escapes the punishment which he justly deserves, and, this to my mind implies weakness and gross indifference on the part of the public. We have, however, a legal way of exacting a penalty other

than a revocation. Some months ago an automobile driver was accused of driving while intoxicated. He moved for a jury trial and the motion was granted; a physician swore the man was intoxicated at the time he was driving but the jury failed to convict. The circumstances were such that the district attorney had asked the bureau of motor vehicles for aid. We made an examination of the case, scheduled it for a hearing and, based on the testimony taken before our motor vehicles referee, we found that this man had been operating a truck "in a manner showing a reckless disregard for the life and property of others." Accordingly, we took away his license and removed another menace from the highways.

In 1934, 12,389 hearings were conducted by our referees, a considerable number of which were similar to the foregoing, in that there was some evidences that intoxicants were *the* underlying cause of an accident resulting in personal injuries.

A person who has been convicted in our state of driving while intoxicated who is again charged with that offense, must be prosecuted for a felony, and if convicted, the mandatory punishment is imprisonment for not less than sixty days or more than two years, as well as a fine of not less than $200 or more than $2,000.

Is drunken driving on the increase in our state? Beginning with 1927 when there were 2,406 such revocations, we jump the next year to 2,560 and in 1929 to 2,577. There was a considerable increase in 1930 amounting to 2,759 and the following year the figures rose to 2,816.

In 1932 one of our licensees convicted in another state of this offense tested the validity of our action in revoking his license, because of a dissimilarity in the language of our statute and that of the other state. The appellate division of the First Judicial department held that under our law we could not revoke the license because of such difference in language. This decision came at the close of the legislative year, and it was necessary for us to follow that opinion in all cases of convictions for driving while drunk, which occurred in states other than our own and where the language of such statute was different from ours. We brought the matter to the attention of the Legislature of 1933, and an amendment to remedy this condition was passed. It was signed by Governor Lehman and became effective June 1, 1933. This by the way, resulted in a great drop in the number of revocations in the years 1932 and 1933. In 1932 there were 1,430; in 1933 only 1,157. In 1934 they rose to 1,954. In the present year, for the first eight months, there were 1,254 revocations made by us for driving while intoxicated. This compares with 1,117 for the first eight months of 1934. While the present year's figures are greater than last year's for the corresponding eight months, it will be seen they are much lower than in 1931 and the preceding year, when we had total prohibition. Nevertheless it is disturbing that we should have any increase this year and this should be a timely warning to the general public and all enforcing officials to take heed of the menace which stalks about us. Where conclusive evidence is shown that motor car drivers have the effrontery to drink intoxicating liquors to the point of drunkenness and then drive on our highways, the severest penalties possible under the statute should be meted out as a warning to others of the consequences of such folly.

Although the law sets the minimum time for a revocation as six months, it has also placed in the hands of the commissioner of motor vehicles exclusive authority in the approval of an application for a new license.

In pointing the way for more severe punishment and penalties for those who are convicted of this offense. I have decided that to approve an application for a new license until at least one year has elapsed from the date of such conviction. Where a driver has had two convictions for driving while drunk, it has been very rare that I have approved, even after the lapse of many years, an application for a new license. Our statute also provides that a person convicted twice of driving while intoxicated, where in both instances an injury or death has resulted, shall be barred forever from securing a driver's license. Now, after the revocation period of one year has elapsed, the driver makes a new application and reports are secured from the police department to determine if he has been guilty of any other offense. If he be free in this respect, the application will be approved, and he may take a new driving test, but no license or motor vehicle registration will be issued until the applicant submits a policy of insurance or a bond in the amounts of five and ten thousands dollars for personal liability and one thousand dollars for property damage. He must continue to keep this insurance on file with us for three

years. If the policy is canceled on ten days notice, his license is immediately suspended until his insurance is re-instated. It is becoming increasingly difficult for drivers in New York convicted of driving while intoxicated, to secure insurance of this type.

There is no way of determining the number of traffic accidents caused each year by intoxicated drivers, partly because police officers are not often at the scene when the accident occurs. A driver under the influence of liquor will rarely admit such a condition or that intoxicating liquors had any influence in causing the accident. The number of convictions, therefore, is not an accurate guide to the number. But note what figures we have for our state. In 1929, 837 intoxicated drivers caused the deaths of 57 persons. In 1931, 838 of these drivers caused 37 fatalities. Although in 1932 there were only 630 such drunken drivers, the fatalities rose by 22 to a total of 59. During 1933 there were 7 less drivers involved, with the fortunate decrease in fatalities to 46. Last year 810 drunken drivers killed 62 persons. This, by the way, was seven-tenths of one per cent of the total of 113,884 drivers involved in accidents of any kind resulting in personal injuries. In the first six months of this year 321 intoxicated drivers were responsible for accidents causing 21 deaths.

Back in 1926 a prominent business man on Long Island struck a boy bicyclist, dragging him a quarter of a mile. He left the boy on the road to die and drove 14 miles away, where he was arrested in an intoxicated condition. Despite his influence and standing he was convicted and sentenced to jail. Repeatedly after his release he made application for a license. Each time I denied his request. He settled in the northern part of New York State seven years ago, and has become a valued member of the community, profiting by the results of that terrible accident. Recently, upon the recommendation of the Chief of Police, the District Attorney, the Mayor and other prominent citizens, I approved his application, after a lapse of nine years and placed him on probation so that his good conduct will warrant the continuance to him of a driver's license.

The Mayor of New York City gave attention to the dangers of drunken driving and recently issued an order directing that surgeons of the police department be subject to call at all hours of the day and night for examination of drivers accused of operating cars while intoxicated. In co-operation with the health department he caused hospital internes to be summoned in such cases to strengthen the prosecution's evidence to insure conviction.

A motor vehicle administrator in a state adjoining our own placed his highway patrol officers, who have the powers of arrest, at road houses, restaurants and hotels on certain nights with instructions to watch for intoxicated persons who might attempt to enter their cars and drive away in that condition. If they did so, they were placed under arrest. I have recently called that practice to the attention of the policing authorities of our state urging them to give such a plan consideration and, although the motor vehicle examiners of our bureau are not peace officers I have assured the police officials of my complete co-operation with the use of these examiners in this work, if it is undertaken.

What about the tests to determine if a person is intoxicated? A medical examiner in New York City said, "Every fool can tell whether or not a man is drunk. What is drunkenness? Drunkenness is largely a matter of relativity. Are you going to make a speech or drive a bicycle? You may be drunk for one or sober for the other. A glass of wine may put you off cycling altogether, as cycling is a matter of delicate adjustment, but I have certainly heard some excellent speeches made when the speaker had drunk so much he would not have seen a bicycle if you had put it on the table before him."

Drivers with too much alcohol seem to have an increased self-confidence. They might do well to study what happened to a car on the west side elevated highway in New York City less than a month ago. Racing along at four o'clock in the morning it came to a bend in the road, jumped the curb, crashed head-on into the steel railing, bounced back, careened along the wall and again hit the guard rail. The man who sat in the rumble seat escaped injury. "I looked up," said he, "and there was nobody in the front seat." Down in the street a ship worker heard the crash and looked up. "I saw some things sailing through the air," he said, "they looked like three cushions somebody had thrown out of their car. Then I heard three shots. I knew they were skulls cracking." The three were lying on their backs when the ambulance surgeon

arrived—two men and a woman. One of the spectators noticed that one of the dead man's hands still clutched a glass.

I believe a conviction of drunken driving should, by statute, outlaw a driver for at least two years from the highways and carry in addition a penalty by fine of at least $200 and/or a jail sentence.

The enforcement of our present law is attended by difficulties that discourage officials. Perhaps this will be corrected by the adoption of a scentific method of determining to what extent efficiency has been impaired in a specific case, and made so convincing that the evidence will be accepted in court.

It has been suggested that the law be amended to include "dangerous driving" on which charge police officers could make arrests where it would be impossible to prove, beyond a reasonable doubt, that a man was driving while intoxicated. The consumption of liquor would be used as corroborative evidence rather than as the sole basis of the charge. However, I believe police officers could well charge a motorist with driving while intoxicated and reckless driving, and if he escaped the former charge, he might be convicted of the latter. Reckless driving could provide for more severe penalties in instances where excessive use of liquor is involved.

Education undoubtedly must be employed to reach the man inclined to drink too much and drive a car. Education will enlist public sentiment and lead to a demand for more severe penalties for the offense, as well as rigid enforcement. Let us dedicate ourselves to the task of educating the children in our elementary and high schools to guard against the dangers of the excessive use of alcohol, both from a health standpoint and while driving motor cars, for these children of to-day will be the drivers of to-morrow. An intensive campaign among them throughout the school systems of this country will produce millions of future drivers with a thorough knowledge of the dangers that beset such a practice. We are teaching these children the value of safety in crossing highways. Now let us teach them the dangers that attend the operation of motor cars by those who drink.

The Arrest and Trial Report of an Intoxicated Driver

Characters in Order of Appearance:

Desk Sergeant—Officer G. A. VanArsdall, Louisville Police Department.
Accident Investigators—
Officer Heustis } Louisville Police Department.
Officer Carey }
Defendant—"John Smith"—An unidentified Louisville newspaper reporter.
The Doctor—Dr. Herman A. Heise, Columbia Hospital, Milwaukee, Wisconsin.
Bailiff of the Court—Officer A. R. Forster, Evanston Police Department.
The Judge—The Honorable Harry Hibbert Porter, Chief Justice of the Municipal Court, Evanston, Illinois.
State's Attorney—Mr. Francis Bartlett, Assistant City Solicitor, Cincinnati, Ohio.
Witness for the State—Dr. B. L. Corbett, Executive Secretary, Milwaukee Safety Commission.
Defense Counsel—Lieutenant F. M. Kreml, Institute of Public Safety, Purdue University.

. . . . . .

Scene One—Police Station, City of Metropolis.

Sergeant VanArsdall seated at desk receives a telephone call *reporting* an automobile accident at 4th and Broadway. The Sergeant relays the call to the Dispatcher who sends the accident investigation squad to the scene.

. . . Curtain . . .

Scene Two—Same as scene one.

Accident investigation officers bring the defendant before the Desk Sergeant. The defendant has apparently been drinking and the officers indicate to the Sergeant that they wish to place against the defendant the charge of driving while intoxicated.

The Sergeant thereupon gave the defendant the following tests:

1. Walking a ten-foot chalk line—defendant passed this test.

2. Bringing the index finger to the tip of the nose with eyes closed—defendant passed this test.
3. Standing erect at the military position of attention with eyes closed without swaying or starting to fall—defendant passed this test.

At this point the Sergeant expressed disappointment with the crudity of the tests they were using and summoned Doctor Heise by telephone. Dr. Heise arrived upon the scene and questioned the defendant at some length, after which he subjected the defendant to the above mentioned tests a second time and the defendant again executed them satisfactorily.

Dr. Heise then ordered that a specimen be taken from the defendant and advised the officers that he would be in court to assist them in the prosecution of the defendant.

. . . Curtain . . .

Note: The defendant had actually taken eleven ounces of 100-proof whiskey within two hours of the time the specimen was taken. The amount was unknown to Dr. Heise or to any of the persons taking part in the demonstration.

The Trial

Scene One—Court Room of Judge Harry H. Porter in session, sitting on the case of John Smith, the defendant in Act One.

Note: This trial was not rehearsed and proceeded without any previous agreement except an agreement as to the facts of the accident and the number of witnesses to be called. The prosecution and defense prepared their cases separately as though for actual trial and Judge Porter, insofar as was possible, heard this case and gave judgment solely upon its legal merits, as he as a trial judge, decided them.

Mr. Bartlett for the prosecution, first called the eye witness, (Dr. Corbett) who testified that in his opinion the defendant was drunk at the time of the accident and that the defendant on trial had been driving a motor vehicle in that condition at the intersection of Fourth and Broadway *immediately prior* to this accident. Corbett was unshaken on cross-examination.

Note: Corbett was put on the stand primarily to establish the element of driving.

The prosecution next called Officers Heustis and Carey, each of whom testified that the defendant was drunk at the scene of the accident, although they admitted, under cross-examination, that the defendant had passed the performance tests of walking a line, etc.

Heustis produced a whiskey bottle containing some whiskey as having been found in the defendant's car at the scene of the accident. This was offered in evidence, but was not admitted when the court sustained an objection by defense counsel.

The prosecution then called Dr. Heise to the stand to testify that he had analyzed the specimen taken from the defendant and found 0.30 per cent. As the result of this test he estimated that the defendant had taken 10½ ounces of whiskey and that he was therefore drunk.

Under cross-examination he described the method of analysis through color comparison, stating as an expert that the percentage found in the specimen was an index of the percentage in the blood and thus the index of the degree of intoxication.

He admitted that his examination showed that the defendant had a bump on the head and *that this could have produced some* of the objective symptoms of intoxication which he had testified to under direct examination.

At this point the prosecution rested.

Defense:

The defendant took the stand and under examination by counsel testified that on the afternoon of the day before the accident he had a tooth extracted; that the dentist had given him medicine to be taken for pain and that this medicine tasted and smelled strongly of alcohol. (At this point the defense introduced in evidence, a part of this medicine which did smell strongly of alcohol.)

He testified further that he suffered severe pain and had taken some of the medicine, part of which he drank—although it was a mouth wash—but was not relieved. Consequently at 1:00 that night (1:00 a. m. the accident having happened the following afternoon at 2:00 p. m.) he secured a quart of whiskey, most of which he drank, and consequently became intoxicated.

He then retired. He arose about noon the next day and still suffering from pain, washed his mouth out frequently with the medicine. He then started out for the Doctor's office, he testified, in a sober condition, but without having voided (an effort by the defense to account for the high alcohol percentage found by Heise).

He then explained that he had struck the car parked at Fourth and Broadway in an effort to avoid a pedestrian and further testified that he received a severe blow on the head at the time of the accident. He held to these facts under cross-examination and explained the presence of the almost empty whiskey bottle *in his car, by* the statement that his nephew had used the car the night before and had apparently left the bottle in the car.

The defense rested.

Prosecution *in* rebuttal.

Dr. Heise was recalled to the stand and testified that the fact that defendant had not voided, would not affect the test since alcohol in the body would oxidize at a uniform rate whether the defendant voided or not. The state closed.

Arguments were waived by both the state and defense.

Decision—Judge Porter: Defendant guilty.

However, in giving the decision the judge explained that in view of the defense offered, his finding would have been *not guilty had not the state offered in* rebuttal the evidence that it did.

Jury—(The audience was polled by Australian ballot before judge Porter gave his decision and the ballots were counted while he was giving his decision) Finding of guilty 79 to 27.

Note: Some of these votes were cast before Dr Heise testified in rebuttal.

ELEMENTS OF TRAFFIC ADMINISTRATION

A Series of Four Traffic Lessons Presented Before the "Traffic School" of the Street and Highway Traffic Section

By EARL J. REEDER

Traffic Engineer, National Safety Council, Chicago

I. What Comprises Traffic Administration?

The regulation of street and highway traffic for reducing accidents and congestion, is one of the most serious problems of public administration. The traffic problem is so new that its traditions and accepted practices are still in the process of formulation. In many matters of public association and contact centuries have established traditions and accepted practices with which the vast majority conform without question. These have become more than matters of law; they are matters of conscience to the vast majority. However, traffic restrictions and regulations have not reached this stage of public acceptance and we who are now working in this field have the responsibility of promoting as rapidly as we can the proper official and public conception of traffic administration.

In our course last year we recognized three important phases of traffic administration—planning, education, and enforcement. Let us review these briefly as the basis for our course this year.

The first of these, traffic planning, dealt with the formulation of the regulations and control measures which are necessary for safe and expeditious use of the streets. Planning must precede the enactment of regulations and restrictions in the form of ordinances or laws, to make sure that these rules of traffic conduct fit the problems that they are intended to solve and are reasonable and enforcible. It must precede the installation of signs and signals to make sure that they are the proper types of control equipment for handling the traffic as it should be handled. Planning should

precede the installation of traffic safeguards—guard rails, illumination of underpasses, or removal of obstructions to view—to make sure that these intended guards do not create more serious hazards than they eliminate. Proper planning must, also, precede an educational program or one of enforcement so that the measures that are adopted may properly reach those at whom they are directed and accomplish the desired results.

We recognized the importance of applying no more restrictions than are necessary, but of applying enough and that in the right places. Too much restriction defeats its own purpose through public revolt; too little restriction is equally ineffective, allowing congestion and confusion; and restrictions in the wrong places have the disadvantages of both.

We recognized the importance of keeping the restrictions, regulations and equipment up-to-date by continuous planning, to meet the rapid changes that are taking place in traffic administration and to solve the new traffic problems that are developing because of improvement in a greater use of highways and vehicles. We criticized guess work and haphazard planning as conducive to congestion and accidents rather than to the solution of traffic problems. We emphasized the importance of getting the facts, watching for developing hazards or congestion, and planning the solution for these problems before they become emergencies and have to be settled under the stress of public clamor for "something to be done" and that at once.

Public education, the second important phase of traffic administration, is the job of informing the public about regulations and restrictions so that individual drivers and pedestrians may easily conform if they are willing. An uninformed public can be neither sympathetic nor obedient to traffic regulations and control.

Many a well-planned regulation or device which, with adequate public support would have been successful in preventing accidents or reducing congestions, or both, has failed because the public misunderstanding, at the beginning, set up insurmountable prejudices.

We recognized that every public department and unofficial agency which is at all interested in maintaining a community that is a safe place in which to live and is a conveniently accessible center of commercial activity, should be interested in establishing public knowledge and understanding of the rules, regulations, restrictions, and equipment which have been enacted or installed for accomplishing this end. We pointed out that no public official who is responsible for traffic can afford to take the attitude that if he plans regulations or control equipment that are properly adapted to the needs, he has done his part and the rest is up to the enforcement officials. Such an attitude overlooks the fact that although they may have been perfect jobs of planning, if the plans do not turn out successfully because the public does not understand them, the planners might as well have spent their time on something else.

Enforcement, the third phase of traffic administration, is a matter of requiring those who are unwilling voluntarily to obey traffic regulations, to do so under the compulsion of arrest and penalization. This, however, is not the only responsibility of enforcement officials. Their job is really two-fold. In addition to the function that we have named above there is also that of supervising traffic to aid it in avoiding conditions which drivers or pedestrians cannot avoid without direction.

