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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 accepts no responsibility for the views expressed either in the papers presented or in the discussions thereon.

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NOTE: The sessions of the Street and Highway Traffic Section, the Child Education Section, and the Home Safety session are published in a separate *small volume of these Transactions, available on request.*

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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 500 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.

Thus the National Safety Council is like a fruitful tree with many branches and firmly imbedded roots that reach out in all directions, lending strength and permanence to the organized safety movement.

Pioneering in Safety

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 during recent years 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 40 per cent. The motor vehicle accident problem is a comparatively new one, yet there are evidences of progress. Recent studies show that accidents among commercial vehicles have decreased; that grade crossing tragedies have considerably decreased during recent years; that deaths of school children have decreased; that deaths in states having effective license laws with centralized administration and in cities having community safety councils have increased much less than in other states and cities; that deaths to pedestrians of all ages throughout the country increased very slightly last year. These facts indicate the engineering, educational, and legal remedies for the highway accident problem are producing results where conscientiously applied.

Since the National Safety Council started as an industrial safety organization, the best results are to be expected in this field. Here spectacular achievements have been made. The steam railroads, for instance have reduced accidents among employees 74 per cent during the past 11 years. A group of our largest steel industries have

a proper staff, and not by some enthusiastic person who has not been trained for the work. Why not use more registered nurses in the smaller plants? The registered nurse is much better qualified to interpret a physician's plan of medical service than any lay attendant.

Much depends upon the physical condition of the employees. I am of the opinion that the physician, by reason of his professional attainments, is best qualified to handle some of the problem cases among employees. Mental symptoms, brought about by worry over home affairs, quite often produce accidents. In many cases the fear and worry of sickness in the family can be greatly allayed by a talk with the doctor or the nurse. Many of these cases have come under my personal observation.

It should also be absolutely the part of the physician to say when a man shall return to his regular employment after injury, and this decision should not be influenced in the slightest by its possible affect on any "no-lost time accident" contest or record. These contests are proper and have brought about outstanding results in the reduction of lost-time frequency figures. However, there have been cases of injured employees being urged unduly to return to some form of work merely to prevent the marking up of a lost-time accident. Nothing should be allowed to interfere with the employee's welfare. The physician has every motive to return the employee to his regular work as promptly as possible, but his higher duty is to conserve both the physical and economic welfare of the employee as well as the employer.

The safety director has need of the medical service, and the two should earnestly co-operate and seek to bring about a mutual feeling among the employees. Both departments are striving by all possible means to prevent economic waste chargeable to the disabilities and hazards of industry.

TUESDAY AFTERNOON SESSION

October 4, 1932

The delegates first attended an informal luncheon, and then gathered for the afternoon meeting in a Joint Session with the Metals Section. This session was devoted to a symposium on the dust problem in industry. Chairman Greenburg immediately introduced the first speaker.

The Effects of Inhaled Mineral Dusts

By LEROY U. GARDNER

Director, Saranac Laboratory for the Study of Tuberculosis, Saranac Lake, N. Y.

As long as men have worked in stone it has been appreciated that an unusually large proportion of them suffer from disease of the lungs. It was natural to assume that such disease would be caused by the dust generated, and this belief was strengthened by the discovery of black, grey or red pigments in the lungs, sometimes accompanied by the formation of scar tissue.

The term, pneumonokoniosis was introduced to describe the lung pigmented in this manner. With further observation pathologists attempted to classify various forms of pneumonokoniosis on a basis of the type of dust inhaled and such names as anthracosis, siderosis, chacicosis and even byssinosis and tobaccosis made their appearance. It was recognized that some forms of the disease were attended by severe symptoms and result in death but there was no correlation between the clinical and pathological pictures and the causative dust. Finally, statistical study demonstrated that of all kinds of industrial dusts silica generally produced a definite type of disease with a characteristic pathological lesion and complex of symptoms.

Today the clinical entity known as silicosis is one form of pneumonokoniosis which is quite clearly defined. Moreover, within the last three or four years asbestos dust has also been shown to produce another specific type of reaction attended by symptoms differing in some respects from silicosis.

The other forms of pneumonokoniosis still lack complete definition. The widespread use of radiography has brought together a mass of descriptive data from individuals exposed to many kinds of occupational dusts but these findings have not yet been correlated with pathological anatomy, chemical studies of the tissues and detailed analyses of industrial atmospheres. There is a tendency to assume that many of these pulmonary changes are due to the action of silica perhaps modified by the chemical components of the dust. We shall only be in a position to speak with assurance about them when the pure types of dust and their various combinations have been studied in human beings or in experimental animals.

For the sake of clarity no mention has been made of the infections which so frequently complicate some forms of pneumonokoniosis. In the prebacteriological era of medicine the use of such terms as "grinders' consumption" and "miners' phthisis" reflects the popular association of pneumonokoniosis with tuberculosis. The names were justified both by clinical and pathological observation for it has been subsequently shown that, in silicosis at least, a super-imposed tuberculosis may cause death in perhaps 75 per cent of the cases. Some observers even go so far as to state that silicosis itself does not develop unless the lungs are previously damaged by a latent tuberculous infection. This is probably an exaggeration, for typical silicosis can be produced in the experimental animal by the inhalation of silica without infection.

The role of asbestos dust as an excitant of tuberculous infection is not as clear cut as that of pure silica. While there are numerous reports of death in asbestosis due to a terminal tuberculosis, nevertheless surveys of living workers have failed to demonstrate any excess of such infection. Simple anthracosis is said to prevent the progression of tuberculous infection. Statistics from coal mining districts do show a tuberculosis rate much lower than that "normal" for the age group. As yet corroborated experimental proof of protective action of coal against tuberculous infection is lacking.

Not only the tubercle bacillus but other bacteria seem to develop with special facility in the tissues previously damaged by silica. For example, the pneumonia rate among silicotic native laborers of South Africa is many times that in non-silicotic natives living under similar conditions. In coal miners, likewise, pneumonia is a common and often fatal complication.

What has been said of the effects of inhaled inorganic dusts would indicate that the reaction of the tissues is not merely a response to mechanical irritation by particulate matter. Today it is generally accepted that the injury is chemical in nature and that only certain of the common types of industrial dusts possess properties capable of exciting reaction. In the cases of silica and the silicate of magnesium or asbestos the slightly alkaline body fluids probably effect a slow solution of the dust particles liberating silica in colloidal form. This substance irritates the connective tissue cells which respond by multiplying. The result is an overgrowth of the supporting framework elements at the expense of the more delicate cells specialized for specific functions.

For these two types of dust the character and form of the pathological changes has been carefully worked out. In *silicosis* the essential tissue change consists of nodules of connective tissue which develop first in the lympoid tissues situated in the drainage apparatus of the lungs. These nodules interfere with the physiological removal of foreign bodies and subsequently inhaled particles accumulate in the framework of the lung itself. Such reaction gradually decreases the normal elasticity of the organ and encroaches upon its functional elements. As a result the cardinal symptom of the disease, dyspnoea or shortness of breath develops. Because of the excessive amounts of scar tissue formed in the lungs the right side of the heart

encounters increasing difficulty in forcing blood into the organs. In an attempt to compensate the overworked heart muscle becomes thicker and heavier and unless infection intervenes the time eventually arrives when the heart fails and death occurs from this cause.

The reasons for the prevalence of infection in the silicotic lung are not altogether clear. It is obvious that when the drainage system is so obstructed by nodules of scar tissue that more dust particles can only be removed with difficulty, the same must be true of bacteria which may be inhaled. As a consequence they remain in the lung and set up progressive infections. But this is not the whole story. The silicotic tissue apparently offers a peculiarly favorable soil for the continued multiplication of tubercle bacilli and perhaps other bacteria. Experiment has shown that even attenuated organisms of this type will produce rapidly fatal tuberculosis in a silicotic guinea pig. Furthermore, inhaled silica dust will cause a pre-existing latent tuberculous focus, harboring a few attenuated bacilli, to become progressive and spread.

The cause of this effect upon tuberculous infection has not yet been ascertained but probably it is in some way associated with the death of tissue caused by the toxic silica. Associated with this factor is an increased activity of the phagocytes which are stimulated by the irritating silica so that these cells tend to migrate rapidly and carry tubercle bacilli into previously uninvolved portions of the lung.

Asbestos dust, perhaps because of its fibrous structure, is not transported very far within the lung. It tends to lodge along the walls of the finer tubes and little of it is removed by the lymphatic drainage system. Tissue reaction, probably initiated by the solution of the fibers, occurs in their immediate vicinity. As in the case of silica this reaction consists of an overgrowth of the connective tissues which is later transformed into leather-like scars.

Aluminum oxide will serve admirably as an example of a non-siliceous dust whose particles are as hard and sharp as those of crystalline silica. When a measured quantity of such particles, 1 to 3 microns in diameter, are injected into the ear vein of a rabbit the majority of them come to rest in its liver and spleen. There they remain, apparently harmless, collected in large phagocytic cells and producing no reaction of the connective tissues for at least two years. Injection of the same quantity of the same sized quartz particles excites the formation of so much scar tissue that the functional elements are almost completely destroyed and the organs are reduced to nodular masses of leather-like consistence.

Carborundum, the carbide of silicon, when inhaled by guinea pigs for periods as long as four years, likewise fails to excite significant overgrowth of the connective tissues. It produces only a low grade inflammatory change with no nodules.

Instances such as those cited constitute the basis for believing that the cellular response to dust particles is not due to their hardness and sharpness but to chemical substances liberated by the action of the tissues upon them. The case for solubility has not been proven directly, for the detection of soluble silica in the tissues offers technical difficulties which today are unsurmountable. Nevertheless this substance is known to be a cell poison and in weak concentrations it will provoke an overgrowth of the connective tissues.

Mention should be made of the effect of inhaled coal dust. Most city dwellers breathe in sufficient quantities of this material during an average life-time to pigment considerable areas of their lungs. Deposits of grey or black dust will be found along the course of the lymphatic drainage system but this pigmentation is associated with little or no new growth of connective tissue. The coal miner's lung is much blacker but in most instances it also develops no deforming scars. When such reaction does occur analysis usually reveals appreciable amounts of silica in the lungs. The presence of excessive quantities of carbon dust apparently influences the localization of moderate amounts of silica so that the latter is not deposited in nodules as in pure silicosis but in streaks along lymph vessels as pure coal would localize.

Coal miners' fibrosis, due to relatively small amounts of silica, is therefore different from that of the pure quartz worker. When the amount of inhaled silica is excessive, the effect of the coal is negligible and the reaction approximates that in pure silicosis. There is said to be more reaction to hard coal than to the bituminous variety but there is evidence to suggest that this is due to the greater amount of siliceous rock which must be worked in mining anthracite coal.

Finally, consider the silicosis of granite cutters. This develops somewhat more slowly than that of the pure quartz miner and it has been maintained that this is due to the relatively small amount of uncombined silica in granite (25 to 40 per cent). But it is believed that other components of the glomerate granite may neutralize or at least inhibit the effects of the silica so that only after prolonged exposures to high concentrations does significant reaction occur. While typical silicotic nodules develop in guinea pigs inhaling pure quartz for a year, not even the earliest suggestion of nodules have appeared in the lungs of animals inhaling comparable concentrations of granite (40 per cent silica) for four years.

This brief discussion of some of the problems involved in pneumonokoniosis draws attention to the limitations of our present knowledge. It indicates that the reaction to an inhaled dust is determined by the chemical and probably physical composition of that dust. It emphasizes the need to further study of different types of dust both in the pure state and in measured combinations. The ultimate aim of such a study should be the neutralization of the toxic action of such dangerous substances as silica.

The Dust Content of the Atmosphere in Various Dusty Industries

By J. J. BLOOMFIELD

Sanitary Engineer, United States Public Health Service, Washington, D. C.

The speaker said in part: The properties of a given dust which determine its capacity to produce pulmonary pathology are, the nature of the dust, that is, its chemical and mineralogical composition, its particle size, and finally the quantity of the dust dispersed in the atmosphere.

One of the outstanding results of the last 20 years of research in the field of dust inhalation is the demonstration of the fact that, in general, the degree of health hazards associated with the inhalation of any dust, all other factors remaining constant, is dependent upon the mineralogical composition of the dust. For example, it is now well established that the inhalation of certain types of dust, such as granite dust, will in time produce fibrosis of the lungs, at times associated with tuberculosis. In other cases exposure to dust may result in the production of much less fibrosis without notable tendency toward subsequent tuberculosis; this is true of cement dust. And finally, there are certain types of dust, as typified by marble dust, which in the quantities and lengths of exposure so far observed produce little lung fibrosis. In general, it has been found that those dusts which are high in quartz content are the ones which produce a disabling fibrosis of the lungs most readily.

So far as the size of the dust particle is concerned, it is apparent that in order for any given dust to produce injury to the lungs, it must gain access to the parenchyma of the lung, the site where the harmful effects of the dust take place. It is known that not all of the particles of inhaled dust gain access or are retained by the human lung. In this connection it is of importance to have regard to the size of the dust particles present in the industrial atmosphere.

With reference to the quantity of dust present in the air of a workroom it is apparent that when the dust concentration is high the exposed person will inhale a greater quantity in a given period of time than he will when the dust concentration of the atmosphere is relatively low, and since the rate of production of the fibrosis

is partially dependent upon the rate in which the dust is inhaled, this latter item plays an important role in predicting the relative danger of different environments. Hence the need for the evaluation of the quantity of dust in the industrial atmosphere is obvious.

Research on the problem of industrial dust inhalation has indicated that so far as their fibrosis producing qualities are concerned, dusts may be divided into three groups: (1) those composed completely of combined silica, that is silicates, such as pure asbestos; (2) those containing free silica in the crystalline form known as quartz, (granite contains approximately 35 per cent of quartz); and (3) dust containing free silica in a non-crystalline form such as diatomaceous earth. In general, it has been found that the harmfulness of a quartz containing dust is in direct proportion to its quartz content. For this reason, in attempting to evaluate the harmfulness of a dust, it is of the utmost importance to ascertain its exact mineralogical composition.

It has been our experience that to determine accurately the exact mineralogical composition of a dust one should resort to a combined chemical and petrographic analysis. By no other method have we found it possible to determine the amount of quartz present in a given sample. In certain instances, such as when one is dealing with a mixture of quartz and pure potash feldspar, it is possible to determine the amount of quartz present in such dust merely by a chemical analysis. However, most dusts which come into question are mixtures of quartz and silicates. Take granite for example. The average granite is made up chiefly of three minerals in about the following proportions: feldspar 60 per cent, quartz 30 per cent, and mica 15 per cent. Chemical analysis shows that this average granite contains 70 per cent of silica. Of this 70 per cent, 30 per cent is present as quartz (free silica) and the other 40 per cent is present as combined silica, in chemical combination with the other minerals that make up granite; it is possible to determine these proportions only with the aid of the petrographic microscope.

We find in practice that samples of dust settled out of the asmosphere at the breathing level of the worker serve admirably for both chemical and mineralogical determinations. Table 1 presents the quartz content of dusts obtained in various industries which we have studied.

TABLE 1

Percentage of Quartz Present in Various Industrial Dusts

Kind of Dust	Percentage of Quartz
Rock drilling dust (bituminous coal mine)	54.0
Granite cutting dust	35.2
Rock drilling dust (anthracite coal mine)	31.0
Brass foundry dust	19.0
Dust from raw mills in cement plant	6.5
Slate mill dust (Vermont red slate)	3.0
Silverware polishing dust	1.7
Anthracite coal dust	1.5
Bituminous coal dust	1.2
Cement dust	1.0
Slate mill dust (Vermont green slate)	trace
Talc mill dust	none
Marble cutting dust	none

It is evident from this table that rock drilling occupations in the coal mining industry and certain occupations in the granite cutting industry and in brass foundries would be in the hazardous class as judged by the proportions of quartz in the atmospheric dust.

It has been demonstrated that particles of dust of a size greater than 10 to 12 microns in longest dimension are very seldom found in the lungs. This absence of larger particles is partly due to the fact that the numbers of such particles greater than ten microns in size present in industrial air is, as compared with the lower sizes, comparatively small; furthermore, these larger particles do not penetrate to the terminal portions of the respiratory tract. Hence we need only concern ourselves with those dust particles that are less than ten microns in longest dimension.

In order to ascertain whether or not an industrial dust is capable of gaining access to the lungs, it is necessary to know something of the size of the particles in the dust under consideration. In practice the samples for particle size studies may be obtained by the use of the Owens jet dust counter. The advantage of this instrument over other devices is that the Owens apparatus projects the atmospheric dust in unaltered condition directly on a microscope cover-slip. This cover-slip may then be properly mounted and examined by any one of several methods. In another method a microphotograph of the dust is made at a high magnification; the particles revealed on an enlarged print or screen may be measured by means of a millimeter scale. No matter which method one uses for particle-size measurements the results may be treated in the customary manner. The particles may be grouped in classes according to size, from which a percentage distribution curve is easily obtained.