This second aspect of enforcement is, perhaps, more closely related to public education than to enforcement, but in practice it is inseparable from the latter. When an officer sees a driver double-parking his car and a line of traffic rapidly accumulating behind it, he can render the driver and the community a service by promptly instructing him to move on into a proper stopping place such as a loading zone or a vacant parking space. The traffic officer who is active and alert can perform many jobs of supervision daily which will enhance public good-will and instruct many drivers in the enforcement of regulations and how to obey them.

Against those who, by wilful or negligent disobedience, fail to comply with the requirements for safety of themselves and others, when these persons have had ample opportunity for learning these requirements, vigorous enforcement of traffic regulations is necessary. Such enforcement is not persecution because the offender has had an opportunity to learn and to obey but has chosen not to do so. Such enforcement is the act of requiring the negligent and the wilful to comply with the same restrictions and regulations with which others comply willingly for the safety of all.

An underlying requirement of the entire program of traffic administration is proper planning. In this course this year we shall deal entirely with this phase of traffic administration. We shall discuss, first, how to plan regulations and equipment; then, how to plan the public educational activities to teach the public the regulations to which it must be subjected; and, finally, how to plan the enforcement program to make the most out of the available enforcement facilities and personnel, in the form of accidents prevented and congestion relieved. It will not be possible to go into complete detail in any of these three phases, because each is sufficient for an extensive course in itself. We can, however, devote our time to some of the basic principles involved and some of the concepts which should guide us in our responsibilities for each or all of these phases.

One important principle underlies the entire program of traffic administration. That is, that traffic administration is at once a matter of service to the entire public by assisting drivers and pedestrians to use the streets and highways more readily and safely, and a matter of restriction to prevent their wilful misuse. Successful traffic administration requires a full appreciation of these two sides of the administrative job, by both the officials and the public. Failure to recognize them may lead one official into a soft, spineless administration on a service basis only, in an effort to please everybody and clamp down on no one, at the same time that it leads another official into a tyrannical attitude in which he sees no good in any driver or pedestrian and recognizes no other functions than restriction, control and regimentation.

The first extreme generally arouses public demand for putting teeth into traffic administration even at the expense of change of personnel, while the second attitude generally breeds a public revolt against persecution and also demands changed personnel.

Planning must take account of the convenience of those who are willing to conform voluntarily as well as provide adequate "teeth" for enforcement against those who must be required to conform under compulsion. In planning methods that lend themselves well to compulsion, voluntary obedience must not be made difficult or unreasonable. The fact must not be overlooked that traffic is for the convenient and safe conveyance of persons or goods from where they are to where they should be. It is a definite utility for which many millions of dollars are spent every year and from which those who engage in it expect to derive profits, pleasure, or other compensation. It is, in fact, even more than that, for it is fundamental to our economic and social life and it must be facilitated rather than stifled or stagnated. Furthermore, it must be accomplished with the minimum sacrifice of life, limb, or property.

* * *

II. Planning Restrictions and Equipment

Unless traffic restrictions and control equipment are properly planned drivers and pedestrians will be taught and required to comply with and depend upon measures which may be improper and which may produce both congestion and accidents rather than relieve them. This job of planning is one of finding out what assistance drivers and pedestrians need in using the streets and highways and of designing appropriate measures to accomplish the desired purpose with the least amount of restriction and at the minimum cost.

More specifically, this planning job is one of finding out just what are the traffic problems and applying the accumulated experience of those who have worked in this field, to the special conditions involved in each individual problem. Mathematicians know that a big part of the solution of a problem is finding out just what it is and getting it properly stated. Then, the application of some fundamental mathematical principles and a little bit of patience, brings the answer. After engineers have found out just what kind of a load a bridge will have to carry, they can design and build that bridge by the application of some well known principles. Their first big job, however, is to define their problem, for if they do not design for the maximum load the bridge may fail.

Traffic planning is just like that. Many signs and signals have been installed at locations which looked dangerous, to prevent accidents of a type which had never happened at those locations because everybody had recognized the hazards and had avoided them. At the same time, innocent looking intersections have continued to build up their accident experience with no attention from officials, because their hidden hazards were not discovered by consulting the accident records, determining how the accidents occurred, and identifying the contributing circumstances.

Our time will not permit us to go into much detail about the planning of traffic restrictions and equipment, but if we can identify some of the characteristic problems and impose somewhat our conception of just what good planning is, we shall have paved the way for individual study and experience to complete the job. Let us, then, take up some of the characteristic classes of traffic planning problems and discuss the approach to their solution.

First of all, traffic planning requires adequate visualization of the distribution and development of the problems. This means the maintenance of certain maps showing the distribution of accidents; the volumes of traffic on different streets; the different kinds of sections by population, types of building occupancy, and business concentration; and the variation of characteristic speeds between zones.

Of these the accident spot map is of first importance. The larger the city the farther the planner should go in the development of the others, because the more difficult it is for him to keep these important conditions in mind without visual help.

Perhaps the most common type of traffic planning deals with the treatment of dangerous or congested intersections. If there is good accident reporting in the city the dangerous intersections will show up promptly by the accumulation of accidents on the spot map. A good criterion for planning is that as soon as the map shows four accidents at a single intersection, a study should be made to determine whether this experience indicates anything about the character of the hazards.

The preparation of a collision diagram will show the directions of vehicle approach which are most dangerous, the most hazardous locations for pedestrians, and the stationary objects which are figuring in the accidents. Only one accident of any particular type is seldom significant because it may be of a type which could occur anywhere. Two accidents of the same type begin to form a pattern. Three accidents of a kind are really significant and it is always quite probable that out of four accidents at an intersection there will be a definite pattern. This pattern will give the clue as to what kind of studies should be made.

If the pattern involves traffic from only two directions it is probable that the treatment is prohibiting parking a greater distance from the corner between these directions, removing an obstruction of view, or installing a stated speed slow sign or a stop sign. The solution that involves the least restriction of traffic is the best if, of course, it is otherwise feasible. Observations of volumes on the intersecting streets will determine on which (if either) speed should be restricted. Speed observations may be necessary for computing critical approach speeds in terms of the locations of obstructions of view. A condition diagram showing to scale the conditions which affect a decision, is usually needed. Application of the National Safety Council's Public Safety Memo No. 73 on "determining critical speeds at intersections" will determine how far back a view obstruction must be moved if that is possible, or how much speeds must be restricted for safety if the obstruction cannot be moved.

If the accident pattern on a collision diagram is more complex, other types of remedies are indicated. It may be necessary to have an observer spend some time at the intersection to see just what traffic does and in what kind of confusion and congestion it becomes involved. The possible remedies for an intersection with an accident pattern of this type are several. They may range from improving the illumination to better identify the intersection at night, to the installation of stop and go signals, the former an example of no restriction and the latter an example of extreme restriction on traffic movements. Again the principle of solving the problem with the least restriction of traffic movement applies.

The accident experience may not be the first clue to an intersection problem. The traffic planner should be watching for evidences of congestion from his own observations throughout the city. When congestion occurs without accidents except those of a minor character, the problem has usually reached an advanced stage and requires

actual control of traffic, either at peak periods or during all except the night hours. The earlier stages of congestion and confusion are usually accompanied by accidents which will usually reveal the problem on the spot map.

Intersection problems may not be confined to one location. For example, when an appreciable number (say one-third) of the approaches from side streets, along a given street, show critical speeds of less than eight miles per hour and thus require stop signs, the need for making it a through street is indicated, unless this number of such approaches can be reduced by removal of obstructions of view. When a through street is so designated, stop signs should be placed at all approaches from intersecting streets. I have tentatively set this criteron as high as one-third of the approaches because the mistake is too often made of spending hundreds of dollars on stop signs along an entire street to protect a very few high accident intersections, some of which might have been corrected by stop signs and others by slow signs or removal of obstructions to view. The penalty for such waste is usually frequent violations.

The inter-connection of stop and go signals at intersections along a street may be desirable for speed control if these signals are not too far apart. Signals which are less than 2,000 feet apart should usually be interconnected to avoid haphazard stopping and starting at successive signals.

The day of allowing traffic to go about wherever the drivers wish has long been passed. State and federal routes are marked through cities for the convenience of the drivers who want to pass through most easily and not lose their way. An important consideration is to avoid conducting through traffic into areas that are already congested. In cities in which I have directed traffic surveys I have found as high as 30 per cent of the traffic which entered the business district on a normal business day, going through in such a short time that it could not possibly have stopped for any business purpose. It served only to congest traffic in that district and make it more difficult for potential shoppers to go there. Of course it should be made convenient for tourists and others who want to go through a central business district, to do so, by carrying the traffic not too far away and marking routes to the district adequately. But to carry through some 25 to 30 per cent of the traffic in the hope that a few of these drivers may pause for shopping is quite absurd.

Routing of traffic is a matter of selecting a route which avoids areas of congestion or hazards or which can be developed with control measures and safeguards to handle the additional traffic with greater safety and fewer hazards than now exist. This may mean widening for greater capacity, installation of stop signs for through street protection, installation of signals at certain points, or providing pedestrian islands at the center of the street at some points. Business and industrial districts are usually not good sections for such routes, because they often cannot be given adequate protection to reduce hazards or congestion.

The planning of parking restrictions is usually a matter of getting the proper turnover in the use of parking spaces along curbs so that individual vehicles can get to the curb for receiving or discharging merchandise or passengers first, and, after that, possibly providing some storage space along the curb for longer periods. We are fast coming to the day when we will not tolerate the lining of our curbs with cars parked bumper to bumper; nor will we tolerate the congestion and confusion that arises from double-parking or stopping out in the street to receive or discharge passengers or merchandise. The future must take care of a very large share of the storage of vehicles entirely off the streets. Merchants will see the advantage of providing off-street parking places for their customers. Building laws will require off-street parking facilities for those who are to be employed in large buildings, and off-street loading facilities for commercial vehicles. The trend is definitely in this direction now but in the meantime we have problems of planning parking restrictions to make the best of the present complications. The mistake is often made of shortening the time limits of parking and thus making the difficulties of police supervision even greater, when increasing the limits might actually simplify the problem and enable the police to eliminate all-day parkers. The first thing to find out in the planning of parking restrictions is what are the demands for parking space and how are the present facilities used. This means actual observations of sample districts covering ten to twelve hours of a charac-

teristic business day. It means compiling the data from these observations to learn how many vehicles were parked for different periods of time. It means computations to determine what parking limits would take care of all the vehicles.

In traffic planning some important questions should be borne in mind. I shall discuss these briefly:

1. "Is the proposed restriction or control equipment necessary for safety?" If it is, there is likely to be little difficulty in getting it approved, for traffic safety is a strong argument for any traffic regulation, if it applies. Safety is a basic consideration in traffic restriction and control.
2. "Will this restriction or equipment be readily understood and easily obeyed by drivers and pedestrians?" The planner must consider the average driver or the average pedestrian and remember that quite a large percentage of those who will be regulated will never have been at that particular location before. They can be expected to obey only if the requirement is unmistakable.
3. "Will the proposed measure improve or complicate enforcement?" Difficult enforcement is a serious penalty for improper or unnecessary restrictions or equipment in traffic, because it renders them ineffective in spite of their theoretical value.

"Is this the most economical measure which will meet the present and the apparent future requirements of traffic?" There is often a temptation to extend a restriction or a system of equipment that is applicable at one point to numerous other points which have no immediate need for it, "while the work is being done." This is alright if the expansion is really going to be necessary, but there is a great difference between providing for future expansion and carrying completed measures to the point where they are not needed now.

It has often been said that traffic planning is the application of good common sense to traffic problems. That is true, but it should not be forgotten that good common sense doesn't mean just snap judgment, even the snap judgment of a traffic expert of the broadest experience. It does mean getting the necessary facts, interpreting them properly, and applying practical measures to the solution of adequately defined problems.

* * *

III. Planning Public Education

Activities for educating the public concerning traffic regulation and control are of two general types. The first type is inspirational; the second is informative. A comprehensive program of public education requires both of these in their proper places and at the proper time. The purpose of this lesson is to bring out the important principles in the planning of public education so that activities may be adapted to requirements.

The inspirational activities are intended to arouse interest and concern about the traffic problem rather than to inform the public about specific practices or conditions. They appeal to the public to support official activity and traffic administration by painting the picture of the seriousness of the problem and creating public desire for reducing accidents and congestion. It encourages the public to believe that better conditions are possible.

A newspaper item, for example, saying that 36,000 lives were lost in automobile accidents last year, telling how many of the victims were pedestrians and how many were drivers of motor vehicles, and, perhaps comparing these figures with the American battle losses in the world war, helps to establish in the public mind the fact that this problem corresponds in seriousness to a national catastrophe. An inspirational speech picturing the seriousness of the problem and appealing to individuals to accept more fully their responsibility for safe driving or safe walking, helps to create a more favorable attitude toward anything constructive that is being done for improving traffic conditions and reducing the toll of accidents and congestion. This kind of activity appeals to the public's desire for individual security, for protection of loved ones, and, for freedom from physical suffering, as the motive for doing some constructive thinking on this subject. Such constructive thinking may lead an individual to the desire for better legislation, or for improved enforcement, or for the installation of some kind of safeguard for a location that is vivid in his mind.

This kind of educational activity makes the public more alert for the dangers which individuals are able to recognize, by teaching them that driving or walking in traffic is a more serious task than they had thought. It teaches them that practices which they may once have learned but have discarded are important because they may mean the difference between life and death for the individual or his loved ones. Such activities often revive precautions well known but discarded as nonessential.

In this kind of educational activity the speaker or writer may present no remedy or give no information which will help the driver or the pedestrians to know how to do something which he did not know how to do before. However, he will be impressed by the importance of safe driving or safe walking in relation to other important acts. He will be reminded that the most important thing in the use of the highways is safety, because safe traffic is successful traffic, while unsafe traffic is too often a failure. This type of educational activity has its definite place. It often has to precede more specific public information about traffic to pave the way for such information to be favorably received and effectively used.

On the other hand it has its limitations. It is not to be mistaken as substituting a complete traffic educational program. The cry "Wolf! Wolf!" in the old story, soon became a familiar cry and lost its appeal. In the same way the mere repetition of the fact of some thirty-six thousand or more traffic fatalities may merely have the effect of convincing the public that this toll is inevitable and not much can be done about it. The inspirational activities are of a temporary value unless the way which they pave is used for conveying more specific information about hazards, practices, regulations and safeguards.

The other and more specific type of public educational activities imparts information on how to drive or walk properly in traffic. It may, in turn, be separated into two different classes or types of information. The first of these deals with conditions that may be encountered most anywhere, and the second with conditions at very specific locations.

There is perhaps no better illustration of the first of these—specific information for general application—than a series of weekly traffic lessons in the newspaper or before a service club on the important regulations and provisions of the state traffic law and local traffic ordinance. Such a series would take up weekly a different provision, explaining its purpose, its meaning and how properly to obey it. The individual driver or pedestrian may have to recognize for himself the locations at which each of these restrictions apply, but he is prepared to perform properly when he does encounter these conditions. What he has learned helps to standardize his practices with the practices of others and to make driving habits more nearly uniform among all drivers.

This sort of activity is applicable to many kinds of information about driving. A new type of regulation is being proposed, for example. If suddenly enacted without informing the public as to its purpose and how it is to be obeyed, and becomes effective immediately, a driving or walking public which is unfamiliar with it may rise in revolt against it and demand its repeal as an unwise and unnecessary regulation. On the other hand, some specific publicity to inform the public about it before it is enacted and further publicity before it becomes effective will go a long way to insure favorable reception and a fair trial. The history of pedestrian regulation at intersections with traffic signals, for example, has, in general, been one of successes where the attempts have been preceded by adequate public education and failures where the idea has been "sprung on the public" without advance preparation.

The second type of specific educational activity imparts information about specific locations and tells properly how to obey the regulations and restrictions that apply at such points. A typical example would be a series of publicity releases in the local newspapers describing the purpose and performance of a new flexible progressive signal system controlling traffic on a couple of miles of an important street. The purpose of such publicity would be to tell the public how to use that system

for the best results—the speed for which it is designed, the meaning of any special turn signals, how to avoid being stopped by a red light because of either too high or too low speed, how pedestrians are regulated, etc. What is said of this system may not apply to any other system in the city. It is intended, in fact, to differentiate this particular system from any other system so that the driving and walking public may know that it is different and not confuse it, for example, with an older simultaneous system ten blocks away.

Many a logical special application of traffic regulation and control has been unsuccessful because its purpose and manner of obedience have not been understood. Drivers or pedestrians, having to do something differently than is normally done at other locations, meet the new conditions suddenly, and, failing to conform with them, get into some embarrassing or disgusting situations which arouse public antagonism and demand return to the old system. However, if the users have been informed about the conditions and have a more sympathetic attitude toward the new regulation, because they understand its purpose before they actually experience it, they will be much more apt to discount their first experiences and reserve their judgment until a fair trial has been given.

There is often the fear that specific activities of either type will not have the public appeal of the more inspirational ones. It is true that they will not have the emotional response that often follows an inspirational speech, particularly before a group which has formerly thought little about this subject. However, inspirational appeals without information for specific direction and guidance may lead as easily to misguided enthusiasm on the part of some as to wise action on the part of others.

Now with these types of activities defined, the planning of the public educational program is, to a large extent, the use of these activities in proper relation to each other and to the traffic administrative program. Let us trace through a typical public educational program for a city which is proposing to inaugurate much more comprehensive traffic administration than it has ever had before.

In the first place, if the public is not "sold" on the need for better traffic administration it may be doomed to failure. Hence, a series of inspirational talks before meetings and over the radio, and a series of newspaper articles giving general information about the local traffic problem, provide the best educational activity for starting the more intensive program. In these, a new public policy of properly planned restrictions and control measures, of public information about new developments, restrictions and equipment, to enable the public to cooperate voluntarily and obey willingly, and of vigorous enforcement against those who are unwilling to obey voluntarily, will be announced.

The educational program must not rest here, however. Immediately, detailed educational activities will be started to sow the seed of specific information in the prepared soil of receptive public attitude. Weekly traffic lessons will be started. Items about the hazards of specific locations will be prepared. Accident statistics will be quoted to show the hazards of different unsafe practices, accompanied by descriptions of how the hazards are to be avoided.

The educational program will use various agencies so as to reach different classes of the city's population. Prominent speakers in foreign language groups will be enlisted to get across to their own people the instructions which are so important. Publications for different races will be provided with articles of general appeal and specific information. Parent organizations will be enlisted in the work of educating the parents to protect their small children from traffic hazards. Commercial drivers will be reached through their employers.