As poimted out earlier, a knowledge of the quantity of dust dispersed in the atmosphere is very important, since with any given dust the rate of production of the injury will be dependent upon the total quantity inhaled.

From the practical hygienic viewpoint, the particle count is at present the best quantitative index of the degree of atmospheric pollution. The decision as to the size range of the particles which should be included in the dust count is a question requiring careful consideration. Obviously the size of the smallest visible particle will depend on the magnification and type of illumination used in the microscope, the refractive properties of the dust and to some extent on the visual acuity of the observer. We must bear in mind that our chief interest in this problem is in the industrial hygienic aspect. Primarily we are interested in differentiating between the dust content in the ordinary normal atmospheres, not yet known to be harmful, and certain industrial dusts which are known to be associated with lung damage. This difference is sharply marked so far as the dust particles between approximately one-half and ten microns in diameter are concerned; but the difference between such normal and abnormal air is masked and lost when we include in our determination the particles of ultra-microscopic size which are present in vast numbers in all air.

So far as the upper limit of particle size is concerned it has been demonstrated by the South African studies that particles greater than ten microns in longest dimension are, as a rule, of negligible importance. The data concerning the lower size limit of potentially hazardous dust is not so conclusive. Moir of South Africa, who examined microscopically 120 dust particles obtained from two specimens of silicotic lung, found that only 13 per cent of the particles were less than 0.5 microns and about 36 per cent of the particles were less than one micron in diameter. The majority of the particles, 60 per cent, were between one and three microns in size. The median size of the dust was found to be 1.2 microns in diameter. Drinker, in comparing the size frequency of the particles measured by Moir with the particles measured by him of the dust found in the sputum of men employed in ore mills, found a close correspondence. These findings have also been corroborated by Navrogordato.

In connection with the lower limit of particle size of dust of pathological significance the following pertinent question arises: Aside from the evidence direct or indirect of the non-retention of minute particles of dust by the lungs, what

TABLE 2
Average Dust Counts in Certain Dusty Trades

Industry and Occupation	Dust exposure in millions of particles per cubic foot	Average per cent of quartz in dust
Talc Mining and Milling:		None
Jack-hammer drillers	2,160	None
Packers	50	None
Muckers	45	None
Crushermen and cylindermen	14	None
Slate Finishing Mills:		3
Floormen	1,598	3
Loaders	1,276	3
Disc crusher operators	312	3
Quartz Grinding Plant:		99
Mill operators	173	99
Laborers	83	99
Packers	55	99
Granite Quarrying and Finishing:		35
Leyner drillers	144	35
Jack-hammer drillers	112	35
Hand pneumatic tool finishers	59	35
Machine pneumatic tool finishers	36	35
Plug drillers	37	35
Attendant labor (indoors)	17	35
Anthracite Coal Mining:		1.5
Miners and helpers	232	1.5
Attendant labor	31	1.5
Bituminous Coal Mining:		1.2
Coal cutters and loaders	112	1.2
Attendant labor	4	1.2
Marble Cutters	33	None
Cotton Cloth Manufacturing:		None
Carders	9	None
Weavers and spinners	5	None
Silverware Manufacturing:		1.7
Dusty trades	5	1.7
Non-dusty trades	2	1.7

evidence is there that appreciable percentages of ordinary industrial dusts ever fragment into those minute sizes less than 0.5 microns in diameter? The best answer to this question would be data of actual measurement of such dust. Unfortunately we have but scant published data on the particle size frequency of dusts in the air of industrial establishments. In 1929 Fehnel made some particle size measurements in connection with the dust study of hard rock drilling in New York City. He reported the findings on three samples, which showed the dust which was less than 1 micron in size to vary from 1 to 15 per cent. Most of the dust in these hard rock drilling operations was between 2 and 5 microns in size. Badham, in studying the dust hazard among sandstone workers in Sydney, Australia, measured some 16,000 particles of dust in the air of work places and found that 67 per cent of these particles were about 1 micron in size. In a particle size

study of twenty-five samples of eleven different kinds of aerial industrial dusts made by the filar micrometer method at a magnification of 1,000 diameters, the speaker found that practically all of the dust was less than 5 microns in size. Only 2 per cent of the particles were less than 0.5 microns, 21 per cent were less than 1 micron, and the majority of the dust, 71 per cent, was found to be between 1 and 3 microns in diameter.

From all of the evidence therefore, and in the absence of conclusive proof to the contrary, it is apparent that we need only be concerned with those dust particles between one-half and 5 microns in size, and from a practical standpoint the lower limit of particle size to be counted may well be taken at about 1 micron. Many methods have been devised and used for the purpose of determining the quantity of dust in air. Suffice it to say that for the purpose of dust sampling in either high or low dust concentrations, the Greenburg-Smith impinger apparatus now finds universal favor. This instrument has been used by the United States Public Health Service in all of its dust studies during the past nine years and is also being used by other workers in this field in this country and abroad.

During the past nine years the writer has made numerous investigations of dust hazard in many industrial establishments throughout the country. In Table 2, a summary is presented of the average dust content of the air in a few of these dusty industries. This table clearly shows that the highest dust exposure was in the talc mines, slate finishing mills, quartz grinding plant, coal mining and granite cutting industries. Owing to the high percentage of quartz present in the dust of the quartz grinding and granite cutting plants, as compared with the dust in the other industries listed in Table 2, quartz grinding and granite cutting are revealed to be the most hazardous of the occupations we have studied.

Orig. paper delivered

Clinical and Statistical Aspects of Silicosis

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It would be difficult to estimate with any degree of accuracy the number of people in the United States who are engaged in dusty trades. It is evident, however, that more people are exposed to dust, which constitutes the greatest single industrial hazard, than is generally supposed. Certain dusts contain poisonous elements, such as lead, arsenic, mercury, etc., which give rise to general conditions resulting from their absorption. This paper however will deal only with those dusts which are known to be direct factors in the production of pulmonary diseases.

Economic Aspects of Silicosis

The economic problem presented by silicosis is tremendous. The suffering and loss of life due to it cannot be adequately measured. In the gold mining area around Johannesburg, South Africa, during the period 1911 to 1929, more than 53 million dollars have been paid in compensation alone. The costs of medical care, hospitalization, and legal proceedings further augment this enormous figure.

Mines in Australia are reported to have been bankrupted by payment of silicosis compensation. I know of a company in our own country which has claims amounting to more than a million dollars for disability due to dust inhalation. There are other plants in the East which will be bankrupted if all the claims which are filed against them are allowed. In most of the industrial states the number of claims filed has greatly increased in recent years.

It is clear that dust-prevention work, like any health-promoting activity, would pay many times in money, good health, and efficient operation.

Strangely enough, only during the past 25 years has dust received much attention

as an etiological factor of disease. The rapid development of industrialization within that period partly explains the impulse toward the study of this source of industrial hazard. The advances which have been made in all branches of industrial medicine have helped to center attention on dust and its effect upon the health, inasmuch as the number of the workers in dusty trades is larger than that of any other group exposed to a single industrial hazard: and an additional reason for increased interest in this subject is gathered from the study of mortality statistics, which reveal the fact that workers in dusty trades have an excessive death rate from tuberculosis, as well as from other respiratory diseases.

The most notable studies of silicosis have been made in the gold mines of South Africa, where the disease, with its complications, has been most commonplace among the miners. It became necessary either to study the disease and devise methods for its control or else to abandon mining. Consequently, funds, personnel and clinical material were made available for the first time on a large scale. Investigators in South Africa have become foremost in this field of research: their scientific work is widely known and has served as a basis for legislation, compensation rates, and further study of the disease silicosis.

There are almost 300,000 workers in the South African mines. It was because of the excessive incidence of silicosis among the miners around Johannesburg that the International Labour Office of the League of Nations selected that city for the first International Silicosis Conference.

In the United States the first study of the effect of dust was made by Dr. A. J. Lanza, an officer of the Public Health Service serving with the Bureau of Mines. His observations, made on miners in the Joplin, Mo., district and published by the Bureau of Mines and Public Health Service, have been confirmed by subsequent studies. Agencies which have done and are now doing investigative work are the U. S. Public Health Service, the Bureau of Mines, and the Universities of Harvard, Yale, and Pennsylvania. Private persons have also contributed valuable information on silicosis.

The word "pneumonoconiosis" is of Greek origin and means "dusty lungs." It is an inclusive term and is being used now more than previously with a designation as to the type of dust responsible for the pathology. There are few instances where a pure dust, i. e., one unmixed with other elements, occurs in industry.

The intelligent consideration of the relation of dust to the etiology of pulmonary disease must include the following: 1. Chemistry and petrography of dust, 2. Concentration, 3. Size of particles, 4. Condition of worker at beginning of exposure, 5. Length of exposure, and 6. Effects produced.

The dusts most frequently met with in the industries are inorganic—incidentally, more harmful. It has been shown conclusively that silica, one of the most common dusts encountered, alone produces more permanent pulmonary damage than all other causes combined.

Condition of Worker at Beginning of Exposure

Reference has been made to the manner in which a tuberculous infection is augmented by the presence of silica. It follows that a worker having a tuberculous infection, either latent or active, will suffer more from the effects of dust than a person who is not so infected. It is highly necessary for workers to be examined thoroughly before being permitted to engage in a dusty trade. Experience with miners in South Africa has shown that a worker having a latent tuberculosis, or a worker in whom such infection was not demonstrable, or if a worker was of the so-called "phthinoid" type, he developed silicosis more rapidly and a tuberculous complication earlier than did the normal worker.

The length of exposure to dust is evidently a great factor in the production of disability. It has been found that the occurrence of silicosis is in direct relation to length of service and concentration of dust.

Effects Produced

In order to determine the effects produced by dust inhalation, a number of studies were made. These observations included a study of the sickness of workers with especial reference to respiratory diseases, physical examinations supplemented by x-ray and laboratory tests, and a study of the mortality records.

I am presenting here some of the recommendations of the International Silicosis Conference on diagnosis and classification. The disease can conveniently be divided into three stages, designated "first," "second," and "third" stages.

"In the diagnosis of every stage of silicosis a history must be established of exposure to inhalation of silica dust in a quantity commensurate with the clinical and radiological findings.

"In the first stage, symptoms referable to the respiratory system may be slight or even absent. Incapacity for work may be slightly impaired. There must be a departure from the normal in percussion and auscultatory signs, and the radiogram must show an increased density of linear shadows and the presence of nodular shadows.

"In the second stage there must be an increase of all the physical signs observable in the first stage, and the radiograph must show an increase in the number and size of the nodular shadows with a tendency to confluence. There must be some degree of definite impairment of working capacity.

"In the third stage all the above conditions are grossly accentuated, and there is total loss of working capacity.

"Tuberculosis may be present in any of the above described stages, altering the symptoms, physical signs, and radiographic appearances, and the degree of working incapacity. Its presence must therefore influence the stage classification."

Patients with silicosis in uncomplicated form are usually well nourished and apparently healthy, except, of course, in the advanced stages.

Limitation of chest expansion is a very consistent finding, and unless the patient has engaged in athletics, the extent of limitation is usually in proportion to the length of service. The restriction of the chest was found (each side was measured with obstetrical calipers) to be symmetrical, in contradistinction to the assymetry occurring in pulmonary tuberculosis.

Symptoms

Dyspnoea is usually the first symptom and most constant complaint in silicosis, and it increases with length of exposure and even after exposure ceases, if the disease has become well established. Dr. Lanza, the American pioneer in the study of silicosis, observed a very great amount of dyspnoea among the miners with silicosis in the Joplin District, Missouri. I do not know of any clinician who has failed to mention this finding when describing the symptoms of silicosis.

It has also been my observation that pains in the chest were a common complaint. A cough, which was usually non-productive, and frequent colds were also in evidence.

Diagnosis of Silicosis

Most of the physicians with whom I have worked or have discussed silicosis are prone to rely solely on the x-ray findings for diagnosis. These men had not been doing tuberculosis work, however, and were not particularly adept in the usual procedures employed in making physical examinations of the chest. The x-ray does give more information than any one other means. However, much can be learned by physical examination, which can usually be confirmed by the x-ray.

The following are some of the principal points in diagnosis by physical examination:

Percussion usually reveals a general impairment of resonance, the intensity of

which aspect varies as a rule with length of service. This finding is consistent with the character of a generalized fibrosis, which is a common characteristic of silicosis.

Tactile and vocal fremitus were not changed appreciably in the earlier stages, but as the generalized fibrosis of silicosis increased these were decreased in intensity.

Fibrosis of tuberculosis causes an increase in both tactile and vocal fremitus. The condition is, however, localized, whereas the fibrosis of silicosis is general throughout the lungs.

In my cases of granite cutters there was no marked change to any particular variety of breath sounds in uncomplicated cases, but rather a softening (or "soft pedal" effect) on all the breath sounds, which naturally brought out the vesicular type of breathing.

Rales were absent in the uncomplicated cases. No toxemia was present, which is accounted for by the absence of infection.

Tuberculosis as a Complication of Silicosis

It is not surprising that workers who have latent tuberculosis infections become disabled earlier than the average individual. It was our experience that these cases developed silicosis more rapidly, and that when they developed the clinical tuberculosis, they were still young people and the disease ran a more prolonged course. This was not true of the cases which developed silicosis first. The South African investigators, too, have observed that the cases which they classify as "phthinoid" break down with tuberculosis early in their mining careers.

Physical examination of silicotic patients who are breaking down with a tuberculous complication provides information which is not always available with the x-ray. Dr. Pancoast stated in a talk on pneumonoconiosis at the local (Washington) medical society recently that during this transitional stage the differential diagnosis is often impossible. When the tuberculous complication has advanced, diagnosis is, of course, easy.

Inquiry into the patient's condition will usually reveal symptoms which are common to uncomplicated tuberculosis. It was our experience that early complaints were fatigue, night sweats, increase in dyspnoea, pains in the chest, and an afternoon rise in temperature. There was frequently complaint of a cough, which was productive. Many patients had hemoptysis and later in the disease, frank hemorrhages from the lungs. Loss of weight did not seem to occur so early as in uncomplicated cases, but when this symptom became manifest, it was marked. Tubercle bacilli were usually found in the sputum early in the disease.

The later stages presented no great differences from those fulminating types of uncomplicated tuberculosis.

The physical signs presented variations from those in uncomplicated cases, inasmuch as there existed already a general pulmonary fibrosis. The latent or post-tussic rale was constant and not unlike the same valuable pathognomonic sign in uncomplicated cases of tuberculosis.

The x-rays of cases in this stage usually revealed areas of conglomeration, or fusing, of fibrotic markings. They were less distinct in character than in uncomplicated silicosis. This fact will be demonstrated in the slides.

The diagnosis of silicosis is not an easy task. The patient's history, careful analysis of his occupational life, a study of his physical condition and reliable x-rays are necessary to determine the presence of silicosis and to attempt to evaluate the extent of disability present. It is obvious that it is difficult for physicians to do this and a greater task for a lay jury. It seems to me that it would be better to have the suspected case examined at a reliable clinic or general hospital by a group of unbiased physicians and to abide by their findings rather than to have these cases fought out in courts. In most every manufacturing city large general hospitals and tuberculosis clinics are available and the use of these institutions will, it seems, insure better decisions both to the patient and to the industry.

Course of Silicosis Among Workers no Longer Exposed to Silica Dust

In the study of silicosis one of the most important questions which has arisen is the health history of those individuals who have worked in the granite industry for a number of years and then left, to find occupations in other trades where there was no further dust exposure. It was possible during the course of the study at Barre to observe 24 such cases.

The latency of silicosis has been referred to by other investigators. The South African workers found that "a steady fall over a period of years in dust concentration is not associated with the corresponding fall in the silicosis incidence." Dr. Watkins-Pitchford also records cases of miners who had been exposed to dust for a long period of time, apparently sufficient to develop silicosis, but who went into the war apparently not silicotic. He asserted that such cases were liable to develop tuberculosis. Doctor Pancoast presents a case of advanced pneumonoconiosis in a quartz miner who had been exposed to dust for eight years. He had been out of the mining industry for ten years, yet the x-ray showed extensive pneumonoconiosis with irregularities of diaphragm, and by fluoroscope he found the diaphragm restricted on each side. There was, perhaps, a tuberculous infection intervening at the time.

Britton reports two cases of workers who had been exposed to dust between seven and eight years. They changed occupations and had been away from siliceous dust for eight and nine years. They developed pulmonary symptoms and were found to be suffering from silicosis and tuberculosis. Tattersall also observed cases of latent silicosis in his studies: "Some of the men (rock drillers), moreover, had changed their occupation for various reasons quite apart from health, but in due course the inevitable dyspnoea came on. One man, for instance, worked eight years regularly with rock drills, from 1906 to 1914, then joined the Army, was passed as A-1; but in spite of his open-air life, dyspnoea came on in 1918, and from then until his death six years later his illness was a typical case of silicosis."

The influence of dust in mortality from tuberculosis is clearly indicated in the following table. New methods of manufacturing stone which created excessive dust by the use of pneumatic tools, were introduced in the granite industry about the beginning of the present century, and the tuberculosis rate has increased rapidly with their use. The rate has risen in direct proportion to the length of time during which they have been employed as follows:

1.5 per 1000	1890-1894
10.8 per 1000	1910-1914
19.5 per 1000	1924-1926*

(*during period of our observations.)