Later, as interest may appear to be lagging slightly, more of the general inspirational activities will be required, and repetition of some of the earlier specific activities will be desirable. The educational program will be continuous.

An important principle to be borne in mind by the traffic official, whatever his official title, is that it doesn't matter how good a design of a traffic regulation or a control measure he may prepare, if the public does not understand it and is not sympathetic toward it, he may as well have never developed it because it is doomed to failure. Public education is not a substitute for good planning; nor, can it take the place of vigorous enforcement; but, without it neither of these can be successful. The wise traffic official will allow no good opportunity for public educational work,

to pass; neither will he depend on chance opportunities for such activities, because he will seek such opportunities in accordance with a specific and constructive program.

* * *

IV. Planning Traffic Law Enforcement

There are two general purposes of traffic law enforcement:

1. Supervision of traffic by officials for facilitating its movement and discouraging traffic law violations.
2. Apprehending and punishing willful or negligent violators.

By supervision of traffic I mean watching for and anticipating jams and tangles from which drivers may not be able to extricate themselves easily. In theory, every driver is obliged to know all traffic regulations, but, in practice, many do not, and in many cases these become involved in situations and dangers which they do not recognize. Theoretically, they are subject to arrest for violations, but in practice a word of instruction from an officer who foresees the possibilities of impending accidents or congestions, may clear the situation immediately.

Perhaps there is no better example of what I mean than a driver who is about to leave his car double-parked on a busy street while he "runs into a store for just a minute." Once he has disappeared into the crowd there is little to be done except to await his return when the seriousness of his offence has been emphasized by the congestion that he has caused, and give him a summons to court. If he could have been instructed to move and find a definite parking space before he left his car double-parked the very act of the officer would have indicated the seriousness of his impending offence, and the congestion would have been avoided.

Supervision applies as well to foreseeing situations which really involve no violations, but arise from traffic suddenly becoming so dense that drivers acting alone are not able to get through it successfully. Being able to be of help in such cases means anticipating their occurrence by knowing what has happened at the same points under the same conditions before, and being present at the proper time. It is proper planning of such supervisory work.

Take, for example, the case of a big football game in a college town. It involves a concentration of traffic of a type that does not occur daily or even weekly. It makes heavy traffic streets of some that have only scattered cars at normal times. Drivers, unaccustomed to these conditions, would get into hopeless jams or hazardous situations without the guidance of police officers. The work of police at such a time is overwhelmingly one of supervision with only an occasional arrest, if any.

Drivers and pedestrians who are disposed to obey traffic regulations, when they understand them, benefit greatly from good traffic supervision. For the unintentional violator preventive enforcement is as effective as arrest and trial and leaves a much more satisfactory and agreeable impression. A prevented accident or violation can be handled by the city much more cheaply than when the violation actually occurs and is followed by arrest and trial in court.

Apprehension and punishment of violators should be reserved for those who cannot be served by preventive enforcement because they are willful or negligent violators. The driver who fails to stop at a stop sign which he knows is there is a wilful violator, or, at least, negligent. To be sure, he may have been thinking about something else and have forgotten about the sign, but that occurred because he did not have enough interest in his driving to consider it the most important thing that he could do while driving.

There is a place for excellent judgment on the part of the officer in distinguishing between a case for supervision and one for a summons or an arrest. The individual officer must beware that he does not assume the attitude that all violations are mistakes or results of excusable ignorance of the law, because, when he does that, he allows the wilful violator to go on thinking that he "put something over on that cop" and convinced that he can do it again when the occasion arises. The officer cannot take the attitude that every one is wilful or negligent and that the only appeal to a violator is through arrest, because he brands traffic law enforce-

ment as a tiger ready to spring upon any person coming within its range, whether that person is seeking to take its life or is merely following a path trodden by thousands of others.

The attitude that an accident is an occurrence in which nobody wants to become involved and for which no one should be punished, has done immeasurable damage to enforcement and is still continuing to do so in many places. I doubt that many accidents result from willful disobedience, but I believe that most of them involve inexcusable negligence on the part of one or more of the participants. Experience in several cities with accident investigation squads has demonstrated that police can and should determine whether there is evidence of such negligence and can make arrests for it without depending on an aggrieved participant to make the charge. I read recently a report that in a certain city out of 36 hit and run drivers who had been apprehended, 21 were released because no one would place a charge against them. What a waste of time and effort to capture 21 serious offenders in a month and then turn them loose!

Enforcement is often an intangible thing. To be sure, a police department can tell us the number of arrests which it has made in a given period of time and, possibly, the number of convictions resulting therefrom. However, that doesn't mean much unless we can relate that information to the extent of the problem by some unit of measure.

In 1922 the Committee on Enforcement of our Street and Highway Traffic Section recognized the need for a unit of measure for traffic law enforcement as related to its problem. It was concluded that the best measure of the need for enforcement is the number of accidents that occurred and that the best measure for the total amount of enforcement is the number of convictions, the first being the end result of violations and the second the end result of enforcement.

Because most jurisdictions of sufficient progressiveness to use such a measuring stick as an enforcement index would have good accident reporting of all personal injury accidents, at least, it was decided that the number of these accidents should be taken as the measure of the enforcement problem, the reporting of the more minor accidents being quite indefinite. Since there is great variety in the enforcement of parking violations but much more uniformity in the handling of moving violations, it was concluded that convictions for driving offences would be a fair measure of the total amount of enforcement. The enforcement index, then, was developed as the ratio of the number of convictions for driving offences to the number of accidents involving personal injuries.

Further investigation indicated that an enforcement index of less than ten times as many convictions for driving offences as personal injury accidents indicated some opportunity for improvement in enforcement, but that a ratio of more than ten was not likely to bring commensurate results from the efforts put in. Hence, the committee recommended that each enforcement jurisdiction should strive for an enforcement index of ten.

If the primary purpose of traffic law enforcement is to prevent accidents, it is evident that the accident record is an essential feature in planning the enforcement program. By this I mean not merely the accumulation of accident reports to be filed away as matters of record but, also, very active use of these reports to determine where, when, and how accidents are occurring. The standard accident reporting card developed by the National Safety Council is recommended to all police departments for obtaining and filing these reports for convenient use. Filing by locations so that the records of any given intersection can be consulted at once is recommended to avoid the loss of the value of the information when it is gathered.

An important part of the planning of traffic law enforcement is the selecting and distributing of the enforcement activities in a way which will accomplish the greatest results with a given expenditure of man power. It is the adaptation of the enforcement activities to the traffic problems of the city.

It is evident to almost anyone who takes any time to observe traffic that not all violations can be observed, and that not all impending traffic complications can be foreseen and prevented, because traffic police forces are not sufficiently large to accomplish this. Hence, the activities of traffic officers must be directed at points at which the greatest results can be accomplished with a given number of man-hours of available personnel. The best measure for determining where these man-hours should be expended is the accident record. This time the record takes the form of a spot map showing the distribution of accidents. Where accidents are most common the greatest efforts of supervision and enforcement should be expended. This does not necessarily mean that the efforts should be made where the greatest number of arrests are possible, regardless of their effect on the accident record. Rather, it means the concentration of the greatest enforcement effort where the greatest effects on the accident record per man-hour expended, can be accomplished.

This principle applies not only to locations but, as well, to times of day and to different seasons. The accident and congestion problems are not uniform as to time. Naturally the greatest exposure to accidents and the greatest opportunity for violations occur when traffic is at peak. That is in the late afternoon, but some police departments have such inelastic procedure as to bring changes of shifts of traffic officers at times when they will remove practically all of these officers from the streets, or, at least, when they will break up the continuity of supervision and enforcement at the most critical periods

It takes but a simple study of tabulated accident records to determine the times of day when the accidents are the most common in the highest accident areas. Likewise, it takes but a small amount of field observance at regular intervals to determine where congestion problems exist and where they are most acute. These points are the places where the highest concentration of man power should be made when the accident and congestion problems are the worst.

If, as is the case, officers cannot witness all violations at all times, and some must go unpunished for lack of man power, shall officers give equal and impartial attention to all offences which they do observe, or shall they place greater emphasis on some than on others? It is evident, of course, that officers should not disregard flagrant violations of any kind, but, in the main, is it not better to give the greatest attention to the offences that most commonly result in accidents? Reckless driving, driving while intoxicated, speeds too high for conditions, parking at danger points and other similar offences which have been demonstrated to be dangerous, are the ones to which first attention should be given. This not only strikes at the very heart of the traffic accident problem, but it immediately breaks down any claim of persecution, because it can be shown that the offences which receive the greatest attention under such a plan are those which have the worst accident records.

The several principles of adapting enforcement activities to measurable accident problems, constitute a program of "selective enforcement." Such a program avoids a policy of making arrests where the most arrests can be made and in the most spectacular fashion, in favor of making arrests for those offences, in those locations, and at those times of day when they will have the greatest effect on the accident record, which should be the real objective in traffic law enforcement. It may mean shifting the emphasis from "Millionaire Row" where population is sparse, parking in the streets is infrequent, and pedestrians seldom have occasion to be in the roadway, to a densely populated apartment district where parked cars line the streets, pedestrians cross frequently, and even moderately high speeds are a menace. It may mean a transfer of attention from a street where an arrest for speeding can be made at most any time, to one where the job is keeping children from playing on the streets, and becoming the victims of unsuspecting drivers going at slow speeds but unable to stop when children dart from behind parked cars.

Selective enforcement tends to become less and less conspicuous as times goes on. The concentration of effort on the most dangerous locations and the most dangerous offences at the most dangerous times, soon reduces these peaks in the accident experience and allows more time for the general distribution of the enforcement and supervisory program.

Coordination of police and court activities in traffic law enforcement is an important part of enforcement planning. There is no place for retaliation in this program. The police chief who says he will arrest violators and send them to court where the judge can do whatever he wants to do with them, is not engaging in good enforcement. He is defeating his own purpose. He is starting but not finishing his job. Delays, wholesale dismissals to clear the docket, and "bad days" for the judge are too common under such circumstances. It is much better to cut

down the number of arrests by proper selection of offences and by greater emphasis on supervision, to the point where they can be handled successfully with the present or improved court facilities.

This always means better cases, more effective evidence, and greater assurance of conviction. It is always better to get convictions in 90 per cent of 100 cases than in 10 per cent of 900 cases. Although the total number of convictions is the same, the former is vigorous and effective enforcement, while the latter is merely convicting those who are willing voluntarily to accept the responsibility for their misdeeds and appear in court to be convicted.

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By way of summary of our entire course this year it can be said that proper planning of traffic administration is the first essential for its success. Lack of planning brings ineffective results and much waste of effort.

Just as the wise business man sets up his business where there is a market for his product and gradually expands out to pick up the more marginal business, so the wise traffic official plans his program to attack the most serious problems first. But he must be sure that he *knows* what his problems are.

ADJOURNMENT.

Child Education Section

Officers 1934-35

General Chairman—FREDERICK ARCHER, Superintendent of Schools, Louisville, Ky.
Vice-Chairman—MISS AGNES SAMUELSON, State Supt. of Public Instruction, Des Moines, Ia.
Secretary—MISS MARIAN TELFORD, Education Division, National Safety Council, New York City.
State Activities Committee Chairman—DR. WALTER D. COCKING, State Commissioner of Education, Nashville, Tenn.
Statistics Committee Chairman—MISS MARY MAY WYMAN, Supervisor of Health and Safety, Public Schools, Louisville, Ky.
Elementary Schools Committee Chairman—MISS H. LOUISE COTTRELL, Stockton School, East Orange, N. J.
Secondary Schools Committee Chairman—FRANCIS BACON, Principal, Evanston Township High School, Evanston, Ill.

Officers Elected for 1935-36

General Chairman—FREDERICK ARCHER, superintendent of schools, Louisville, Ky.
Vice-Chairman—AGNES SAMUELSON, superintendent, State Department of Public Instruction, Des Moines; president, National Education Association.
Secretary—MARIAN TELFORD, Education Division, National Safety Council, New York, N. Y.
Executive Committee Chairman—FREDERICK ARCHER, superintendent of schools, Louisville, Ky.
State Safety Activities Chairman—WILLIAM H. BRISTOW, director curriculum research, State Department of Public Instruction, Harrisburg, Pa.
Statistics Committee Chairman—MARY MAY WYMAN, director of health and safety, Public Schools, Louisville, Ky.
Elementary School Committee Chairman—H. LOUISE COTTRELL, vice-principal, Stockton School, East Orange, N. J.
Secondary School Committee Chairman—EDWARD E. GREENE, vice-principal, Arsenal Technical High School, Indianapolis, Ind.; chairman, Superintendent's Safety Committee, Indianapolis Public Schools.

MONDAY AFTERNOON SESSION

October 14, 1935

The first session of the Child Education Section was called to order by Albert W. Whitney, Associate General Manager, National Bureau of Casualty and Surety Underwriters, and Vice President in charge of Education, National Safety Council,

who presided. After a brief resumé of achievements in safety education Mr. Whitney introduced the first speaker.

The Accident Hazards of Child Life

By LEWIS H. CARRIS

Managing Director, National Society for the Prevention of Blindness, New York City

The National Safety Council presents statistics which indicate that from the time children begin to walk unaided until they become men and women, more of them die as the result of accidents than from any disease. Among children five to nine years of age accidents take two and a half times as many lives as does pneumonia. Between the ages of three and eighteen years, "no disease even approaches accidents in virulence."

In the last year alone 15,400 children under fifteen years of age died as the result of accidents, and 13,500 more young men and women fifteen to twenty-four years of age were killed by accidents—a total of 29,000. And that, more or less, is what happens year after year.

The National Safety Council also tells us that for every fatal accident there are at least 25 additional accidents resulting in serious injury. This means that 725,000 other children suffer serious injuries from accidents each year; many of them are blinded; and thousands are otherwise physically handicapped for life.

The automobile killed thousands of these children; thousands of others were drowned or killed by falls and other accidents. But fireworks, firearms, and other deadly devices used by children in play also took a heavy toll.

We certainly do put deadly playthings in the hands of children with a vengeance on the Fourth of July and at Christmas time. Revolvers, rifles, shot guns, and other firearms should not, of course, be classified as toys, but children do play with them, and in 1933, some 1,200 children in the United States were killed by firearms, most of them in the tiny hands of other children. Think of it—100 children killed by firearms every month, three every day!

Many parents still think the air rifle, or so-called BB gun, is a toy, and a safe toy at that. But ask the parent whose child has been blinded by a shot from an air rifle how safe a toy he thinks it is. There are hundreds of such parents in America today.

Millions of Americans think nothing of putting fireworks of all sorts in the hands of little children, not only on the Fourth of July but in the weeks preceding the Fourth and the days following it—with what results? Well, the country has been told over and over again that in thirty years we have killed and injured more people by using fireworks to celebrate the acquisition of our independence than were killed in acquiring that independence in the Revolutionary War.

October 14 may seem an odd time to be talking about fireworks accidents, but you will appreciate why I do so when I tell you that right now in New York City a staff of ten people provided by the WPA is busily occupied recording and analyzing the casualties of the past Fourth of July.

This study is being made by the American Museum of Safety, with the cooperation of the National Society for the Prevention of Blindness and other public health agencies. The study was financed by the fireworks manufacturers, themselves, who are at last beginning to realize the gravity of the situation. I understand that there are already in hand reports of more than a score of persons who were killed and more than 6,000 who were injured as a result of the celebration of the last Fourth of July with fireworks, fire arms and bonfires.

You may ask, why bring these unpleasant facts to an audience of school teachers? The answer is that school teachers probably have a greater opportunity than any other group to influence safe conduct among school children. This is an appropriate and vital matter for teachers to consider, for another reason. While it is true that the school building is probably one of the safest places for a child to be in, a very large proportion of serious accidents to children occur in school buildings, on school grounds, and while children are en route to and from school.

The National Safety Council recently analyzed reports over a period of six years received from school systems averaging in the aggregate an enrollment of half a million children. The Council found that one-third of all fatal and other serious accidents to these half-million children occurred while they were at home; one-fourth occurred while children were away from home but not at school nor going to and from school; one-tenth occurred while they were going to and from school; *one-fifth* occurred *on school grounds;* one-sixth in *school buildings.* Thus, out of every 100 school children killed or injured by accidents, 36 were killed or injured in school buildings or on school grounds. The prevention of these accidents is primarily the responsibility of school departments and school teachers.

School teachers have not only a responsibility for the prevention of accidents on school property, but have an extraordinary opportunity to help children acquire safe habits without at the same time losing the zest for life and adventure. Often the teacher has greater influence with a child than even the child's parents, and often the teacher can bring about in a positive way what parents have with futility tried to accomplish negatively by threats or merely by saying "don't."

That the school teachers of the country have been successful in their efforts to instill safety into the habits and conduct patterns of their children is demonstrated by records of motor vehicle accidents throughout the country. While motor vehicle fatalities to adults 15 to 64 years of age have increased 180 per cent in the past 12 years, motor vehicle fatalities to school children 5 to 14 years of age have increased less than 10 per cent during the same period. This is due without question to safety education, to the incorporation of safety material in the general curriculum, and to the successful injection of the safety motif in children's games.

I believe, however, that school teachers have *only begun* to do justice to their obligations and opportunities to save child life. Accidents are still more deadly to children than any disease only because safety education in schools has been too largely limited to education with respect to the prevention of motor vehicle accidents.

The teachers of the country, more than any other group, deserve credit for the tremendous saving in human life represented by the marked difference between the increase in motor vehicle accidents to children and the increase in accidents to the general population. These same teachers, having demonstrated that safety can be taught, owe it to their charges to broaden safety instruction to include all other major causes of accidents—those that take place in the home as well as on the streets, and more particularly the 17 per cent of accidents that take place in school buildings, the 19 per cent that take place on school grounds, and the 9 per cent that take place while children are going to and from school.

I have been speaking about accidents in general. Since I am here as managing director of the National Society for the Prevention of Blindness, I want to speak now about one particular type of accidents—those resulting in injuries to the eye.

In the study of fireworks accidents now being made by the Museum of Safety, I am told that close to 500 cases of eye injury have been reported. Among these are children who have lost the sight of both eyes in the process of celebrating our independence; there are other children who have lost completely the sight of one eye; children who have had one eye so badly damaged, it has had to be removed; and hundreds of children who will be handicapped for life by seriously impaired vision. This is too high a price to pay for reminding our children that we once were a colony of England.

The records of the National Society for the Prevention of Blindness tell the story of scores of children who lose the sight of one or both eyes each year as the result of shots from air rifles, gifts from fond parents. I do not believe in producing a race of mollycoddles, nor in attempting to protect growing boys and girls from every possible accident hazard; in fact, I think this cannot be done. I recognize that one of the best ways of teaching a growing child to survive is to make him intelligently aware of accident hazards and to some extent to expose him to these hazards so he may learn how to protect himself against them. At the same time, I believe in discretion—and, if necessary, legislation to eliminate accident hazards. It is poor discretion to place an air rifle in the hands of a boy who

lives in a congested area of a city or to place an air rifle in the hands of any child too young to be aware of its dangers.

We are getting the cooperation not only of the fireworks manufacturers, but of toy manufacturers, in our efforts to make playthings less hazardous, but the time is still far off when we may assume that a toy is safe for a child because its manufacturer or the merchant who sells it says it is.

I have in my hand what is called "A Suggestive List of Toys by Age Groups," prepared by the Toy Manufacturers of the U. S. A., Inc., which suggests, among other things, popguns for children one and a half years of age; *"shooting games"* for children three to four years of age; and air rifles for eight-year-olds.

I cannot agree that these are safe toys for children of these ages.

Commercial toys are not the only ones that do serious damage to the eyes. Every kitchen cabinet and every tool box is full of instruments which, in the hands of little children, are dangerous. None of us would think of giving a small child a hammer and an expensive watch to play with at the same time. And yet at this moment there are undoubtedly in America hundreds of children with eyes far more delicate and far more valuable than the finest watch in the world who are playing not only with hammers, but with scissors, knives and other instruments, one slight jab from which will destroy or seriously injure the eye.

How to bring safety education to the parents and guardians of these children is the task of all of us—the National Safety Council, the National Society for the Prevention of Blindness, the many other public health agencies in the country, and the public schools as well.

Fire Dangers in Homes

By T. ALFRED FLEMING

Supervisor, Conservation Department, National Board of Fire Underwriters, New York City

It has been said: "the strength of any nation is in its homes." The homemaker is a woman, but homemaking is more than merely knowing that the house contains softly-tinted walls, house furnishings which match in color and design, spotless floors and good ventilation. If the homemaker is to continue to preside over the home she should more fully understand the safety of her home from fire causes, their prevalence, the early and dangerous spread of hot air, fumes and flames, and the best methods of protection to life and property therefrom.

An average of 954 homes are on fire for every day of the year. These take an annual toll of approximately 6,500 lives, most of the casualties being women and children. Five hundred people are left homeless every twelve months.

Fully 55 per cent of home fires have their origin in basements. If we know this we will plan so that hot air, fumes, smoke and flames will be confined to the point of origin for at least a sufficient time for the nearest fire company to reach the premises. In the basement of the average home you will find wooden beams overhead and frequently small openings along the walls and in partitions, clothes chutes, etc. all ready to act as flues to distribute hot air, fire and smoke throughout the partitions in the upper part of the structure and between the floors. In the first three minutes fire has spread all over the house in concealed spaces.

Fire-stopping of all openings leading upward—a good plaster ceiling placed on metal lath—close-fitting doors on dumbwaiters and other chutes—and the protection afforded by a thick hardwood self-closing door at the head of the cellar stairs, would cut off the distribution of the fire in its early stages. A good reliable fire detector placed near the danger point would give an early alarm. These precautions would save many lives and more homes. Fire prevention should begin at the drawing board when the house is planned.

The chimney, unless constructed under rigid code requirements, is always a hazardous feature. Correct construction should be followed by careful periodical inspection.

Attics, closets and storage spaces are flagrant contributors to fire losses. Careful supervision and proper lighting of these areas will obviate a possible catastrophe. Good housekeeping consists of applying to these unseen rooms the same punctilious care given to the living quarters. "A clean house seldom burns."

Children and adults are being burned to death in greater numbers because of unscreened fireplaces—materials used in garment manufacture are much more susceptible to flame than a few years ago. Training of members of the household in extinguishing clothing fires is essential—a heavy quilt, blanket or rug available—a cool head—rolling the burning subject tightly while in horizontal position will save many a life.

Your home has in recent years been changed and is now an electrical workshop. What effort have you made to avail yourself of information regarding the use or misuse of electric power? A perfectly safe installation of wiring may become a peril both to life and as a fire hazard by careless handling of the electric supply, or misunderstanding its use. You had better consult a good licensed electrician.

Numerous mystery fires in homes are chiefly due to spontaneous ignition. Fires from this cause are usually found in clothes closets or storage spaces, where cleaning products, mops and polishing rags are stored. Paint-smudged clothes and greasy overalls are also frequent offenders.

Precautions against this threat must cover certain basic fundamentals. First, nearly all vegetable and animal oils or fats are prone to cause spontaneous ignition; mineral oils are not a real menace here. Second, the chemical action requires a certain amount of moisture, a certain amount of air, and a certain amount of warmth for the ideal performance. Thus an oil mop or furniture-polish cloth in a closet with the door closed just about meets all the requirements. The closet is warm; there is a certain degree of humidity in the atmosphere; a limited amount of air comes in through the cracks around the door. With just enough of each element, a fire will result. It may take two months to bring it about—it can be accomplished in an hour—it commonly occurs in two to three hours' time.

A good galvanized iron can for keeping all such cleaning materials and stored on the back porch, is a simple and economical safeguard.

Gasoline, energine, benzine and naphtha are treacherous in the home for a number of reasons, the principal one arising from its best asset as a cleaner—quick evaporation—it vaporizes so quickly that if you take the top off a gallon can of gasoline it will not be long before enough vapor has been produced to fill an ordinary kitchen. Long before the capacity of the room is reached the vapor becomes dangerous—you never have any method of gauging the hazard at any given time. Gasoline fumes are heavier than air and thus find the low areas.

A lady in Canada was wiping up her polished floors with gasoline, when she noticed a small blue flame on the floor. An explosion followed immediately and now she is disfigured for life. Another woman in Texas cleaned a coat and hung it on the line outside for over an hour. While brushing it, after taking it in, the garment took fire and burned her to death. A servant was using kerosene to start the kitchen fire. An explosion followed but the fire was extinguished within a few seconds. The hot air and fumes ascending the stairway killed the mother and her baby at the head of the stairs.

There is really no place in the average home for these flammable liquids, because there are no precautions you can take to ensure safety. If you have escaped thus far, it is due to "luck" and that is as temperamental as gasoline vapor itself.

TUESDAY EVENING SESSION

October 15, 1935

ARE CHILDREN SAFE IN YOUR COMMUNITY?

A large group of Louisville school officials, supervisors, principals and teachers, as well as general Congress delegates attended the second session, which was called to order by Mr. Frederick Archer, Superintendent of Schools, Louisville, Kentucky,

who presided. After several numbers by the Apollo Quartet Mr. Archer introduced the first speaker.

Are Children Safe At Home?

By KATHARINE FISHER

Director, Good Housekeeping Institute, New York City

Far be it from me to attempt to enumerate the many loopholes through which youngsters escape from any safety zone that we may build around them in the home. Probably you have heard the story of the anxious mother of a young son who, not hearing him around for a while, called to her daughter, "Mary, go and see what Johnny is doing and tell him he mustn't."

There seems to be a need for more effective cooperation between mother and Johnny. I once heard a kindly old doctor telling a group of young parents that, while their children no doubt created many problems for them, they should not overlook the fact that they were a fruitful source of problems to their children.

It seems to me that we should try and look at these safety problems from the child's angle. For I sympathize with the wise little boy who was heard telling his chum that big people didn't know how hard it was being a child!

We shall never be very successful in teaching children how to protect themselves against unsafe conditions solely on the strength of that word "don't." Yet they must be protected against danger. And just as early in life as possible, they should be taught to avoid dangerous situations. This requires wisdom, patience, good judgment and understanding. We cannot expect too much independent action on the part of the child, as far as safety is concerned. Yet we must not discourage initiative.

Children are curious; they wish to investigate the world about them, and this urge often gets them into trouble, more or less serious. It follows that the younger the children, the more care should be taken to keep their environment as free from hazards as possible. The little creeper is safest sleeping in his crib or moving about in his play pen with toys suited to his age, when he is not within the range of mother's watchful eye.

As he becomes a runabout, his environment cannot be kept as safe, but much can be done by keeping things out of his reach and by gradually training him to avoid dangerous habits and situations.

Young children are quick to imitate. Johnny sees mother lighting the top stove gas burner, so why shouldn't he do so, too? Ranges equipped with safety gas cocks, that cannot be turned on by little fingers, bring peace of mind for mother, if Johnny wanders to the kitchen while she is answering the door or the telephone. Matches should, of course, be kept beyond the reach of young children, and so should steaming hot water. There should be a gate at the top of every flight of stairs, in every home where there are young children.

I would like to see our houses more suitably designed for children. Hooks for their clothing should be hung low, to remove the temptation to stand on a chair. The switch for turning on the bathroom light should be within their reach. And more consideration should be given to good home lighting, not only for lighting dark corners but for study and other close work. "Johnny, do your homework." But what about the study lamp? Is it suitably designed, and is it of the right intensity? Such lamps are now available, and they are valuable eye-savers.

As children get older, they should be given a definite sense of responsibility in reference to the home safety program. They may help to keep a safety code in active daily use. We have outlined such a code at Good Housekeeping Institute and we urge parents to use it for a periodic checkup about the house. A copy is sent free, on request. Homes that have an adequate safety code in daily action are, of course, safer places for children.

Then there is that whole question of mental hazards. Home, to be a safe place for children, should be a restful place, with a happy atmosphere. If mother allows herself to become tired and worried, she may indulge in unpleasant nagging. Home is a place where character is in the making, as well as meals. Children can be encouraged and invited to cooperate happily in the life and work of the household, thus relieving mother of many little time consuming tasks. They may be given a choice in "chores" about the house and may be taught quite early in life to look after their own room, to leave the bathroom in order, and to avoid making unnecessary work for mother in "picking up" after them. With this home environment and training, they are better equipped to take care of themselves on the street and away from home, and they are much more likely to be law-abiding and more considerate for the safety of others.

Are Your Children Taught Safety At School?

By MARY MAY WYMAN

Director of Health and Safety, Louisville Public Schools

Before anyone decides the place of safety education in any school system, there are two questions that must be answered. (1) Do you want your children to live long enough to return to school tomorrow and all the days to come so that they can get the rudiments of an education? (2) Do you want your children to remain physically sound, in full possession of their faculties and the members of their bodies?

Having answered "yes" to these questions, you have committed yourself as to the necessity for education in safety. If you believe that accidents do not just happen, that they are *caused*, then you must admit that safety in any undertaking is the result of careful, systematic planning. Society cannot depend on parents to teach the child all he needs to know about safty. More accidents actually occur in the home than in any other place that the child goes. Parents frequently are ignorant of the importance of safety education; they minimize the power of example; they forget that many of the simple facts of safety are bound to laws of habit formation. And this is a lack that needs correcting. The full effect of our safety teaching in the schools should be felt when the boys and girls in school today are the heads of families. In the meantime, the schools must organize safety education, with the approval and all the help the patrons can give.

No one can foretell what the children in school today will need to know twenty years from now. We could not, then, even if we would, give information that would be useful some time in the future. Schools must keep pace with changes. The language of horse and buggy days is not understood by children in this age of aeroplanes. We, therefore, have a common ground on which to discuss safety education.

If the school cannot expect to provide the child with a reservoir of safety facts upon which he can draw in time of emergency, what can it do for the child?

The school can provide opportunity for the solving of the many problems with which safe living is concerned. We are sure that children as adults will face many problems, both of a personal and a community nature. Today, adults very often fail to see our current problems, and still more frequently have no conception of what to do about conditions that exist. If this problem solving in school is to be valuable, it must be the response to real situations that develop in daily life.

There are many real safety situations to be met in school life—passing through the halls, using the drinking fountains, the gymnasium, the shops, the route to school, etc. Let us say that a near-accident occurred when two children bumped into each other in a corridor. Under the guidance of a skilful teacher, children can be led to see where the difficulty lies, and can be taught how to analyze the reasons why congestion occurs in a particular place. (In the old school, some teacher would have said that all classes were to pass only in a single line, and the pupils would then obey implicitly and unthinkingly.) Children are ingenious in suggesting possible solutions. As they make these suggestions, others of the group will be frank in their criticism. Finally, they will agree on a tentative plan, and the plan will be laid before all the pupils. They will be urged to cooperate, and if the safety council is a success, every child in the school will do his part. If the suggestions do not work fully, the group can and does revise plans.

This situation has been a part of life experience; it has been handled as adult groups should solve their problems. The minority have had some experience in leadership; the majority have experienced cooperation in a project. This problem was simple; it involved no reading; there probably were conferences with teachers and

principals. Knowledge, however, has been gained by many children—not dry-as-dust textbook facts for future use, but real knowledge of current happenings and civic life. Knowledge has been put to work at once. This situation has been one opportunity to help the child form a desirable pattern of behavior in the face of a felt need. When the next problem arises, these children will have a basis for solving it. They will know how to get to work; the common factors of new and old situations will be used in constructing a new pattern to fit new needs.

Here is another example. A high school built in 1910 and considered adequate in that day was still being used although there were double the number of students for whom the architect planed. One particular stairway was surprisingly narrow and dark. The boys began to notice that almost daily someone fell on these steps. The school safety council decided to do something about it. The principal was sympathetic, it was a bad spot, but school budgets were cut; installation of lights cost money. "To whom in the school system does one report such things?" asked the safety council. Here was an item that student procedure could not regulate. A letter was drafted, and was so convincing that finally lights were installed at the dangerous point on the stairway.

This actual occurrence illustrates that safety education, being a response to modern demands, does not permit the learning of isolated facts. A whole flock of ideas had to be gained at one time. Analysis of the problem and critical evaluation of pupil procedure in relation to the use of the steps were necessary before a request could be formulated. The factors that might cause accidents had to be studied, and a plan to prevent them had to be projected. Writing that letter was motivated. It was worth doing well. All the students in the school experienced the joy of achievement. The school's safety council had accomplished something for the good of all; here was pride in a real achievement. To this day, when difficulties seem great, the students in that school grin and say, "well, we got the light on the stairs because we went after it." This experience changed the boys—was one step in integrating the personalities, to use teachers' terms. Safety education offers rare opportunities for doing just these things.

If you have not been convinced that we live in a machine age, examine the program of this Safety Congress. It is shot through with steel, concrete, motor fleets, silicon, railroads, and all the other items of a machine age. Our kitchens are full of gadgets—devices that are the outgrowth as well as a part of the mechanism of life today. Our schools must keep pace. Machines kill; they maim; they destroy human happiness. Machines are wonderful—they make life easy, and pleasant, and give time for leisure. But they must be regulated, and all the safety devices possible are not so efficient in keeping the machine working for human happiness as are human beings educated for safety. Here, then, is our opportunity.

Life cannot be reduced to routine. The world is not the same world that existed one minute ago. Traffic flows on. The machines that were here at this intersection have gone to other intersections. Some of the factors in the pattern are the same. The grocery is on one corner, the drug store on another, but the total situation is different. I want to cross now—not yesterday, not tomorrow. The machines are moving all too rapidly. In my accumulation of behavior patterns there are certain situations similar to these. I must wait until the light is green in the direction in which I am going. I must watch for machines turning corners, or disobeying red signals. I get across that street, but my personality has been modified by my experiences.

Whenever communities adopt new regulations for safety, it is the business of the schools to help the school population gain an intelligent understanding of the new regulations. This activity is typical of classroom instruction. The text to be used is not a book published five or more years ago, but a compilation of the ordinance prepared in the last few weeks. We school people must be aware that we can modify personality and must mold that personality desirably for social welfare.

Let us turn to a kindergarten class for another illustration. The children in the kindergarten are excited this morning. Most of them saw a bad accident at the corner. They relate the gruesome details. One saw more of the horrible than the other. The teacher lets them express themselves, and then she says, "Do we have to have accidents at this corner?" "No," comes the answer in chorus. Then they tell why the accidents happen,—the drivers go too fast; they don't look; etc., etc.

"We have to cross that corner," says the teacher. "What do we do when we go home?" "Let's go show you." In a little while, all 40 are on the corner, and a lot of experiences are lived in a few minutes. The teacher is the leader; again she is one of the group; experience has been the real teacher. A lot of associated ideas have been learned at one time. Personalities have been modified because behavior patterns have been strengthened

Franklin said, "Experience keeps a dear school, but a fool will learn in no other." Modern education says, "We learn only by experience." Safety education, to be effective, must be built on activities that the child can experience.

There are many opportunities for teaching safety in connection with other activities. The problem in learning to read is to learn that certain symbols express ideas. If the idea is within the child's comprehension, the task of teaching him to recognize the symbol is much less difficult. Every child has safety experiences. The good teacher builds reading lessons around such experiences as walking to school, crossing with the policeman, or obeying the traffic light. There are many safety signs close at hand that the child sees daily. He needs to learn to read these signs for his well-being. These signs should be used as part of the reading material.

Everywhere good teachers are realizing their possibilities. Like the kindergarten teacher, they are taking advantage of the opportunities that are presented. They realize that no child learns one idea at a time; they are making it possible for concomitant learnings to give education in safety its rightfully important place. The lesson that is a good art lesson may teach safety marvelously well; historical and geographic facts assume new importance when the safety features are pointed out.

Our schools will be just as good as the tax-paying public will allow. Safety education in systems of any size does not occur of itself. The program must be planned. It must be the business of some individual to help the teachers. It must have the unqualified backing of the superintendent and those associated with him in administrative duties. The members of the Board of Education must believe that education in safety is a part of modern education, and they must be willing to have the children in the schools participate intelligently in the program

We must remember that real education in safety consists of experiencing safety, of living safely and fully on the level of development in which the child finds himself. Safety cannot be taught by giving back to the teacher that which the textbook or the teacher or some other fountain of wisdom has said the day before. Primary and associated learnings must be experienced in situations where the child receives help in making wise choices. Through solving problems that confront the child today, he learns the technique of solving problems. Facts may disappear, but habits and attitudes carry over. Changing, integrating personalities are the materials with which we teachers work. The success of our programs in safety can easily be measured in terms of diminishing accidents. Finally, in safety education, to use the language familiar to teachers, we help the child to do better the desirable things he is going to do anyway.