A consideration of the mortality statistics of Barre, Vermont, shows that there has been an excessive death rate from pneumonia and other respiratory diseases (tuberculosis excluded) during this period.

Methods for the Control of Dust in Industry and for the Protection of the Worker

By THEODORE HATCH

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The speaker said in part: The health hazard associated with exposure to industrial dusts varies with the industry and depends upon a number of factors, chief of which are the physical characteristics of those exposed, the chemical and physical properties of the dust, and its concentration in the atmosphere of the work places.

The evaluation of the hazards in a given industrial plant must therefore be based upon a thorough investigation of the factory conditions and a careful interpretation of the results. The investigation should include physical examinations of the men and a study of morbidity and mortality statistics, chemical examination of the dust, and determinations of its physical properties such as particle size. The sources of dust and the concentrations produced by the dusty processes must be determined by a complete dust survey. This should be accompanied by an occupational analysis to determine the extent and frequency of exposure of the workers to the hazardous dust. A knowledge of the plant processes and the characteristics of operation of the dust producing machines is also necessary.

In the present state of our knowledge, the manner in which these factors combine to determine the dust hazards cannot be subjected to an exact analysis. The health hazard will be reduced, however, by the introduction of any measures that tend to lengthen the time of exposure necessary to produce the damage, and the object of any program of prevention, therefore, is so to control conditions that the limited time for safe exposure is extended beyond the ordinary span of exposure.

The most direct means of controlling the hazard is by reducing the dust concentration to which the workers are exposed. The efficiency of the required dust control depends upon the allowable concentration in the atmosphere which in turn is determined by the toxicity of the dust and the tolerance of those exposed. The standard of permissible dustiness may be increased by careful selection of the men, by means of physical examination, and limiting their exposure through a system of rotation of employment. It may be further increased by reducing the percentage of toxic material in the dust and otherwise controlling its chemical and physical characteristics.

Standards of permissible dustiness have been proposed for a few of the dusty trades. From a study of the sickness and death rates among the workers in relation to the dust concentrations to which they are exposed, safe concentrations have been determined for the cement and granite cutting industries in the United States, the gold mines in South Africa, and the sandstone industry in Australia. The permissible concentration of zinc oxide has been determined direct by studying its effect upon experimental subjects.

A standard for lead mining which has been proposed was based upon the conditions found in that industry. This list, while it is not complete, serves to indicate the limited nature of the data and emphasizes the importance of careful interpretation of factory conditions in the evaluation of the dust hazard. It often requires years to demonstrate the hazardous nature of certain dusts, and immediate results therefore may have little value. In the absence of definite knowledge, the safe course is to consider all dusts dangerous until proved innocent.

The dusty processes encountered in industry differ widely and exhibit a considerable variation in the restrictions placed upon the design and operation of devices for the control of the dust. No single method of control can be universally applied: on the contrary a number of methods have been developed to meet the needs of the dusty trades and the choice of methods must be based upon a thorough study of local conditions. The common methods may be listed as follows: (1) substitution of a non-hazardous process, (2) isolation of hazardous process, (3) general ventilation, (4) control of dust at point of origin.

The silicosis hazard has been reduced in a number of industries by substituting for the dusty process one which is dust-free or which produces a relatively harmless dust. In the granite industry the surfacing machine, a heavy dust producing tool, has been replaced to some extent by the gang saw and the artificial abrasive wheel. These are wet processes and have reduced the dust concentrations associated with the surfacing of the stone to a figure well below the hygienic safe limit. In grinding and polishing jobs, the sandstone wheels have been replaced by artificial abrasive wheels containing little or no free silica and though dust is still produced,

exposure to it does not lead to the high tuberculosis rate formerly found among grinders and polishers. Another example of this method is the substitution of steel shot and other silica free abrasives for sand in the blasting of castings. To give satisfactory results, the foundry sand must be removed from the castings before blasting, otherwise it is broken up and scattered as silicious dust.

This method of control is decidedly limited in application since it usually involves fundamental changes in the manufacturing process. Moreover, great care must be taken in substituting the so-called harmless dust, to make sure that a new hazard is not replacing the old one.

It is possible to isolate the dusty process in many cases. This may consist merely in confining the hazardous stages of manufacture to a separate building or room, thereby reducing the number of men exposed to the dust (and these men may be protected by masks), or it may mean complete isolation for the workers in an enclosed space. Complete isolation of sandblasting operations within a cabinet is now common practice. Escape of dust is prevented by keeping the cabinet under a slight negative pressure, and by means of suitable controls and windows, the operations may be directed from the outside. For some processes automatic blasting, requiring no direct operation, may be employed, although the entrance and exit locks for the material must be carefully maintained in order to prevent the escape of dust at these points.

In a few instances of generalized dust production throughout the factory, the use of general ventilation may prove satisfactory as a means of dust control. Under such conditions, the introduction of large quantities of dust-free air serves to reduce the dust concentration by simple dilution. This method is used in certain mining operations, also for purposes of removing heat and toxic gases as well as dust. In general, it involves the installation of large fans and is expensive to operate. In cold climates it becomes prohibitive owing to the great increase in the cost of heating. General ventilation should be looked upon as an adjunct to other methods of control, rather than an independent method.

Effective control of the dust at the point of generation prevents it from reaching the breathing zone of the worker and hence offers a positive means of reducing the dust hazard. It may be effected by the use of water or other liquids for capturing the dust, or by means of local exhaust ventilation.

The use of water for laying dust is an old method of control. It has been used extensively in connection with grinding wheels and is commonly employed in mining and tunnel operations in the form of wet drilling and water sprays. In operation, some of the particles are carried off immediately by the stream of water whereas others are thrown into the air with the water spray. The latter, however, are suspended in water droplets and therefore settle out rapidly. This method of control undoubtedly reduces the dust concentration but investigations have shown that it does not always give the high degree of protection required. Its efficiency depends primarily upon the completeness with which the particles are wet. In some cases the fine particles are surrounded by envelopes of gas and may pass through the liquids without coming in contact with it. Others, escaping with the water spray, may remain suspended in the atmosphere after the water droplets have evaporated. The wetting efficiency has been increased in some cases through the use of oils and other liquids.

Local exhaust ventilation consists in removing the dust through a suction hood placed close to the point of generation. This method of control is widely used in industry and is most effective when applied to a stationary dust producing machine or when it is attached to a moving tool, thus keeping it at a fixed distance from the point of dust origin. Its general application has been recognized and most states have incorporated specifications for the design of local exhaust systems in their industrial codes. Surveys in certain industrial plants, however, have demonstrated that many systems do not have the required efficiency of dust removal. This

can be attributed, in most cases, to improper design and location of the collecting hoods and failure to provide sufficient and proper distribution of air flow through them. In some plants the systems have been rendered useless through lack of maintenance.

The design of local exhaust hoods is complicated by the fact that the conditions under which they operate vary greatly from one process to another. The basic principle of operation, however, remains the same and certain fundamental rules of design exist which should be followed in all cases.

The dust particles thrown off at the point of generation possess kinetic energy by virtue of their mass and velocity. The function of the exhaust hood is to introduce into the area of dust production a counter force in the form of air velocity which overcomes the energy of the particles and draws them into the collecting system. *The air velocity required varies with the nature of the process* since it depends upon the size, shape and density of the particles and their speed of travel.

This function is common to all exhaust hoods and the object of their design is to create the required air velocity with a minimum total air flow and power consumption, but at the same time without obscuring or otherwise interfering with the manufacturing process. To this end four rules of design may be formulated:

1. Enclose the process as far as possible. Properly located housings or baffles to intercept the particles reduce their energy, and hence decrease the air velocity required for their collection. Enclosing the process also reduces the area of the hood opening and for a given rate of air flow increases the velocity at the face. The use of housings and baffles is limited to processes that do not require close attention and manipulation. The Kelley trap employed with pneumatic rock drills *is a good example of a complete enclosure.*

2. Locate the hood opening in the path of the dust stream. In many instances the dust is thrown off in a well defined direction, and by proper location of the hood the energy of the particles can be made to carry many of them directly into the collecting system. This is especially important in the case of high speed grinding wheels, for example, which throw the dust particles off at velocities of 10,000 feet or more a minute.

3. Locate the hood as closely as possible to the point of dust generation. The air velocity decreases rapidly with distance from the opening, and hence, the distance to the dust source has an important bearing on the rate of air flow necessary to produce the required air velocity at this point. In the case of a four-inch round opening, for example, the rate of flow required to develop a given velocity at a point six inches out is ten times greater than that required in the same velocity *two inches from the face. It is important to note in this connection, however, that* the rate of decrease of velocity with distance is less for the larger openings. Moreover, the distribution of flow is more uniform. These facts point to the desirability of using as large an opening as possible.

4. Choose a hood having a uniform velocity distribution over the area of dust production and a minimum flow from the dust-free or so-called ineffective areas. To this end, the size and shape of the hood should be determined by the extent of the area of dust production. For example, one opening of moderate size may be satisfactory for a concentrated dust source, but for an extensive area of dust production, the larger opening or even one rectangular in shape would give better results. Also, by placing a flange around the hood the efficiency of the air flow is improved and the rate of flow necessary to create a given velocity at this point is decreased.

Owing to the great variety of conditions under which exhaust hoods are employed, it is impossible to formulate a set of rules of design which are universal in application. On the contrary, every problem must be solved independently. In spite of their limited applications, however, the foregoing rules serve to emphasize the need for a careful study of the characteristics of operations of the dusty process and the importance of the aerodynamic characteristics of an exhaust hood in determining its efficiency. They also suggest the impossibility of employing any single measure of operation as the basis of design.

State codes commonly specify exhaust hood requirements in terms of the negative static pressure at the hood throat. In some cases a single value has been adopted for all dusty processes and an examination of existing codes reveals a considerable variation in the suction requirements. In some cases the diameter of the throat is also specified.

The use of this index arises from the fact that it constitutes an approximate measure of the rate of air flow into the hood. This is true, however, only when the area of the throat and the shape and size of the hood are also specified.

The inclusion of these factors in the specifications, however, is not enough since the efficiency of an exhaust hood is not a function of the rate of air flow, but rather of the air velocity at the point of dust generation, and this in time is determined by the nature of the process and the design and location of the hood. Furthermore, the rate of air flow necessary to develop the required air velocity also depends upon the shape and size of the hood and its distance from the dust source.

Thus the static suction at the throat bears little relation to the dust collecting efficiency of an exhaust hood and has no place in legal specifications. On the contrary, the only satisfactory index of operation is the efficiency of dust removal itself. Industrial codes should therefore be written in terms of permissible dust concentrations and approval must be based upon actual dust determinations in the factory. In this connection it must be emphasized that visual inspection is not enough since with the ordinary conditions of illumination, concentration below 50-60 *million particles per cubic foot of air* cannot be detected by the eye alone. In general, concentrations of this magnitude are well above the hygienic safe limit.

Satisfactory data upon the design of exhaust hoods can be secured only through experimental investigation and experience, combined with actual quantitative measurements of dust collecting efficiency and carefully executed investigations of this source must replace the present uncertain methods of design.

Methods of Protecting the Worker Against Dust Inhalation

By PHILIP DRINKER

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The silicosis problem in this country is not a pleasant spectacle for those of us concerned with industrial hygiene and safety measures. Painful as the cure may be, it consists of two perfectly definite steps: (a) medical examinations of new employees and routine examinations of all persons exposed to dangerous dust concentrations; and (b) reduction of dust concentrations breathed by workers to what are considered to be safe limits.

If dustiness can be controlled by local exhaust fans and dust collecting equipment, protective devices such as respirators or positive pressure helmets have no place except as emergency equipment. However, many processes like abrasive (sand or steel) blasting, paint and enamel spraying, porcelain manufacture, stone cutting, sand grinding, and the like, will not, in all probability, be made reasonably dust free for some years to come. *In work of this type, respirators and other* protective devices have an important place. The safety man should understand thoroughly what can be expected of protective devices, and above all, should be able to check and observe whether the workmen are getting the protection they require.

One sees occasionally statements to the effect that respirators have no place in industry because they filter out only large particles and let pass the small ones which are always the more harmful. Against this is the indisputable fact that the dust catching efficiency of several makes of respirators exceeds 90 per cent on silica dust with particles less than 2 microns. A careful measurement of the size of dust particles entering and leaving respirators shows a slight but unimportant reduction in average size of the dust particles. But by far the most convincing proof that well built respirators remove dust is the microscopic examination of the nasal discharge and sputum of a man who wears a respirator in a dusty atmosphere, and of one who does not.

Requirements for Respirators. Up to the present time our only U. S. specifications for respirators have been formulated by the Bureau of Mines. Respirators submitted to their Pittsburgh Experiment Station are tested according to a schedule which is the direct result of their pioneer war work in gas masks. The Bureau requires *for approval* that a gas mask canister (which includes respirators) have at least 50 per cent filtering efficiency against tobacco smoke, measured at 85 liters per minute, and a resistance *at all times* of less than four inches of water gauge, and that the filter shall not plug readily and thereby make the breathing resistance prohibitive. They require also a "man test" in which the respirator shall give adequate protection to men performing light work in an atmosphere containing an irrespirable suspension (not silica) of definite concentration.

A paper by Katz, Smith, and Meiter of the Bureau of Mines, has made it clear that these specifications are inadequate for respirators in daily use in industry. A resistance of four inches at 85 liters per minute is too high for any but the trained subject such as the soldier in war time or the rescue squads of our mines and public utilities. Katz showed that respirators with high efficiency and low resistance were entirely practical to manufacture and to use.

The Bureau determines tobacco smoke efficiencies by estimating photometrically the smokiness of air entering and leaving the filter of the respirator. The actual density or concentration of the smoke particles in air is not estimated. By a similar photometric procedure, the filter can be tested for silica dust efficiency. The test is rapid and reasonably accurate—hence, its appeal to the laboratory worker. For tobacco smoke testing, the method works nicely but for dusts it is not, in the writer's opinion, satisfactory. A dust concentration far higher than that ordinarily met with in dusty industries is essential to the test, and unless special measures are used, the actual concentration is unknown.

For some time, there have been used in this laboratory the following test methods:

1. *Definitely known concentrations of finely ground silica (less than 2 microns)* within the concentration limits of approximately 50 to 200 million particles per cubic foot are drawn through the respirator at 28.3 liters per minute, the effluent air passed through a standard impinger, and the impinger sample compared against another sample, taken at the same time, of the unfiltered air. Comparisons of the two samples can be made by the standard dust counting method by turbidimetry or photometry. The last mentioned is much the quickest and is sufficiently accurate for all practical purposes. A ten to twenty minute dusting should give an efficiency of at least 90 per cent.

2. Finely ground calcium carbonate (less than 2 microns) in the form of "whiting limestone" or of magnesium oxide smoke (less than 1 micron) from burned magnesium ribbon can be determined either chemically or photometrically, both procedures being quicker and more accurate than the counting method. A 90 per cent *minimum efficiency is required, the test concentration varying from 25 to 150 mgs.* per cubic meter.

3. By burning yellow phosphorous, a wet white suspension of about the texture of tobacco smoke is obtained. A filter which shows 50 per cent efficiency against this substance usually exceeds 90 per cent against fine silica. Estimations can best be made either by using two impingers in series or by electric precipitator and determining chemically the quantity of smoke collected.

4. Smoke made by burning various kinds of pipe tobacco are a little easier to catch than the smoke formed by burning the special mixture used by the Bureau. By drying thoroughly ordinary pipe tobacco and using chemically dried air, a smoke approximating that used by the Bureau is apparently obtained. A filter which shows 50 per cent efficiency against smoke from dried tobacco will generally exceed 90 per cent against all dusts.

5. Resistance to airflow, by the Bureau's set-up, should not exceed 0.3 inches before silica dusting (item 1) nor 0.4 inches after dusting, both resistance tests to be made at 85 liters per minute, using an inclined manometer and suitable flowmeter. (The Bureau now permits any resistance less than four inches.)

A more exacting resistance test is obtained by drawing through known amounts of magnesium oxide fume which has an extraordinary tendency to plug filters.

6. For the man test, a small hole is punched through the face piece of the respirator and a small bore, dust free tube is connected to a special type of impinger or to an electric precipitator. A man, wearing the respirator, performs moderate work in an atmosphere of known dustiness and air from within the face piece of the respirator is sampled for dustiness at a steady known rate of about 15 liters per minute or less. The dustiness of the sample thus collected should not exceed 2 million particles per cubic foot or have an efficiency of less than 90 per cent, whichever rating is the more exacting. The sampling rate, in this case, must be about 15 liters per minute, in order not to interfere with the natural respiratory efforts of the subject. If it is desired to sample by impinger, a tube with a nozzle diameter of about 1.6 millimeters (instead of the standard 2.3 millimeters) should be used, with which instruments a rate of 15 liters per minute is suggested.