What Does Industry Do for the Safety of Your Children?

By THOMAS LIGHTFOOT

Engineer in Charge of Accident Prevention,
Koppers Coal and Transportation Company, Pittsburgh

I do not believe that anyone can give an adequate answer to this question. Although numerous industrial enterprises are continually sponsoring safety programs, looking toward the safety of the children of their employees, the public knows little or nothing about them. Nevertheless, this work is going on throughout the entire country. The subscription list of *Safety Education Magazine*, published by the Education Division of the National Safety Council, would, I am sure, show many subscriptions in the names of various industrial concerns which distribute this magazine each month among the schools located near their plants, in order that the teachers may further the cause of safety.

A description of what one industrial concern is endeavoring to do for the safety of its employees' children may be a reflection of what other concerns are doing.

I am connected with a large mining company which produces bituminous coal in the states of Pennsylvania, Kentucky and West Virginia. Several years ago it occurred to our company that inasmuch as our properties were designed to produce coal for a number of years to come, many of the children now in the schools in our communities would find their way into our employ either as miners, foremen, or in other capacities. It was, therefore, a matter of great concern to us that safety be taught to children in the schools so that those who might eventually find their way into the mines as our employees would know something about safety. We felt also that there was a secondary angle to the teaching of safety in the schools—that children would carry home to their parents messages of safety. The father or brother employed in the mine might note and remember some casual remark on safety that the child would make and thereby be more careful in his work next day.

The schools in these mining communities are a type of which any community might be proud, and the teachers are an unusually splendid group. A survey of a number of these schools indicated that the teachers were very willing to teach safety in some form or other, but that they had little or no opportunity to find out what to teach or how to go about it. After contacting county school authorities, a request was made to the various teachers that they devote forty-five minutes a week to teaching safety. The company agreed to provide each teacher with a copy of *Safety Education Magazine* each month; furnish them with posters from time to time; and prepare and give to each teacher an outline of a course in safety for children. This would enable them to coordinate and direct their efforts in an orderly manner. The outline was prepared in booklet form, published and distributed to each teacher.

Children living in mining communities have peculiar and unusual hazards, unknown in ordinary rural districts, or in the city. True, the automobile is a problem and children have to walk along the roads in the mining communities just as in other places; so they are taught to be careful of the automobile. However, this is only one of many hazards. Burning piles of coal and refuse, ever producing poisonous gases, are one of these unusual hazards. Children have been burned or suffocated as a result of playing on these burning piles of refuse coal, or playing around railroad cars standing on sidings, or while playing on tipples on holidays and Sundays when the mine is shut down. The danger of contact with high voltage wires is also to be taken into account. Mining communities are usually close to wooded areas with the hazards of forest fires, snake bites, and other dangers incident to life in more or less isolated territories.

When children learn about these peculiar hazards they realize that mining is an occupation requiring constant vigilance on the part of the worker. By learning of the hazards outside of the mines they subconsciously become aware of the hazards inside, and talk about them at home. In this connection, at one of our schools last November (a colored school, incidentally) each child was asked to write a letter to his father, setting forth reasons why he should be careful in his work. Each letter was then taken home and read to the father, and was tacked on the wall of the kitchen, where it stayed through the entire month of November while the special safety drive was on. The number of parents who commented on this procedure, and the fact that there was no accident in that particular mine during the month of November, showed that there is a very definite connection between safety education in the schools and safety performance in our mines.

WEDNESDAY LUNCHEON SESSION

October 16, 1935

Three luncheons, each with overflow attendance, were held, the present one being for elementary school principals and others interested in safety education in elementary schools. Dr. C. A. Rubado, assistant superintendent in charge of Elementary Schools, Louisville, presided as chairman, and introduced the speakers.

New Developments in Elementary School Safety Programs

By MRS. MARY RAY

Principal, Public School No. 60, and Chairman, Superintendent's Safety Committee, Public Schools, Indianapolis, Ind.

The extent of the ground to be covered by a program of safety education is so inclusive that to be effective it must be closely related to an active teaching of character development. It is difficult to conceive of children growing into law-abiding citizens unless the qualities of courage truthfulness and initiative are cultivated. A training merely in observance of set rules, helpful though these may be as resources in emergencies, cannot develop the individuals who will participate in correcting the present hazards. To secure the aims of safety education for children, it is necessary to develop a sense of individual responsibility for their own acts and the consequences of these acts. Prudence and the ability to make correct decisions quickly; good sportsmanship and regard for the rights of others are essential qualities, alike in the field of academic education and in its interpretation in the acts of daily living.

We may then define the terms of safety education of children to be: To develop (1) A knowledge of the common causes of accidents; (2) Habits of personal safety and a consciousness of responsibility for the safety of others; (3) Respect for those individuals whose duty it is to enforce regulations of safety.

The introduction of the younger children to these aims presents little difficulty. Their eagerness to learn and their faith in those who teach them are a challenge to us to offer protection while the necessary experiences for making judgments are acquired. Here is presented the need for Safety Patrols, adequate police protection on hazardous thoroughfares, and for that careful teaching at home and at school which develops caution but not fear. As the children grow older and acquire experience and sense the delight in taking a chance, thus discovering that all such chances do not result disasterously for them, we are faced with the very real problem of how to get next to the children and obtain the practice of our aims.

Probably the step which tends to dignify the subject most effectively is the place which many school systems are making for safety education in the curriculum proper, either as a separate subject or as a unit in the social studies. This cannot fail to fix its importance in the minds of pupils, teachers and parents. Its removal from the extra-curricular class of activities assures it regular if not always adequate time. In line with the same idea is the development of "readers" which supplement such teaching by stories and incidents of interest to children. They attempt further to drive home the teaching by simple suggestions which help to check upon the interpretation and applications to be made. I have in mind one such reader suitable for eight and nine year olds presenting in story form such incidents as "going barefoot", "running after the ball", "cleaning my dress." A series of exercises follow each story which check interpretation by the true-false method; others, the significance of events by the arrangement in proper sequence of certain incidents and a third exercise, the application of certain rules. Similar books suitable for older children are also available.

The development of school spirit and a desire to keep the record clean is encouraged by mass student gatherings of ten minutes or less, when the school song is sung, the traffic patrol is cheered and special honor is done to individual officers by song and applause. Teachers and children alike are stirred by the children's voices singing,

"How do you do, Traffic Boys, how do you do?
Is there anything that we can do for you?
At your station rain or shine,
With a spirit true and fine,
How do you do, Traffic Boys, how do you do?"

A preliminary move, which serves as a background to meetings of this type was recently tried with effective results in one school. The teachers conducted an intensive teaching campaign which lasted one week. Every effort was made to secure the children's point of view and to arouse their active cooperation. Many slogans were composed and incorporated into posters by the art classes of all grades.

These were displayed everywhere about the building in halls and rooms. Topics suitable for discussion by the children were presented, such as:

1. A pedestrian has been injured by an automobile in a city. Make a list of five questions which police would ask to discover the cause and conditions of the accident.
2. Tell briefly about one incident which shows a cause for accidents. Illustrate on the blackboard.
3. After school, count the number of children you see playing in the street. List reasons why they play there. Suggest remedies.
4. Make a list of five most dangerous practices of boys and girls in connection with traffic safety.
5. Make a list of things pupils can do to cooperate in making traffic safer.

In conclusion, on Friday, auditorium exercises were presented illustrating concretely the spirit achieved. The aim—"A week without violations. Actions rather than words." The result—"A start toward fixing safety habits. Awakened safety consciousness." The follow-up—"Line upon line, precept upon precept."

A consideration of safety programs must include others than those sponsored by the schools. Aroused by the 1934 report of accidents, made available by the National Safety Council, magazines, local newspapers, the American Red Cross, and other national organizations are stirring adults to a consciousness of the dangers which confront us. Figures state that 33,000 lives were lost by accident in the home alone, (150,000 maimed). This is described as a "disaster of greater proportions than any we have been called upon to cope with since the days of the World War." When these facts are presented to the local Councils of Parents and Teachers, their cooperation must be assured. Many councils in Indianapolis have added safety chairman to their boards, thus assuring consideration of this subject both in the home and elsewhere. There is real menace presented in the home by such conditions as loose rugs, misplaced objects and poor lighting. We may even succeed in getting parents to attend a safety program with enthusiasm! The fire prevention bureaus and the accident prevention department of the police can and in many places do give active support. Their campaigns add effectiveness to the work in many cities. Recently in Indianapolis the police department has established a court to convene Saturday mornings, not at the jail but in a room at the Public Library where the young traffic violators are required to appear, accompanied by their parents. Here matters are adjusted with the judge. Roller skating in the streets has ceased to present so conspicuous a hazard since our police followed the example of some other cities and confiscated some pairs of skates.

Constructive publicity on the part of the daily papers has helped to impress the children and is now a stimulus to the adults who are urged to join the crusade by signing the safety drivers' pledge. Some 25 papers of the state are joining with the evening paper in this campaign, and I am informed that throughout the state, in business centers in smaller towns, it is an important topic of conversation.

All this gives a hopeful aspect to what must be somewhat depressing to those who familiarize themselves with the reports of the National Safety Council. For not until we have awakened parents to the realization of the serious hazards which modern life presents to the youth today, can we hope to achieve the necessary protection to human life. The responsibility is a divided one. The home presents its increasing hazards as do all forms of entertainment, all business activities, all school situations; and in the education of children, so closely related are home and school that neither can succeed in any undertaking without the support and cooperation of the other.

Discussion

A brief discussion followed the presentation of Mrs. Ray's paper. In reply to the question, "How far does safety teaching carry into the homes?" Miss Rosamond Losh, executive secretary of the Children's Bureau, Kansas City, Mo., stated that, in her experience, the families have learned much through the schools. Parents in the homes she visits are very receptive to safety suggestions, and welcome the home inspection blanks sent through the schools. Miss Losh believes that the home safety program is lagging behind the traffic safety work. She described the Home Safety Campaign in Kansas City, which involved a house to house canvass.

Dr. R. M. Sherrard, assistant superintendent of schools, Pittsburgh, quoted some figures to show the large number of accidents to children in the homes of that city. There was also brief discussion of the problem of protecting children crossing a boulevard two blocks from schools. Miss H. Louise Cottrell, vice-principal, Stockton School, East Orange, New Jersey, expressed the opinion that such a situation should be handled by the police.

WEDNESDAY LUNCHEON SESSION

October 16, 1935

The luncheon for junior high school principals and others interested in safety education in junior high schools was called to order by Dr. W. T. Rowland, assistant superintendent in charge of secondary schools, Louisville, who presided.

What Should the Junior High School Safety Program Include?

By GORDON C. GRAHAM

Safety Engineer, Detroit Board of Education

Until very recently, the methods and activities by which safety education was taught in junior high school grades were similar to those employed in the lower elementary grades. This resulted largely from the fact that accident prevention instruction, in its earlier stages, was introduced to the curriculum in the lowest grades and, by a gradual process of expansion and repetition, was carried forward into the upper elementary levels. During this expansion, the basic aspect of the curricular content underwent some changes as to depth, but little as to breadth.

Within a few years the effectiveness of the safety education program in the elementary schools was clearly reflected in the motor vehicle child accident statistics which began a decline that has persisted without interruption despite a constantly increasing adult fatality rate. However, this improvement in the child accident record was manifest in the five to fourteen year age groups.

A few years ago I had the feeling that accident prevention instruction had been carried on for a sufficient period to determine whether there was any appreciable carry-over into the upper age brackets. If the program of instruction in this field was effective, the fact should be evident in a study of the accident statistics to age groups from fifteen to nineteen, and twenty to twenty-four; groups that, presumably, had received education in safe habits during the ten to fourteen age periods. An examination of the statistics was most disappointing. Accidental deaths of all types showed marked increases in the junior and senior high school age groups, as contrasted with the elementary age classifications. The announcement of a prominent insurance company that the fatal accident experience of drivers under eighteen was 65 per cent worse than the average of drivers of all ages, and that drivers between the ages of eighteen and twenty-four was 27 per cent worse, was a further indictment of the effectiveness of our safety program's carry-over into upper grades.

Analysis and subsequent evaluation led to the opinion that there was need for the development of new and more adequate approaches to the accident problem in grades of secondary school level. The transition in the child outlook in these grades had been recognized and provided for in other subjects, but not in safety education. The old approaches of crossing streets, hitching, playing in the street, the dangers of matches and poison ivy, which had been emphasized through all the elementary grades, were continuing in the secondary schools with little change and considerable monotony. The fact that students had reached the age of "assertive freedom," had

a desire to "be older," and were even anticipating their adult freedom by aping older people, had not been openly recognized in the safety education plans of secondary schools.

To meet this changing need, a variety of new approaches was developed for junior and senior high schools. Greater emphasis was placed on the development of attitudes rather than specific habits alone. Fair play, law obedience, and good citizenship in relation to accident prevention were emphasized. The advent of students as motorists was recognized, and Traffic Clubs were formed. Traffic laws were studied in social science classes, industrial safety was made an integral part of school shop courses, and home safety found a place in home economics courses. Special courses in safe driving began to appear in high schools. The economic and sociological aspects of the accident problem, from a community standpoint, found favor in many high school programs. Junior Safety Councils were organized in intermediate and high school systems. Student accident reporting procedures were found effective. These and many other methods and devices were introduced to combat the accident problems of these age groups.

Undoubtedly these changes have resulted in far more effective safety education instruction than was being given five or six years ago in secondary schools. However, the effectiveness of these changes is not as yet appreciably apparent in the accident statistics. There are three principal factors responsible for this lack of apparent progress among older student groups.

First, there seems to be a greater resistance to curricular changes in secondary schools than in those of elementary grade, in many cities. Their complacency with mid-Victorian instructional programs, bolstered by the fetish of college entrance requirements, is far less vulnerable than that of the elementary schools. There is often an unexpressed fear that the changes proposed may be "faddish" and will have to be dropped after a few semesters.

Second, the advanced character of the subject matter to be taught in secondary schools often makes it difficult to find teachers who are suitably qualified to give the necessary instruction. Few teachers have had any instruction along these lines in teacher-training institutions, and the number of textbooks dealing with these problems are few and, for the most part, inadequate. Many shop teachers are technically qualified to give instruction in matters pertaining to the operation of motor cars, but have only a cursory knowledge of motor vehicle legislation, traffic law enforcement, highway engineering developments, economic aspects of accidents and accident statistics.

Third, and probably of greatest importance, is the fact that there are constantly in operation certain negative forces in the community which tend to overwhelm the entire educational effort of the schools, most particularly in those schools dealing with pupils who are on the verge of adult life. I am referring to the negative education which children experience from the example of their parents and other adults, together with the ofttimes negative attitude on the part of the community as a whole toward the accident problem. How can our safety education program be effective among child groups that are about to become adults, and who constantly mimic the habits and attitudes of adults, when the community attitude is the absolute negation of our entire program of instruction? Just so long as traffic law obedience is a farce—just so long as reckless driving and careless pedestrian street conduct are condoned, just so long will our efforts in the secondary schools be like bailing water with a sieve.

All of which brings us to the question—what can we as educators do about it? I believe that, if the last factor alluded to above is taken care of, the first two will take care of themselves. If the forces of education will actively join hands with the community agencies who are trying to remould the public attitude, I believe that these changes in attitude will be accelerated to their proper point. If the schools will present a united front with the local safety council, chamber of commerce, police department, or other community agencies, the extent of negative adult education upon the youth of the vicinity will be very materially lessened. Much of what we now teach in safety is of little value, due to adverse adult behavior. Community action can change this. With these changes will come a demand for more safety education work in junior and senior school grades. This increased demand, if sincere and persistent, should exert a changing influence on secondary school curriculum

content, and this change in turn will of necessity result in teacher-training institutions making available suitable instructional courses for teachers.

If the schools adopt a policy of isolation from other agencies in the community dedicated to the prevention of accident, they are simultaneously reducing their educational effectiveness. For, until the widespread negative education of our adults is broken down, we cannot expect our present program of safety education in the secondary schools to carry over into young adulthood.

Discussion

In the discussion period which followed Mr. Graham's talk, Dr. Herbert J. Stack, director of Child Safety Activities, National Bureau of Casualty and Surety Underwriters, New York City, outlined six important points in a well-balanced junior high school safety program: (1) An active junior safety council, with a standard school boy patrol as one of its activities. (2) Instruction in safe practices in all school shops. (3) At least two assemblies a year devoted to safety. (4) Classroom instruction of a specific nature, as follows: in correlation with general science the study of fire prevention, firearms accidents, etc.; in correlation with civics a study of good citizenship problems, also those involving the driver and pedestrian; in the health education or hygiene course, a study of water safety and first aid. (5) Instruction in home safety as a part of the regular course in household arts. (6) Maintenance of a safe school building, with adequate playground facilities.

Mr. J. Russell Craig, safety director for the Pennsylvania Indemnity Corporation also discussed problems relating to the junior high school.

WEDNESDAY LUNCHEON SESSION

October 16, 1935

The luncheon for secondary school principals and others interested in safety education in senior high schools was called to order by Mr. John E. Brewton, director of research, Public Schools, Louisville, who presided.

Good Driving Courses

By DR. AMOS E. NEYHART

Department of Industrial Engineering, Pennsylvania State College

An analysis of the improper driving practices which caused 2,571 deaths in Pennsylvania in 1934, revealed the following percentages:

Exceeding speed limit or too fast for conditions	56 per cent
Driving on wrong side of road	15 per cent
Drove off roadway	12 per cent
Drove through safety zone	4 per cent
Cutting in	4 per cent
Others	9 per cent
	100 per cent

Because accidents are not investigated carefully enough to determine exactly what was the cause, and because most accidents have not one but a combination of causes, it seems entirely reasonable to consider operators responsible for 65 per cent of all fatal accidents. (Based upon reports of the various states.)

Why have this 65 per cent of fatalities at all? There is no justification or excuse on the part of the operator when he is guilty of "improper driving prac-

tices." HE EITHER KNOWS AND DOESN'T CARE, OR HE DOESN'T KNOW AND DOESN'T CARE TO KNOW.

Just how can we eliminate this group entirely from our roadways? It seems to me that one method *is through* "good driving courses" which will include sufficient material to enable the new drivers to form *correct driving habits* and as a result be not guilty of improper driving practices. In order to meet this objective the following outline is suggested:—

1. Accident Facts—
   (a) Entire country.
   (b) State.
   (c) Local community.
2. Highway Rules and Regulations—
   (a) State.
   (b) Local community.
3. The Automobile (study chassis)—
   (a) Mechanisms and devices (location and uses).
4. The Automobile—
   (a) Demonstration of mechanisms and devices.
   (b) Demonstration of safe driving practices.
5. The Automobile—
   (a) The demonstration of mechanisms and devices is followed by the use of mechanisms and devices by the prospective drivers. This should be given off the highway and away from traffic. Care should always be exercised to make sure the practice is correct. The act must be performed correctly from the start.
6. The Automobile—
   (a) Driving experiences—the driving route should be paid out so that the new driver will obtain helpful experiences, to make for safe driving. All *safe driving practices* should be pointed out during these lessons in the car. Examples: How and where to stop at stop signs, signal lights, and in traffic; how to make right turns, left turns, or to go straight ahead; how to pass slower moving vehicles, etc.
7. Preparation for the Examination for an Operator's License—
   (a) The examination questions.
   (b) Check-up of safe driving practices.
8. The Actual Examination.

Sources of Information

1. Accident Facts—(a) Entire country—National Safety Council; (b) State—Highway Patrol and safety division of Motor Vehicle Department of State; (c) Local Community—Police Department.

2. Highway Rules and Regulations—(a) State—Department of Motor Vehicles of state; (b) Local Community—Police Department.

3. The Automobile—(a) Mechanisms and devices—garages usually have a chassis for demonstration purposes. Information can be obtained from the instruction book of any automobile manufacturer.

4. The Automobile—(a) Demonstration of mechanisms and devices; (b) Demonstration of safe driving practices. A trip is made through downtown traffic in the car with the learners observing the use of mechanisms and devices and the safe driving practices. The teacher does the driving and demonstrating.

5, 6, and 7. The Automobile—Each learner experiences the actual use of the mechanisms and devices by practicing in the car. Examination questions sent out by the Department of Motor Vehicles are carefully reviewed. Safe driving practices checked.

8. The Actual Examination for an Operator's License—The new drivers are taken to an examination station and there tested by a member of the highway patrol.

Several manuals are available containing course content. However, these manuals are only educational, and do not complete the job by *developing driving skills*. With the development of good driving skill as a paramount objective, I taught 84 new drivers. As a result of this experience I wrote a manual which is intended to guide the learner in developing *correct driving habits*. The lesson assignments are given in logical order, that is, in such an order as to fully prepare the learner for the next new experience. Unfortunate driving experiences during the learning period are eliminated, and students are always prepared through correct driving habits to meet an emergency.

Methods of Presentation include (1) charts and graphs, (2) discussions, (3) blackboard demonstrations, (4) visiting garages (to study chassis), (5) actual driving experiences in an automobile.

The Teacher—In a recent research study on "The Relation of the Training and Other Characteristics of Automobile Drivers and their Proneness to Accidents," I found that learners have the same driving habits as their teachers. Therefore, if the learners are to have safe driving habits, it seems reasonable to make sure that the teacher is known as a safe driver because of his attitudes and safe driving skills. Personality and teaching ability are highly important.

Our Experiences in Teaching 86 New Drivers at State College, Pennsylvania. Sixty-two of the 86 new drivers were taught one at a time, while the remaining 24, high school students, were taught in a group. When the time came to go out in the car for driving experience, the high school class was divided into groups of four. Early morning hours and late afternoon were found most convenient. Each group met three times a week.

The technique used and the content of the course covers so much that I refer those interested to an article, "A High School Group Learns to Drive," in the October Number of *Safety Education*, and to the manual that was used as a text, "The Safe Operation of an Automobile—A Manual for Teachers and Learners," by the speaker.

It took an average of 13.35 hours per learner when the new drivers were taught one at a time, as compared to eight hours when the group method was used. The writer is convinced that the drivers taught by the group method will have a better driving record, because each learner actually spent 24 hours in the car observing, in addition to the eight hours actual driving experience. They had an opportunity to observe many more "safe driving practices" than the individual learner, because of the 32 hours in the car against the 13.35 hours of the individual learner. Again, according to the psychology of learning, it is better to practice short periods at a time than to use only a few periods with more time per period. However, the goal is to teach new drivers *safe driving skills* regardless of the time required to attain this objective.

It is a well known fact that it requires a longer period of time to teach new drivers when the age of the learner goes up. However, our main interest is to realize a group of *real* drivers. The writer has observed during this teaching experience that the older learner assumes a definite feeling of responsibility and courtesy for others on our roadways. There is not as much *cockiness* as one finds in the younger group.

The average number of miles covered per learner as a driver, that is, back of the wheel, when taught individually was 114.6 miles as compared to 72 miles when taught in a group. Here again we must remember that each driver by the group method rode 216 miles in addition to the 72 miles as a driver. This additional mileage offered an opportunity for many more new experiences. The writer feels that in the past we have been in too much of a hurry to obtain an operator's license, and have neglected the importance of developing *safe driving skills*.

The driving experiences of the learners who were taught by this systematic method bear evidence that safe driving is the result of safe driving habits. Some of these drivers who were taught several years ago, now have over 30,000 miles to their credit, and not one of them has had an unfortunate driving experience. Again, only time will prove its merits, because a careful check-up will be made periodically for a number of years to determine the value of such a course.

In order to afford an opportunity for teachers interested in our method used at State College, Pennsylvania, the Department of Education and Psychology at the college will offer a three credit course on "Teaching the Safe Operation of an Automobile."

Dr. Miller McClintock, Director of Erskine Bureau of Research, Harvard University, led the discussion which followed the presentation of Dr. Neyhart's paper.

WEDNESDAY AFTERNOON SESSION

October 16, 1935

The session was called to order by Albert W. Whitney, associate general manager, National Bureau of Casualty and Surety Underwriters and vice-president in charge of Education, National Safety Council, New York City, who presided.

Following several selections by the Louisville Teachers String Ensemble, Mr. Whitney introduced the first speaker.

Education Supports Engineering

By WILLIAM C. KNOELK

Chairman, Milwaukee Safety Commission, Milwaukee, Wis.

Statistics show that the "human element" is still the chief cause of accidents. A traffic authority said recently, "safety education in schools and home must supplement traffic engineering." The good work accomplished by engineers in providing automatic safeguards actually causes some individuals to yield themselves implicitly to mechanical devices when a modicum of judgment should warn them to rely upon safety devices *plus common sense*. Education attempts to provide the way to apply common sense. The willful and reckless, refusing to employ the engineering aids that are provided, are not the only offenders in traffic. The blundering, the hasty, the thoughtless, even the indecisive, must also be considered. There are other "types" who need more than mechanical aids to make them drive safely.

Nor is that the whole story. Even the usually careful driver—and this is equally true of the laborer, the machinist, the housekeeper, the pedestrian—has moments of "accident-proneness" that are almost beyond his control. Fatigue, worry, preoccupation, and day-dreaming are some of the contributing factors. Security and safety are not merely matters of economics: they have to do with the subconscious. They are not only the product of material conditions; mind-set and health are important ingredients. The highly desirable—and desired—feeling of well-being is not only a physical thing. It has a distinct mental and emotional tinge. If you would reduce the high accident record of an individual check up on the machine, the circumstances, the physical conditions, *and the man*. By force of natural laws, the safe driver of today may be an accident-prone driver tomorrow. Study the man. How was he thinking? What was his mental attitude? Was he upset emotionally? This is a field in which education needs to aid engineering.

Progressive schools today recognize the need of training for home and traffic safety with such a philosophy to guide them. Children are taught the right way to cross streets, the need for an alert mind in traffic, the usual hazards of group life, and the courtesy and caution of decent citizenship. But they are taught more. They are made to understand not only the knowledge of safety but also the philosophy. A similar plan must be employed with adults. A perfunctory obedience to traffic signals may be good; an understanding and intelligent cooperation with such devices is better; and a willing and enthusiastic recognition of the need for, and support of, the system is best. This is the job of education. Excellent equipment without the support of good public opinion—public judgment—is probably less effective than interested caution with less of engineering safeguards.

What has been said of traffic safety is, of course, equally true of home safety. To broadcast information on safety problems is an excellent project, but it is only half the story. The effective use of the information is the more important, more difficult half. It is also more difficult to achieve. There are not only physical hazards to overcome; the mental hazards are probably more difficult to meet and to surmount. Unless home is a restful place, with an atmosphere of friendliness and happiness, where we can relax completely and forget the fatigue and worry of the day, we are not well equipped to protect ourselves against unsafe conditions on the street and at work.

Education—as far as our schools are involved in the problem—cannot be said to do all possible, unless the teaching personnel is imbued with a crusading spirit of safety that not only comprehends the difficulties of the work but becomes militant in the correction of existing handicaps. Great movements are born out of great enthusiasms. When the teacher's zeal is sufficiently burning to set on fire the pupil's eagerness to do his share in making our homes and streets safer, the problem is on the way to being solved.

Obviously, the thesis that is set up in this presentation runs way beyond the teaching about things. It involves the economic status of a community; and even the mental and emotional health. A city in which a large portion of the population is living below the margin of bare subsistence or in which a big number are resentful, bitter, or even only apathetic, cannot be as safe as one in which these conditions do not exist. Safety education is concerned with more than mere intelligence. It has to do with interest and with attitude. We are swayed in our judgment fully as much by our attitudes, and prejudices as by our logic. Hence, educating for safety is no simple matter. After all reasonable safeguards are provided, when effective enforcement is the usual order, the hardest job still remains—the engineering of human consent. To do this job requires good safety education not only in schools but in adult life as well.

Possibly all of this might be put under the caption of safety consciousness. However, if consciousness is merely an awareness of the problem, it is not enough. There must be an interested and willing support given to the safety movement. Many factors are involved in this equation, but the heart and essence of the work—from the standpoint of our schools—is that teachers be convinced of the worth of the movement, be enthusiastic in the cause, and employ the accepted methods of spreading the gospel.

The Present Status of Safety Education

By MISS AGNES SAMUELSON

President, National Education Association, Des Moines, Ia.

No educator now questions the necessity of safety instruction and activities in the school. It is difficult to find any subject that has developed so rapidly. There may be some disagreement as to method. Some maintain that incidental instruction in this subject is sufficient. It was not found to be sufficient in the case of spelling, for example. Perhaps these statements indicate the limits of one of the interesting problems before us. We have on the one hand a general acceptance of the subject and a willingness on the part of school people to agree that the school must interest itself in the fact that a large number of children each year are killed or crippled through accidents, and that special training is necessary if the adult of tomorrow is to avoid accidental death or injury. We have on the other hand some school administrators, including some who express belief in the importance of safety education, who make no provision for this instruction.

To those who sincerely believe in the effectiveness of the present programs, one may address several frank questions. Are teachers given opportunities to familiarize themselves with new developments in the accident problem and improved technics in safety education to an extent equal with the opportunities offered them to keep up to date in their presentation of more traditional subjects? Are safety materials provided for the use of teachers? Are those materials held to the same high standards applied to materials in other fields? Has a testing program been developed that is comparable to others or is the child accidental death rate considered an adequate measure of the success of the program? Has the school assumed responsibility for safety education, and arranged for the direction of a continuous program, or is the subject sponsored largely by outside groups which are allowed in the classrooms because of the importance of the subject, the influence of the groups, or the fact that local school administrators and teachers are already carrying a heavy load? It behooves the educational profession to find the answers to these questions, if the program is to move in the right directions.

If these questions could be addressed to the responsible heads of city and state school departments in every school system in the country, the following facts about

the present status of safety education would appear to be abundantly clear. Many systems have complete, balanced programs. The leaders of school systems in some areas have accepted the theory of safety education but have not arranged for its practice in their schools. Some of the present programs need reorientation in the whole educational program of the community.

It is clear that our problem is different from what it was a few years ago. When Part I of the Twenty-fifth Yearbook of the National Society for the Study of Education was published in 1926, safety education specialists were still engaged in emphasizing the importance of the subject; the problem; development of the safety movement; and realization of the educational aspects of the problem. These are the significant titles of the first three chapters of that book. The problem has changed. We are concerned not only with the development of new fields but also with the more adequate tending of fields already opened. Where ten years ago we faced the hazards of indifference to "just another subject" we now face the dangers of satisfaction with inadequate programs. It is not enough that approximately 300 cities and 20 state departments of public instruction report the publication of course of study manuals and bulletins on safety education. It is essential that these publications be of a high educational order if the schools are to make their just contribution to the protection of their charges from present-day hazards. Our appreciation of this is in itself an indication of progress. Only when a special subject becomes an accepted part of education do we concentrate on its presentation in accordance with the highest standards of educational philosophy and methods.

Arranging for the adequate administration of safety education has not been easy during recent years. Depression budgets have made it impossible to increase the number of supervisors. According to present reports only one city school system this fall has seen its way clear to add a supervisor in safety education to its staff. Other factors also are involved. A belief in integrated programs, for example, may account for the fact that only a limited number of city school systems and one state department of public instruction have supervisors whose titles indicate their responsibility for safety education. In the majority of cases, responsibility for the program has been assumed by general supervisors, assistant superintendents, research directors, special supervisors particularly of health education and others. Thus, on a city-wide scale, the subject has been handled in connection with another subject or group of them; while in the individual school the principal has taken direct charge or assigned the subject to a faculty member already carrying a full load. However, during the last two or three years a steadily increasing number of experienced school people have expressed doubt of the effectiveness of the integrated safety program and have urged that the subject be more definitely placed in the curriculum, directed by an official whose other work, if he must have any, has been so arranged that he has time to give to the supervision of safety education, and the responsibility for teaching the subject definitely centered on a selected group of teachers. This is now being done in some schools; will apparently be done in an increasing number. One large city, famous for its safety work, has announced that during this year eight periods of high school English will be devoted to safety education. Specific material will be prepared for the particular group of teachers who hence forth will be held accountable for this instruction.

The number of courses of study in safety education to which reference has been made may be misleading. There does not now appear to be available any complete report showing the number of school systems which have published courses of study, manuals, bulletins, monthly lessons, or other types of material for the teaching of safety education. Several cities, which issued courses of study when safety education was a new subject and little material was available, have revised those courses three or four times. Other cities prepared temporary, mimeographed courses during the early days of the movement but did not revise or improve them. One other factor increases the difficulty of reporting on the numbers and types of courses of study. In some school systems, safety education is known to have been integrated to such extent with some other subject that the safety program is not readily discoverable. Many activities that ordinarily form important parts of safety work are thus developed and recognized under some other label, frequently under that of health education. Of course the important thing is not how it is done, but that it is done.

Safety courses are ordinarily suggestive. Unless the material they contain has been integrated with some other subject, or group of subjects, there is no time or

place for the presentation of the material. Teachers are encouraged to teach safety when the subject matter of their regular work makes such correlation intelligent and effective. The amount of instruction given under such circumstances varies directly with the interest and initiative of the individual teacher. In this connection a new development seems about to take place; more and more is being said, within the schools as well as by specialists from without, about the importance of a definite time allotment for safety education. Recommendations and suggestions vary from thirty minutes a week to thirty minutes a month in the elementary schools.

Keeping pace with the development of classroom programs has been the growth of safety activities of extra curricular character. These have taken the form of club or junior safety council activities, and the best of them have been organized along the general lines followed by the majority of school clubs. It is now estimated that the schools of at least 200 cities have approximately complete student safety organizations. These devote considerable energies to improving conditions about schools and homes and to training pupils in safe practices. These clubs give to children invaluable educational experience of learning through doing.

One aspect of the extra curricular activity program developed with vigor throughout the country is that of the schoolboy safety patrol. Such organizations exist in approximately 800 cities and towns. Developed first in city schools, the patrol is now growing out into rural areas. In the majority of cases the squads are organized in accordance with the Standard Rules for the Operation of Schoolboy Patrols developed in 1930 by a committee representing the National Safety Council, the National Congress of Parents and Teachers, and the American Automobile Association. These rules provide that the function of the patrol is to aid in the instruction of pupil pedestrians in safe conduct on the streets. While this principle is still generally observed, there is evidence to indicate that in some cities at least schoolboy patrols are being substituted for traffic officers. This does not mean that school children are required or permitted to stand out in the center of intersecting streets and perform as uniformed officers. It does mean that some police departments, faced with a real shortage of uniformed men, have found it necessary to leave patrols in sole charge of intersections formerly thought sufficiently traveled to require the presence of a traffic officer.

The present status of the schoolboy patrol movement may be summarized as follows: Probably a quarter of a million boys—yes, and a few girls—serve as safety patrols in the country today. They serve courteously, consistently, unselfishly. They merit and hold the confidence of their teachers and fellow students; the respect of the general public. To attain their highest efficiency they must be carefully selected, properly equipped, adequately trained, and constantly supervised. The principal of every school with a patrol or a faculty member assigned to this work should take an active part in the organization and administration of that patrol. School officials have a sympathetic understanding of the problems of stretching a too limited personnel over too large a task, but a shortage of uniformed traffic officers does not justify any city in exploiting its elementary school children.

Safety education has been of great interest to many individuals and groups outside of the schools. Largely to them belongs whatever credit is due for the existence of a sizeable body of legislation on this subject. An analysis of this legislation was recently made under the direction of Dr. Walter D. Cocking, Superintendent of Public Instruction in Tennessee. He found that instruction in safety and fire prevention is required by law in 20 states. The first legislation of this kind was adopted in South Carolina in 1923. The largest amount of legislative activity occurred in 1928 and 1931, five new laws being enacted in each of those years. An examination of those sections of the school codes devoted to instruction showed that in 12 states fire prevention alone was required, in four states training is to be given in the prevention of street and highway accidents, and in four states an inclusive program is desired as indicated by use of the term "Instruction in Accident Prevention." Not much significance can be attached to the existence of this legislation. Some states with excellent school safety activities have no legislation on the subject. A few states with apparently adequate legislation have not yet made any appreciable progress in the development of safety teaching.

While we are now concentrating attention on the improvement of existing fields of safety instruction rather than the exploration of new ones, there are two

important levels on which additional work is essential. These are courses in secondary schools and in teacher training institutions.