Requirements for Sandblast Helmets. Winslow, Greenburg, and Reeves have shown that positive pressure sandblast helmets can be tested while actually in use by the sandblaster. An improvement of their technic has been made by Greenburg and Bloomfield, so that anyone familiar with the standard impinger outfit can perform the necessary tests. All admit that sandblast helmets should be tested under practical sandblast conditions and not in the laboratory.

A hole is made in the helmet, a suitable rubber tube connected, and the air within the helmet sampled by the standard impinger, at 1 cubic foot a minute, for a reasonable period—preferably at least twenty minutes. The subject should be sandblasting throughout the period of sampling. The dustiness thus found should be less than two million particles per cubic foot, regardless of the abrasive used or the condition of the objects being blasted. As a control, it is advisable to sample the compressed air supplied to the helmet in case the air supply is itself also dusty.

Requirements for Paint Spray Masks. As paint spraying is carried out only with a convenient source of compressed air at hand, it is natural that masks supplied with positive pressure should be used. Like the sandblaster, the paint sprayer moves about but little and is not greatly inconvenienced by a light air-line attached to his back or clothing. While spraying under practical conditions, air within his mask should be sampled and the protection afforded by the mask rated in terms of the concentration inside the face piece. The device should give the same measure of protection as afforded by the sandblast helmet.

The manufacturer of protective equipment should be allowed all possible license in modifications and improvements having to do with appearance, obstruction to vision, comfort, ruggedness and practicability of his equipment. If the manufacturer desired his product to be certified as to its performance under the conditions for which he designed and built it, the prospective purchaser and safety engineer is equally desirous of knowing the performance data.

In view of the past work of the Bureau of Mines, the unquestioned integrity of

its personnel and the uniform high caliber of its work, the Bureau's laboratories at Pittsburgh seem the logical place for such certification to be done. The manufacturer of protective equipment welcomes definite specifications he can meet, no matter how rigorous, and expects to pay the testing bill whether his equipment is passed or rejected. No private testing laboratory would be expected to undertake this type of work without charging the manufacturer a fee adequate to give the laboratory a reasonable profit. The Bureau's fees in the past, for this type of work, have been modest, but the funds reverted to the U. S. Treasury, and not to the Bureau's laboratory. Unless an absurd and wholly unnecessary hardship is to be placed upon the Bureau, it should be permitted to do such work on a cost, or pay-as-you-go, basis.

General Discussion

Chairman Greenburg after delivery of the papers invited discussion, which was lengthy and spirited. This may be summarized as follows:

Dr. H. K. Pancoast, Philadelphia, pointed out that while X-ray presents the best method of observing changes in the lungs and also for determination of their incapacity, most examinations are not thorough. This point is frequently overlooked. Expert evidence is very important in making a diagnosis and grading incapacity.

The point made by Dr. Russell, of the advisability of special boards to decide the physical status of employees exposed to silica hazards, was also emphasized by Dr. W. J. McConnell, Metropolitan Life Insurance Company, New York City. In this connection Commissioner R. G. Knutson, Wisconsin Industrial Commission, spoke of the difficulties experienced in handling compensation cases. He suggested amendments to the occupational disease laws in various states for the complete coverage of occupational diseases, so that claims can be decided by the commissions rather than by common law. The conflict of testimony by so-called experts appearing before the commissions is sometimes remarkable. In some cases a final decision has been necessarily withheld until after an autopsy. John Roach, Deputy Commissioner of Labor, New Jersey, advocated the appointment of a Medical Board to be paid by the State whose opinion in compensation cases should be final.

There is a great difference of opinion about these cases, said Chairman Greenburg; the compensation commissions differ, the doctors differ, and on the other hand, industrialists have not been alert to the situation; but they can do a great deal in the future. Compensation Boards in the past have been somewhat arbitrary in their decisions. Some time ago I suggested in Connecticut that the commission should be made up of a lawyer, a physician specialist, and an engineer; but this suggestion did not meet with very much favor.

Asked to outline how silicosis cases are handled in Canada, Dr. J. G. Cunningham, Toronto, Ontario, said: Our laws define the terms silicosis and tuberculosis, and they further define the industries and occupations affected, but they refer to mining especially. The cases come from the individual physicians and are referred to the silicosis board. When the claim is received, the board examines the records and the claimants, to see if the regulations of exposure have been complied with; if so, the claimant is personally referred to the silicosis board; two or three of the members examine the case personally, and then each case is decided by all three members of the board. The claim is then referred back to the compensation board.

Two other points of interest occur to me, he said further: first, we have had a number of stone cutters with 15 years exposure to limestone, contacting tuberculosis, but in every case the occupational history showed that they previously had cut sandstone; second, in an extensive examination of workers exposed to silica dust and alkaline powders, reports in the literature have shown the rapid development of silicosis, but in our experience an examination of two small groups with similar exposure has shown only a small amount of fibrosis. The importance of exposure to coal dust also has not yet been sufficiently realized.

Dr. J. P. Leal, U. S. Public Health Service, Washington, D. C., emphasized the point made by Professor Drinker concerning the use of masks, that the minimum pressure necessary to operate such a mask should be used, that a decision should be made as to what this is, and that we should be sure that pulmonary excursion does not operate against appreciable pressure and against proper and continuous lung ventilation.

It is important to find some workable protective device, said Mr. Roach, that will protect workers in sixty or seventy different industries where the exposure exists. It is possible that in laboratories a well made apparatus will work fairly well, but in the various industries workers are found who have sharp and irregular features, and many times a mask or respirator will not work on these faces as on other workers with round, smooth features. The protective device thus becomes a menace rather than a help. We are also very much concerned whether the filter is satisfactory and will properly strain out the particles.

It has been mentioned, said Dr. Russell, that some limestone and sandstone workers have had silicosis. We must remember that granite workers and others have shown the presence of silicosis, although they have not been directly exposed, and other workers beside cutters have shown the presence of silicosis, all of these cases being due to previous occupational exposure involving silica hazards. Recently we had a case of a man with silicosis and tuberculosis, his job having been loading coal (not a real silicosis exposure), but previously he had been a gold miner. He is now 50 years old, has tuberculosis, and three of his five children also give positive tuberculin reactions, which is against the usual conception that tuberculosis from silicosis is transmissible.

Professor Drinker said: I have been asked whether I consider a respirator a good protection if no other apparatus is available. My answer is that it would not be. In a high concentration of dust, if the respirator is functioning properly, it should reduce the amount of dust breathed. But a respirator is not really an eight-hour day apparatus. In other processes, however, where the work is intermittent and a workman is not obliged to wear his respirator continuously, it should function as an efficient protective apparatus.

WEDNESDAY MORNING SESSION

October 5, 1932

For the record of this joint session of delegates of the Industrial Health Section with the Chemical Section, see page 165 of this volume.

WEDNESDAY AFTERNOON SESSION

October 5, 1932

Chairman Greenburg, on the opening of this session, called for the report of the Nominating Committee and officers were chosen as follows:

For Chairman, Dr. R. G. Leland, American Medical Association, Chicago.
Vice-Chairman, Dr. W. R. Redden, American Red Cross, New York City.
Secretary, Dr. C. O. Sappington, Chicago.

Chairman Greenburg then introduced the first speaker.

the influence of the machine upon human well-being. It is not surprising that the statement is being made that this depression is to a considerable degree due to the use of machinery. It is not surprising that the phrase "technological unemployment" is in daily usage. These statements are a challenge to the engineering profession.

The engineers of the nation should make a searching examination to determine whether or not some evils, as by-products, have grown out of their work. Undoubtedly they have and if so, it is their responsibility to determine what they are and to eradicate them in so far as possible. As someone has well said, "the engineer has conferred many great services of incalculable value upon mankind, and he cannot afford to be blind or indifferent to their sociological effects. While the factory and the power house increase comforts and add to the amenities, they do not reach their full sociological efficiency as long as they poison the atmosphere or load it with dust. The thousand mechanisms which are employed for transportation and other useful purposes are wanting in perfection as long as they produce excessive and injurious noises. It is the duty of the engineer and it should be his desire to affect the removal of all the objectionable features which accompany his handiwork, so that men may receive untold benefits without the loss of a single one of the comforts which were enjoyed in a less mechanical age."

May we, now, resort to the dangerous matter of making some prophecies as to what may be expected from the engineer in the next 50 or 100 years? There will be witnessed railways electrified and inland waterways developed far beyond our present conception: telegraph, telephone and power lines underground and it may be power transmitted through the air. We shall have homes heated, cooled and lighted with artificial light having all the wholesome qualities of sunlight. We may anticipate homes equipped with television and movietone and supplied with numerous appliances for relieving the drudgery and increasing the enduring satisfactions of home life. We shall have a greatly increased number of synthetic commodities. We shall see the economic and social status of farm life markedly improved.