Within the last two or three years safety, as such, has come to receive increased attention in secondary education. The term "safety as such" is used advisedly, since it is true that a large body of subject matter frequently included in safety outlines has always been taught in high schools. Students in properly administered school shops, kitchens, and laboratories have always received definite instructions on the safe use of the equipment therein. While the high schools have not been called upon to assume responsibility for safety training in fields less closely related to activities within the school, they are now beginning to recognize the importance of training young inexperienced drivers. In several states notable progress has been made in this field. Courses in automobile driving have been offered, some of them for credit toward graduation, others for special certificates to be presented by the state motor vehicle officials when applying for a driver's license. Some of the most successful have taken sixteen hours, one class period a week during the semester.

There is a tremendous amount of interest in this new work shared by school people and laymen alike. Those most interested in the continued improvement of this instruction recognize the existence of several problems. At what grade level should this instruction be given? Where can trained instructors be secured? What is to be taught? Is there danger, while not over-emphasizing traffic hazards, of under emphasizing home and recreational and other hazards? What contribution can the interested official and citizen—the state highway patrolman, local police, safety council manager, automobile club secretary, insurance salesman—make to the development of instruction in this new subject? How can the radio, press, library, and other agencies of interpretation be more helpful?. What specific things can the civic, women's clubs, and other organizations do?

In summarizing this aspect of safety education emphasis must be placed on its relative newness, the energy with which it is being urged upon the schools, its fundamental value and its great appeal to the high school student who confidently expects to drive a car not later than day after tomorrow.

This new high school program in automobile driving may well become that part of safety education which focuses attention on the need for trained instructors in this field. Only about half a dozen systematic courses for the training of teachers in safety teaching methods are now being offered. Countless institutions have opened their assembly periods to safety speakers, but that is not enough. The subject matter is not thin. Matters relating to economies, social customs, laws, physics, and the effect of the automobile on the social and economic structure of America should be included in a study of the automobile.

THURSDAY MORNING SESSION

October 17, 1935

SCHOOL SHOP SESSION

The session was called to order by Gordon C. Graham, safety engineer, Board of Education, Detroit, Mich., who presided and introduced the speakers.

Developing Safety Instruction for School Shops

By L. K. COVELLE

State Supervisor of Trade and Industrial Education, Safety Division of Vocational Education, Stillwater, Oklahoma

Teachers, particularly in the school shop phase of industrial education, know that safety must always be considered, but their safety instruction is based upon a microscopic view, rather than a telescopic view, because they rely largely upon their

own personal opinions and experiences. The procedure and method of instruction differ with every individual. There is no uniformity.

On the other hand, any thinking shop teacher knows that no set plan or campaign against shop accidents can function for the reason that there is no such thing as a *general* accident.

Therefore the emphasis must be placed upon the cause of accidents, and until the cause is removed accidents will surely occur.

A great deal has been done to safeguard the boy by the use of guards. Industry has made this possible through the construction of the equipment, yet very little research or study has been made on the real cause of accidents in the shops. The error in teaching safety, in most cases, lies in thinking of carelessness as the only cause of accidents. Every new accident teaches us a new peril, yet we attempt to banish each peril by pointing out to the boy a few obvious dangers and telling him to be careful. Many accidents occur not through carelessness, but through ignorance based on a false sense of safety.

Practically all progress in industry is due to research. If we are to progress in shop instruction, we must resort to the same process of research for curricular changes. It will necessitate thought on the part of every shop teacher to make such a study usable and applicable in building up a curriculum of safety.

It is further necessary to compile data on accidents in school shops to determine how the cause shall be removed. It is only through an actual record of major and minor shop accidents that we have a starting base for analyzing and altering a curriculum.

Industrial accidents are decreasing in severity and number. This is probably due to the fact that in practically all organized industries every accident, major or minor, is a matter of permanent record and is subjected to an investigation to determine the cause. This practice is actuated not only from a humanitarian standpoint, but from an economic standpoint. When an honest effort is made to determine the cause of an accident, remedial measures may be established so that the mishap will not recur. There is another motive for complete accident records, and that is that workmen's compensation may be involved. When accidents in industry, in addition to causing lost time and human suffering, became an additional economic factor through workmen's compensation, industry recognized the need for safety instruction. With the lessons that industry has taught us, we in the school shops must not wait until the courts and compensation laws force us into safety instruction for protection. We have only to look at court records to find that major accidents have occurred in school shops in several states and that school boards have been held responsible.

Again we are fortunate in being able to look to industry to help us solve the problem of constructing a curriculum in safety. If we could bring our shop features in each state to cooperate with the Department of Vocational Education or the State Department of Labor and report all accidents, much could be accomplished. To further the interest in safety, our teacher training institutions should offer courses in safety and in safety instruction.

Very few shop teachers have had definite instruction, if any, on how to integrate safety instruction with teaching operations.

Much good has been done through the use of posters in an attempt to reduce accidents in the shops. But data have not been accumulated and are not available in our state as to the frequency in accidents with hand tools, with machines, and in the handling of materials. If constructive work is going to be done, it will require honest effort and thinking on the part of every shop teacher as well as earnest cooperation, all working as a group to begin organizing and compiling these data.

There could be no more worthy project than bringing shop teachers to the realization that the time is coming, if it is not already here, when any boy, if he wishes to make a successful entry into industry, must have inculcated within him the habits of safe thinking in addition to any skill he may possess—for the two cannot be separated. As we develop correct habits of thinking in our school shops, we are going to turn out boys to be safe workers as well as skilled workers. To give a boy a balanced training it is essential that we approach the problem of safety instruction with the same zeal and energy as we approach the problem of skill.

How We Impart Safety Instruction to Our Students

By DEAN BENNETT M. BRIGMAN

Speed Scientific School, University of Louisville

As a part of our freshman orientation program at the University of Louisville we present a course on accident prevention which embodies a series of lectures, demonstrations, and inspection trips. It is a required course, treated in the same manner as any other course in the curriculum. We believe that our university is the only institution of higher learning that requires its freshmen engineering students to take such a prescribed course of study.

That you may have a clearer conception of our program, it is necessary to explain the workings of the Speed Scientific School. This school, a unit of the University of Louisville, has just completed its tenth year of existence. It operates on a "modified" co-operative plan; that is, it offers in addition to a standard curriculum in chemical, civil, electrical, and mechanical engineering, an industrial training in the various manufacturing establishments, utilities, laboratories, and other industrial organizations in and about Louisville. This industrial training, better known as "co-operative work," is a method whereby students are assigned for a prescribed period to work in a plant or other industrial organization. While the students are employed they receive a wage and are under the jurisdiction of the establishment to which they are assigned. These working periods vary from two weeks to twelve weeks, and the assignments cover, according to the school, from the freshman year to graduation.

In the Speed Scientific School the period of co-operative work is twelve weeks and is confined to the sophomore and junior years; hence, my use of the term "modified" co-operative plan. This co-operative work is under the jurisdiction of a department of correlation and co-ordination. Assignments and supervision on the part of the school are made by a co-ordinator who is a member of the faculty. He calls regularly upon each co-operative student while in the field to observe the student at work, to question and answer questions upon the practical applications of the classroom and laboratory theories involved in his work, and to discuss the progress and proficiency of the student with the official under whom the student works. These contacts made by the co-ordinator are the only connection the student has with the university during his co-operative employment.

We concentrate this co-operative work in the sophomore and junior years on the theory that the freshman is not cognizant of the seriousness or intricacies of an engineering career, and because of this lack of understanding he must be taught what it is "all about." We omit the work for the senior because at the end of his junior year he has had four of these twelve week periods of co-operative work and should be prepared for specialization in his particular branch of the profession.

It is obvious therefore that these students, while on their co-operative assignments, may have worked in as many as four different plants and that they have been engaged in many different pieces of work throughout the whole organization in which they were employed; consequently, it must be still more obvious that his preparatory instruction should include principles and essentials of "accident prevention."

The Speed Scientific School is indebted to Mr. Robert L. Schmitt, secretary of the Louisville Car Wheel and Supply Company of Louisville, for this plan. Mr. Schmitt has been interested in and connected with the Louisville Safety Council since its organization. He suggested to me the necessity for the course, and offered to prepare and present to our students a course on "accident prevention." Quite naturally, the first step in any course of instruction is to set up the objectives; these we boiled down to two: 1. safety mindedness; 2. self-protection.

The first objective is designed to teach that we are all individually responsible for accidents. We keep constantly before the students the fact that the university is training them for a professional career, that in the course of events they are expected to be administrators and executives of industries, and whether they are at the top or the bottom of their respective professions, they as educated men must be by precept and example the exponents of the safety of those with whom they labor.

The second objective, "self-protection," is self-explanatory when it is recalled that the students are themselves employed in the industries as regular workmen. They are informed that when they go into the various plants their own safety is at stake; that they must be alert and on guard not for themselves alone, but for those unfortunates who might suffer because of their thoughtlessness or carelessness.

The actual work of imparting this instruction is simple. We make use of the psychological effect of having a stranger come to the class room to speak on a subject of accident prevention. These visitors are selected each year from the industries of Louisville. Sometimes we bring out-of-town speakers to the classroom. Each one of the lecturers has been given before hand an outline of the specific subject he is to present. He may add what he chooses, but he is cautioned not to delete. If he wants to illustrate his lecture, we provide any form of projection he requires. If he wants to pass out forms or other printed matter, it is quickly accepted. Other lecturers bring safety appliances for inspection and permit the boys to handle them and try them on. We have demonstrations of resuscitation methods and frequently the lecture hour becomes a session of argument. We have models of machinery equipped with safeguards in the classroom, the boys operate and play with it, and few fail to find out all about the exhibit. Time is given for questions and answers, and at the completion of the course, a final examination is given which covers the entire course. The grade, like any other course, must be a passing one to obtain credit for the work.

In the course prepared by Mr. Schmitt the following subjects are typical of those presented each year:

"Man—Greatest Factor of Safety"
"History and Organization of Accident Prevention Work"
"The Successful Manager"
"The Importance of Accident Records"
"Good Housekeeping"
"The Importance of Work-clothes and Tools"
"Guards as Accident Prevention Agencies"
"The Value of Education in Accident Prevention"

Supplementing the foregoing, other speakers discuss such typical questions as:

"Fire Prevention"
"Mine Safety"
"Public Safety from the Police Standpoint"
"Public Safety from the Standpoint of the Safety Council"
"Public Safety from the Viewpoint of the Automobile Club"
"Public Safety from the Standpoint of the Utilities"
"First Aid"
"Construction Safety"

Finally, inspection trips are taken through several factories. These trips are arranged jointly by the Department of Co-ordination and Correlation, and English. The English Department uses the trips for the subject matter of compositions and the Co-ordination and Correlation Department uses them to illustrate factory organization, processes, and safety management.

Industry's Interest in School Shop Safety Training

By R. C. SALISBURY

Safety Engineer, Hardware Mutual Casualty Company, Stevens Point, Wis.

One may be inclined to the belief that industry's interest in school shop safety training is negligible: that there is little connection between the two. But on more serious reflection, the interest of industry may be concisely described as the desire for the development of a standard plan of safety education through which the philosophy of self-preservation in the youth is aroused to the point of everlasting action.

I confine my remarks to the vocational school, since its primary purpose is to prepare individuals for suitable and profitable employment for specific vocational skills. We recognize, then, that safety education is an important part of the training.

This is especially true because of modern equipment coming into use during the past ten or fifteen years, making shop work more hazardous, but at the same time affording a better opportunity for instilling correct and careful habits in the student. For many years we have heard, that safety education must have its inception in the school. As a part of its curriculum the school, therefore, should set the pace for industry, and the solution of the problem undoubtedly lies in:

1. The development in youth of an appreciation of that type of accident that no known safety device can prevent.
2. The development in youth of an understanding of the basic causes of accidents and a knowledge of how to correct them.
3. The development in youth of a wholesome respect for the value of mechanical guards and other protective equipment.

With these basic ideas of education in mind, this section of the National Safety Council may concern itself in the establishment of a program that will influence industry to lend its best assistance toward training young men and women to appreciate the value of removing hazards that the untrained fail to recognize.

It is not my intention to belittle the value of mechanical safeguarding. The mechanical device on a piece of machinery is without question a great factor in the prevention of accidents, but it does not definitely prevent them. As long as there are steps to trip on, ladders to fall from, dangling sleeves to be caught in machines, and countless other possibilities that seem to be a part of every day life, accidents will be a factor to be reckoned with. Industry may provide a definite service in sending trained men into the school shop to give specific instruction not only on the operation of the machine, but also to instill in the mind of the youth it's interest in the avoidance of dangerous and careless practices.

This is being done with some success in a large shoe factory in Marshfield, Wisconsin, and by a cheese factory in Beaver Dam, Wisconsin. Both concerns have set up in their local vocational schools machines used in the manufacture of their products. Once each week certain of their foremen are loaned to the schools for the purpose of giving definite safety instruction. Here the students are taught the value of safety devices and guards, the proper methods of starting and stopping machines, the importance of stopping machines for oiling, wiping and repairing, the proper placing of materials, the proper method of removing chips, the safe use and abuse of hand tools, shifting of belts and fastening of chucks, and so on. The underlying thought of course is to make the student safety conscious.

There is, however, a woeful lack of knowledge of the many safety codes dealing with practically every phase of industry. It is not at all uncommon to find students, and also superintendents and foremen, in complete ignorance not only of specific rules and regulations, but of their very existence. Here then lies an opportunity for proper class instruction, whether administered by industry through foremen training or as an established procedure by the school. The trouble with most of us today is that we are still wallowing in the bog of emotionalism. We frequently hear men state their qualifications for certain types of work, but we rarely *if ever hear them say they are thoroughly familiar or even cognizant of the fact* that there is in existence specific information dealing with the problems of accident prevention.

I submit for your careful consideration the proposal that safety instruction in the school be guided by the full use of state codes, and where they do not exist full use of the safe practices pamphlets issued by the National Safety Council.

Industry can give valuable aid in the furtherance of accident prevention knowledge by making available to school instructors the data gathered from their experience on (a) accident statistics, (b) basic accident causes. I have a list of 43 typical basic causes of accidents.

Can we not as instructors and safety engineers begin today to develop in youth a consciousness for a true understanding of the basic causes of accidents and will we not be making progress in the right direction? After all, machine failure is responsible for only a small percentage of industrial accidents.

ADJOURNMENT

Home Safety

TUESDAY AFTERNOON SESSION

October 15, 1935

The session devoted to a discussion of home safety problems was called to order by the chairman, Rosamond Loch, director, Kansas City Children's Bureau, Kansas City, Mo., who presided.

Safety Begins at Home

By KATHARINE FISHER

Director, Good Housekeeping Institute, New York City

Mark Twain said that "Everyone talks about the weather but no one ever does anything about it." A discussion of home safety problems should not end in talk; it should stimulate effective action. For you and I know that the majority of the fatal accidents in our homes each year, as well as the injuries that leave people maimed or disfigured, can be prevented.

Why then do these accidents occur? Because of the same old human failings—carelessness, neglect, ignorance, indifference and taking risks. It is your opportunity and mine, not only to broadcast information as to safe practices and conditions in the home, but also to suggest ways and means of making use of this information most effectively.

Any family group can easily be informed as to safe practices and conditions. I have here an outline on home safety, which lists many possible hazards and unsafe home conditions. We send this outline to anyone interested, with the suggestion that it be used systematically to check up on conditions in their own home, and that they encourage the children, especially the older ones, to help in taking this inventory. Women can do much, through their clubs, to promote periodic inspections of safety conditions in every home in the community, so that these homes will have a safety code in active daily use. There is also now available the booklet "Safe At Home," prepared by the National Safety Council.

During the last decade or two, housekeeping has entered the mechanical era, and it is highly important that modern mechanical equipment be made as safe as possible. It should also be used safely. These machines have introduced new hazards, but they have not made our homes less safe; the trend, I believe, has been toward greater safety.

Just think for a moment of the hazards of kerosene lamps, still in use in many homes. Think of the chimney fires in using the old wood and coal stoves, and of the demands they made on the cook! The hot surfaces of these stoves were responsible for many burns. I remember the afternoon that I put my hand on the red hot kitchen stove, when we youngsters were playing "blind man's buff." That burn took weeks to heal and it had to be carefully dressed to prevent serious infection.

We know more about caring for burns and other wounds today, yet we often neglect to give adequate attention to minor burns and scratches—sometimes with disastrous results. No long ago, I saw this warning posted in a factory: "One out

of six untreated cuts or wounds becomes infected." This notice might well be posted on the home bulletin board too.

Fortunately, we are ceasing to indulge in those semi-yearly orgies of spring and fall housecleaning, when the whole house was turned upside down and scrubbed from attic to cellar! We were constantly stumbling over things that were out of their usual place. And do you remember the clouds of dust that rose from the carpets when they got a thorough sweeping each week, and when they were beaten in the backyard in spring and autumn? The vacuum cleaner has brought easy and dustless sweeping and a more healthful home.

Scatter rugs have taken the place of some of those carpets. But the use of small scatter rugs invites serious falls, unless they are securely "anchored" by putting under them a non-skid material that prevents them from slipping. We have tried out a number of these "anchors" at the Institute and we offer a list of those found effective. Even when small scatter rugs are as securely "anchored" as possible, however, it is hardly wise to place them just at the top or the foot of stairs.

You and I should take advantage of every opportunity to promote the wider use of these rug "anchors." We should also preach the gospel of better home lighting in guarding and conserving eyesight, and we should stress the importance of suitably placed night lights in preventing falls. We should also emphasize the value of a sturdy hand-rail or handle placed just above the bathtub, where it can easily be grasped.

I can speak about stairs from personal experience, as I have fallen down stairs twice. One flight to the basement had no hand-rail. It has one now. The other was badly lighted and the treads slippery from too much wax. Wax should be used sparingly on any floor surface, and then it should be carefully buffed until it is quite hard.

A few months ago, a friend of mine caught her toe in a small tear in the stair carpet, as she hurried downstairs. She was hurled against the wall, bumped her head badly, dislocated her right shoulder, and broke the right arm between shoulder and elbow. She had looked at that tear in the carpet for days and had thought, "I must have that mended." We are all guilty of neglecting minor repairs about the house and sometimes we pay dearly for this!

We keep on using the decrepit old step-ladder, until some day a tread collapses, giving us a nasty fall. We balance ourselves on wobbly tables, and rocking chairs, and chairs with cane seats, or on flimsy step-stools, in hanging pictures or reaching up to high shelves. And we don't always "get away with it."

There is much to be said about fire prevention in the home, about the disposal of hot ashes, of rubbish, of oily rags, and care on the part of smokers: this whole subject deserves special consideration. I ask for your cooperation in giving more publicity to the grave dangers involved in using, in the home, gasoline or any other highly flammable solvent. It is not only the cause of many serious fires but of disastrous and devastating explosions frequently causing loss of life. What are we going to do about it?

Good Housekeeping Institute has been warning housekeepers of this great danger. For many years we have not accepted for test, or for advertising, any home appliance using gasoline, because of the serious hazards involved in storing and handling it in the home.

We have long been urging women, in our editorials in "Good Housekeeping," and in letters and bulletins, not to do dry cleaning at home. Gasoline and other flammable solvents are out of the question and even nonflammable solvents often have fumes that are toxic. Moreover, only a poor cleaning job can be done with home methods. Most spots and stains can be removed successfully at home, and the small quantity of nonflammable solvent needed for this work is comparatively safe, if used in a well ventilated room.

As a group interested in safety problems, one of the finest contributions we can make to the cause of home safety is to publicize, as dramatically as possible, the great danger of using gasoline or naptha at home.

I have said that the use of modern equipment has not made our homes less safe. However, we cannot forget that some new hazards have been introduced. In testing this equipment, we give careful attention to the safety aspects. Let me give a few examples of our requirements:

Winter is coming and many heating pads will soon be in use. Electric pads may cause serious burns and fires, if they get out of order. We approve none that has not, at least, two thermostats, so that if one gets out of order the other can function.

Smoothing irons, to be approved, must have a well-designed stand or heel rest, to minimize fire hazards. Of course, irons should be disconnected when leaving the board, even for a few minutes, but this is often not done. Automatically controlled irons, protected against overheating, are safer.

A washing machine, to be approved, must have a moisture-proof cord, the motor must be insulated from the frame of the machine and the driving mechanism and the electric wringer must have a roll release that operates easily and quickly.

We are constantly pointing out the danger of using portable electrical appliances in the bathroom; any defect in one of these devices may result in a shock if we are touching a grounded surface, and we often stand near the water pipes or have a hand on a faucet. If there is a heater in the bathroom, it should be the built-in type, with the frame and other metal parts grounded and permanently connected to the wiring.

You have, no doubt, seen electric connecting cords strung around baseboards and behind radiators. You may have stumbled over a cord strung a long distance over the floor from a lamp. Wiring of this kind invites serious fires and accidents. Then there is the unsafe, but common, practice of connecting an electrical appliance to a lamp socket, and the danger of using worn connecting cords. Let us promote the use of cords carrying the label of the Underwriters' Laboratories which meet definite safety standards.

A gas range, to be approved by the Institute, must have burners designed for clean, safe combustion. If it has an oven thermostat, there must be a pilot light that will stay lighted under varying conditions of gas pressure. If it has a solid top, this must be built-in and suitably designed for that particular range. We warn housekeepers against the use of the solid grids for gas ranges that are removable, as these may not be at all safe. We stress the value of safety gas cocks, those that cannot be turned on accidentally, or by small children. Any kitchen range, to be approved, must have a broiler that does not invite fat fires.

The can opener is busier than ever! A can opener should work easily, open all shapes of cans without inviting injury to the fingers and leave a smooth, not a jagged, edge.

Let us help to make the Christmas tree and Christmas lighting safer. Electric lights are, of course, safer than candles, but the wiring should be kept in good condition. Trees should not be left standing long after Christmas, as they become dry and may easily be ignited by a spark from the fireplace or cigaret. If bon-fires are made of them, they should first be cut up and the fire supervised by an adult.

Information on home safety problems is only half the story. The effective daily use of this information in our homes is the other and more important half. I have spoken only of physical hazards. What about the mental hazards? Unless home is a restful place, with an atmosphere of friendliness and happiness, where we can relax completely and shed the fatigue and worry of the day, we are not well equipped to protect ourselves against unsafe conditions on the street and at work.

A Study of 4,000 Home Accident Cases in Chicago

By A. D. BATTEY

Assistant Statistician, National Safety Council, Chicago

Facts about home accidents are exceedingly difficult to obtain. No organization in the United States has authority to require that accidents occurring at home be reported to it, as state and municipal officers require, for example, the reporting of automobile accidents. Without this element of compulsion, little progress can be made in gathering complete and authentic data.

The National Safety Council has assembled a fair number of facts on home accidents, largely from insurance company records. These, coupled with information on the general accident situation, have enabled the Council to make estimates of the number of deaths and injuries from home accidents each year. Considerable reliance can be placed on these figures, even though they are approximations, because

they represent a careful study of the problem from all angles. We can say, with a fair degree of accuracy, that the 1934 total of 34,500 deaths includes 15,500 from falls; 6,000 from burns, scalds, or explosions; 1,000 from the absorption of poisonous gas; 1,500 from other types of poisons; and 10,500 from all other types of home accidents. Also, that 6,000 of these deaths were of children under five years, while only 2,700 were of youngsters from five to fourteen years old; that 11,000 were adults from 15 to 64 years of age, and that 14,800 (or 43 per cent) were people over 64 years old.

That is a rough outline of the situation, but it is not sufficient to indicate the type of prevention activities which will be most effective. How many of the 15,500 deaths from falls resulted from falls down stairs, how many from slipping on loose rugs? How many of the deaths from burns came from children playing with matches? And even if we could answer these questions, there is still the much wider field of injuries in the home that do not result fatally, about which very little is known. The National Safety Council has made annual estimates of these injuries, in total, but there is not sufficient information to permit separate estimates of non-fatal burns, falls, asphyxiations, and so on, nor to show the factors involved.

This being the situation, we were pleased to learn, some months ago, that it would be possible for us to organize and conduct a limited survey of home accidents in Chicago as a Works Relief project, under the Illinois Emergency Relief Commission. It was decided to make a survey of the accidents that were sufficiently serious to result in the injured person being taken to a hospital.

With hospitalization as a limiting factor, we outlined our method as follows: First, the hospital records would be searched and whenever a home accident case was found the details of the injury, the length of hospitalization, etc., would be transcribed onto a special case record form. Second, with this information an investigator would be sent to the home of the injured person to obtain the facts about what type of accident it was, how it came to occur, what factors (such as toys on the stairs or slippery floors) were involved, and how much the accident cost the family.

We found, however, that we could not get the necessary cooperation from the hospitals. The officials were willing to give such information as was contained in the hospital records, except for the name and address of the person injured. This was considered confidential. Hospital records usually do not go into the question of how the injury occurred, nor mention the kind of accident. Therefore, the refusal to give the name and address so that an investigator could get the vital details meant that the survey would have very little value.

In this extremity, we asked for permission to use the records of Cook County Hospital, a public institution; and this was readily given. Since Cook County Hospital is a very large place, we could still count on getting a large proportion of all hospitalized home injury cases from these records. However, all the cases came from the lower economic groups in the community, for no one is admitted to Cook County Hospital who can afford to pay for hospital care. Although this factor spoils some comparisons that could be made, most of the conclusions reached should apply satisfactorily to the whole city.

The Illinois Emergency Relief Commission assigned 12 workers who were capable of searching the records and making the investigations; and in about two months they had located and recorded the necessary information on approximately 17,500 accident cases from the hospital records of 1933 and 1934. This number includes all types of accidents, for we desired to get a picture of the entire accident situation as reflected in the hospital records. It was impossible to tell before home investigations how to classify some of the cases. Many were noted in the records simply as "fractures," with no qualification that might indicate where the fracture occurred.

We were able to identify immediately about half the cases as due to accidents occurring at places other than the home. Investigations were begun on the other half last May, and today we have about 4,500 completed reports. Of these, 2,500 proved to be home accidents. When the investigation is completed, we shall probably have about 4,000 home accident cases on all of which there will be detailed information. We shall then be able to make a thorough-going analysis of the home accident problem in all its aspects.

When we had completed the investigation of the first 500 cases, we made a preliminary analysis to see what kind of information we were getting and what results the entire study would probably show. I want to tell you some of the "high spots" of this special analysis.

First, consider the seriousness of these 500 cases. Our study showed that on the average the patients were given hospital care for 13 days; 143 needed to stay in the hospital only one day, and an additional 84 left at the end of two days. In fact, half of the entire group received three days or less hospitalization. At the other extreme, 50 persons were in the hospital for more than a month; 22 for more than two months.

In most of the cases, hospitalization measures only a portion of the disability. If we exclude the deaths and the persons who did not make a complete recovery, on the average, disability lasted for two months. In other words, after spending approximately two weeks in the hospital, these people were incapacitated at home for an additional six weeks.

Now something about the costs. Hospitalization of these 500 injured persons cost the taxpayers of Cook County a total of $16,700, or about $33 each. One hundred fifty-five of them were employed at the time they were injured, and were supporting 493 people from their wages. It is hardly necessary to say that the economic independence of these people was rendered more precarious by the accidents. In fact, 41 families were forced on the relief rolls directly or indirectly because of the accidents.

The classification of the accidents by type and location furnishes equally interesting information. It was not possible in the preliminary survey to list all the various types, so they were summarized under ten heads. Falls constituted 332, or two-thirds, of the cases studied. In this group, falls down inside stairs numbered 37, or about one tenth of all falls. However, if we add the falls down front steps (27), and down rear steps (37), we have a total of 101, or a third of all falls. Next in order are falls outside the house, not from an elevation; such as by slipping on an icy walk, stumbling over some object, etc. These number 67, which is 20 per cent of the falls total. Falls in the kitchen number 34, in the living room 25, and in the bedroom, 18.

The second most important type, burns, scalds, and explosions, numbered only 32. This is too small a group to classify satisfactorily by location. As might be expected, about half occurred in the kitchen and a fourth in the basement. However, more cases are needed to complete an analysis of location. It seems certain that they will prove to be a minor cause of home injury.

Handling, lifting, or carrying objects resulted in 31 of the 500 hospital cases. Six occurred in the living room, and 8 outside the house. One was the result of a man trying to lift his automobile so that he could place a block under a wheel. He will probably never fully recover.

These are the only types of accidents sufficiently numerous to warrant discussion until we have completed the survey.

When we consider all types of accidents (motor vehicle, other public, and occupational, as well as home), we find that the record is far worse for men than for women. Men have roughly two-thirds of the serious accidents; women only one-third. We might reasonably expect that in home accidents, however, women would have at least as bad a record as men. It is somewhat surprising, then, to discover that out of our 500 cases, 285, or 57 per cent, are men. Their experience in the home is not much better than outside.

Now a word about the age of these 500 injured persons. Nearly half of them were from 25 to 64 years old, which is largely a reflection of the fact that about half of Chicago's population comes within these limits. In other words, the accident experience of this group can be assumed to be approximately average. Persons over 64 years old had 67 of the accidents, which is 13 per cent of the total. Since persons in this age group make up only 4 per cent of the city's population, their accident experience is considerably worse than average. Children under five years of age had 63 accidents, and those from five to fourteen had 102 accidents, which makes their record a little poorer than average. The safest age group is that from 15 to 24 years. These young people had 34 accidents, or 7 per cent of the total, while they constitute 18 per cent of the population.

These comparisons tell only part of the story. We should also take into account the number of hours per day that people of different ages are at home and, therefore, are exposed to home accident hazards. We know that children under five years and adults over 64 years old are home most of the time, but for the rest we can make no definite statements.

Let me complete the picture of the seriousness of these accidents. I have said that on the average these 500 people spent two weeks in the hospital, and that the 387 who eventually made a complete recovery were incapacitated at home for an additional six weeks. What of the remaining 113? Of this number, 59 were partially disabled for life. In some cases, the disability amounted to no more than the loss of a finger; in others, it was the loss of an arm; but all of these people will find greater difficulty than before in meeting prospective employers' physical requirements. In addition to these partial disabilities, 15 persons were totally and permanently disabled. That means the remainder of life spent in bed or in a wheel chair (in one or two fortunate cases, perhaps on crutches). To this must be added considerable expenditures for continued medical care. Then, there were 39 persons who died of their injuries.

The questionnaires our investigators used in getting information on these hospital cases contained sections dealing with the mechanical and the personal factors involved. It was difficult to get the people to analyze the accidents in these terms. However, in 85 of them poor housekeeping was admitted to play a part. This includes 13 cases of objects on stairs, 11 of wet floors, 8 of toys or other articles left on floors, 10 of rugs not properly laid, 18 of ice on steps and walks. Faulty equipment was found to play a part in 51 cases. Twelve of these involved defective step ladders, 11 defective stairways, and 4 broken chairs.

Personal factors contributed to more than a third of the injuries. Hurry was most prominent, being reported in 87 cases. Then come old age with 34 cases, and physical handicaps with 25. Other reported conditions, none numerous, are fear, sleepiness, sleep-walking, and impaired vision.

How Can Parent-Teacher Associations Promote Home Safety?

By MRS. HAMILTON SHAFFER

Second Vice President, National Congress of Parents and Teachers, Dayton, O.

For the past several years the National Congress of Parents and Teachers has been promoting a program of accident prevention and safety in all of its phases. A Safety leaflet and copies of the plan of work of the national Safety chairman are sent to all state, council and local safety chairmen. Resolutions on points dealing with safety in home, school and community are adopted annually at the convention. These resolutions become the bases upon which our national safety program is planned. The Congress lends its support to all constructive legislation dealing with safety. Its position is made known to the state branches which co-operate to secure the passage of approved measures such as the Standard Drivers' License law. At a recent meeting of the National Congress Board of Managers, action was taken opposing the growing practice in municipalities of using school boy patrols as substitutes for regular traffic officers in order to save municipal funds.

The report of the National Safety chairman at the National Convention held in Miami, Florida, last May showed that during 1934 the Safety chairmen of 44 state congresses "had worked consistently and enthusiastically in the sponsorship of safety activities of all kind."

In 1933 fifteen state branches carried on specific home safety activities through radio broadcasts, local association programs, plays and demonstration and co-operation in the home safety survey sponsored by the National Safety Council.

A conference on "Safety Through Education; Through Legislation" was a part of the convention program in Miami. The summary stated: "The price of safety in the home is three-fold: first, a clear and complete understanding of what elements in the home-life of the child involve dangerous situations; second, a definite plan for obviating these dangerous situations through removal or substitution; finally, a consistently courageous attitude on the part of the adults in the home which shall meet all the home activities with a careful, constructive, planned attention, thus developing through good and purposeful adventure, the life abundant."

Recent issues of The National Parent Teacher magazine have carried the following articles on some safety. "Convenience and Contentment in the Home," "Safeguarding the Child from Physical Harm," "Furnishing the Home for Children," "The P. T. A. at Work" and "It's Up To Us" State Congress bulletins also carry articles on this subject and safety programs are being carried out in councils and congress units throughout the country.

Our National Safety chairman has presented the following suggested program for use in Parent Teacher associations:

1. To teach parents how to avoid accidents.
2. To aid parents in giving maximum protection to children while at home and on the streets.
3. To aid teachers in giving maximum protection to children while on school property.
4. To aid both parents and teachers in the development of safety skills and attitudes among children that will make possible active and adventuresome lives.
5. To develop in the community a sense of responsibility for child and adult safety.

Every safety committee should have a sub-committee on home safety. This group should have as its major objective the education of homemakers in accident causes and accident prevention in the home and its immediate environment. Regular home inspections to discover unsafe conditions and practices should be encouraged. Control and elimination of all possible hazards should be urged as a regular part of home activities and duties.

Here are a few of the hazards, common to almost every home, that are responsible for that constantly mounting number of accidents by falls: Dark halls and stairways; stair steps, especially, cellar steps cluttered with brooms, buckets, mops, garden tools, old shoes, rubbers and toys; rickety step-ladders; highly polished floors; loose rugs and that every present hazard, the slippery bath tub; medicine cabinets and shelves with their sinister dangers lurking in unlabeled or improperly labeled bottles, pills of doubtful value, and used safety razor blades.

Parent Teacher Associations are peculiarly fitted to carry on a constant campaign for safety in home, school and community and particularly safety in the home. The teaching of safety is pre-eminently a home responsibility. It should begin with the very young child. It should be an integral part of all he learns. He should be encouraged to do things the safe way and guided in the process of learning. His first lessons in safety come when he takes his first step. His parents exercise extreme caution to prevent injuries to himself. The same solicitude should accompany his activities as he develops into full fledged childhood. The elements of safety can be inculcated in the story-telling hour and the coloring of pictures could be made to teach a safety lesson. His physical well being should be safeguarded so that possible accidents need not be attributed to defects in hearing or vision or to neglected mental or physiological conditions. The home should teach children that accidents are due to indifference, over-confidence and lack of right thinking. Life is made up of adventures, good and bad. We want our children to learn to avoid the bad so that they may live to enjoy the good.

ADJOURNMENT

Accident Prevention Equipment Manufacturers

Who Made Exhibits at the Twenty-Fourth Annual Safety Congress and Exposition

Louisville, Kentucky, October 14-18, 1935

Public Safety Exhibit—Seelbach Hotel

Automatic Crossing Gates, Inc., Louisville, Kentucky.
Automatic Railroad Grade Crossing Gates.

Bendix Products Corporation, South Bend, Indiana.
Automotive Testing Equipment.

Eagle Signal Corporation, Moline, Illinois.
Traffic Signals, Pre-timed and Demand Controllers.

Evans Products Company, Detroit, Michigan.
Railroad Grade Crossing Barrier and Traffic Signals.

Harley-Davidson Motor Co., Milwaukee, Wisconsin.
Police Motorcycles and Equipment.

John C. Hoof Company, Chicago, Illinois.
Motor Vehicle Speed Control Governors.

Indian Motocycle Company, Springfield, Massachusetts.
Police Motorcycles and Equipment.

Martindale Electric Co., The, Cleveland, Ohio.
Roadway Safety Signal Stands and Signs.

Peerless Manufacturing Corp., Louisville, Kentucky.
Reflector Buttons and Signs and Railroad Crossing Signals.

Safety Signal Devices, Inc, Chicago, Illinois.
Safety Signals for Automobiles, Trucks and Buses.

United Motors Service, Inc., Detroit, Michigan.
Precision Testing Equipment for Automotive Headlights.

United States Steel Corp. Subsidiaries, Chicago, Illinois.
Steel Products and Cement.

Victory Methods, Inc., Wellsburg, West Virginia.
Traffic Signal Systems.

Weaver Manufacturing Company, Springfield, Illinois.
Automotive Testing Equipment.

Wig-Wag Safety Signal Co., Chicago, Illinois.
Safety Signals for Automobiles, Trucks and Buses.

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