Then may we not anticipate with confidence the members of the engineering profession taking a more active part in the affairs of government, an agency defined by Burke as "a contrivance of human wisdom to provide for human wants." Since government, according to Clay, "is a trust and the officers of the government trustees, and both the trust and the trustees are created for the benefit of the people", it is the ever increasing duty of the members of the engineering profession to contribute of their time, thought and effort to the development of a sounder and more economic government in order that human wants may be equitably and fully realized.

We should remember that our duty as citizens comes before our duty as engineers. The special or superior knowledge which our training gives us also lays upon us an obligation to use that knowledge in the interest of the public. It is my conviction that the engineer's battlefront of the future should not be alone the subduing and controlling of the forces of nature, but also the combatting of the impediments to human progress, security and happiness.

Chairman Lloyd called for the report of the nominating committee whose personnel included E. W. Beck, Chairman, J. I. Banash, R. McA. Keown, W. R. Smith and A. S. Regula. The following officers were elected:

General Chairman—H. S. Smith, Union Carbide & Carbon Corp., New York.
Vice-Chairman—S. E. Whiting, Liberty Mutual Insurance Company, Boston.
Vice-Chairman—E. S. Beaumont, Peoples Gas Light & Coke Company, Chicago.
Secretary—W. Dean Keefer, National Safety Council, Chicago.
Members of Executive Committee for three-year term—Harry Guilbert, The Pullman Company, Chicago; W. M. Grafi, National Bureau of Casualty & Surety Underwriters, New York City; and R. E. Donovan, Standard Oil Company of California, San Francisco.

ADJOURNMENT

TWENTY-FIRST ANNUAL SAFETY CONGRESS
NATIONAL SAFETY COUNCIL

Automotive and Machine Shop Section

Officers 1931-32

General Chairman—C. M. Dotterrer, Graham-Paige Motors Corp., Detroit, Mich.
Vice-Chairman—Carl Storck, Buick Motor Company, Flint, Mich.
Secretary—E. C. Walker, Dodge Brothers Corp., Detroit, Mich.
News-Letter Editor—K. A. Callan, Kelsey-Hayes Wheel Corp., Detroit, Mich.
Chairman Poster Committee—G. E. Sanford, General Electric Co., Schenectady, N. Y.
Chairman Membership Committee—W. A. Bechill, Chrysler Corporation, Detroit, Mich.
Chairman Publicity Committee—C. W. Bishop, Lycoming Manufacturing Co., Williamsport, Pa.
Chairman Statistics Committee—John Clifford, Briggs Mfg. Co., Williamsport, Pa.
Chairman Engineering Committee—Dr. James H. Greene, The Studebaker Corp., South Bend, Ind.
Chairman Slides and Safety Kinks Committee—Marvin A. Heidt, Budd Wheel Corp., Detroit, Mich.
Chairman Health Committee—Dr. A. F. Lecklider, Fisher Body Corp., Detroit.
Members at Large—
L. E. Averill, C. H. Dockson Co., Detroit, Mich.
Hoyt L. Fracher, Detroit Steel Products Co., Detroit, Mich.
R. A. Shaw, The Murray Corp. of America, Detroit, Mich.
R. F. Thalner, Buick Motor Co., Flint, Mich.

TUESDAY MORNING SESSION

October 4, 1932

In the absence of General Chairman C. M. Dotterrer, the first session of the Automotive and Machine Shop Section convened in the Wardman Park Hotel with Marvin A. Heidt, Director of Personnel, Budd Wheel Corporation, Detroit, presiding. After welcoming the delegates the chairman said in part:

"The sessions this year have been developed around the economic side of accident prevention. In developing this theme your program committee has built the sessions upon the theory that the Boards of Directors of some organizations are not familiar with the entire scope of the safety functions. On the basis of this theory, a hypothetical company has been designed which has been called the Disc Manufac-

turing Co., whose management has not realized the responsibility either from an economic or a humanitarian standpoint.

"The sessions today and tomorrow will allow us to study the affairs of this company with a view to the steps that will be necessary to reestablish it on the right side of the ledger. The speakers who will appear on the platform have been drawn from diversified lines of activity. It has been impossible, consequently, for them to dovetail precisely the talks which we would like to convey. But they will carry out the major objective of these sessions, which is to expound principles, and if we accomplish this effectively, your attendance will not have been in vain.

"We will, then, by way of introduction, give you a look into the office of the General Manager of the Disc Manufacturing Co., where internal affairs have been anything but good and we find this manager struggling blindly to bring order out of chaos."

The delegates were then both entertained and made thoughtful by the presentation of a little playlet entitled "Profit or Loss." This playlet had the following cast of characters:

General Manager, M. J. McCarthy, Safety Director, Fisher Body Corp., Detroit.
His Secretary, Helen Whalen, Washington, D. C.
Safety Engineer, J. V. Lyle, Personnel Director, Fisher Body Corp., Cleveland.
Chairman, Board of Directors, Marvin A. Heidt, Personnel Director, Budd Wheel Corp., Detroit.
Board of Directors, The audience.

During the progress of this playlet the cost of accidents and of accidem prevention measures was developed in a striking way and the safety lesson was driven home. Chairman Heidt then introduced the first speaker.

Modern Management's View of Safety

By CHAS. T. WINEGAR

Director of Personnel, Chrysler Corporation, Detroit, Mich.

In substance the speaker said that he had been associated with safety work for eighteen years but that his becoming safety-minded probably goes back only to four or five years ago. He was leaving the Olympia Boxing Palace in Detroit one rainy evening. There was a very large crowd, and the usual congestion of traffic was so bad that it took him nearly twenty minutes to cross the street. He was a witness of an automobile accident in which a young boy was badly injured. The speaker drew a striking picture of the boy's badly broken body slumped in the roadway, of the darkness and confusion, and of a drunken driver who was able to escape without being apprehended.

The speaker took this incident to draw a comparison between the conditions under which we live day by day in the outside world as compared with the organized life of the worker in the average industrial plant.

Nevertheless, he said, the problems of the safety man are more or less complicated because he is dealing with humans and we know there are all kinds of human people. Also, the safety man has to deal with the emotions of human beings. Our emotions make us strangers to each other and make up the difference between profit and loss. The safety man in his profession has been doing the best he can to correct man's emotions.

One of the striking things evident in industry today is the fact that the industrialist who came up from the ranks wants his employees to have something he did not have. He wants his employees to work under safe conditions. Under present conditions, therefore, the safety man has a more important job than he has ever had in his life, and he will have a still more important job in the future.

This long period of unstable industrial and economic conditions has affected everyone directly or indirectly. How do you think it has affected the man formerly steadily employed, but who has recently been working only one or two days per week? And how do you think it will affect the man who has been out of employment for months? In my plant, we find that a great many of our accidents are occurring to the man who is newly back on the job. And these circumstances are bound to have an increasing influence upon accident rates in the future.

But management has a deeper interest in the welfare of the employee than it did some years ago. I have been interested in watching eye cases. One day not long ago I saw a workman with a bandage over his eye, and I stopped him and asked him what was wrong. He stated that two or three days before he had a cinder in his eye and he had not slept for three nights. I took him down to the factory hospital and instructed the man in charge that if this man was not better before morning, he was to be sent to an eye specialist. The specialist saw him next day, and stated that the man had been properly taken care of in the plant hospital. However, this little personal attention had its effect both in the mind of the workmen and of the eye specialist. The word quickly got abroad through our plant that someone higher in the management had taken a personal interest in an injured man.

I understand that some firms have entirely eliminated their safety program, because of the so-called expense in these difficult times. I consider this a very serious mistake. In one of the Detroit plants where safety work was discontinued, an employee has since been seriously injured, and in this plant it has proved to be a tremendously costly lesson.

The Personnel Department's Place in the Safety Program

By DR. JAMES H. GREENE

Manager, Cooperative Department, Studebaker Corp., South Bend, Ind.

The speaker said in part: From my point of view, the term "Personnel Department" is an all-inclusive one. It follows, therefore, that a properly constituted personnel department will contain within it, as divisions, all of the various activities which deal with relations between the employees and the company. By the same token, therefore, the safety department or division becomes a unit in the personnel department. I would somewhat arbitrarily classify the essential personnel activities as follows:

1. Working conditions including safety, health, employee service such as cafeteria, and other employee conveniences.
2. Wages, job stability and financial security, including such items as savings, insurance and pension plans.
3. Promotion possibilities and general morale, including opportunities for training, recreation, etc.

A thoughtful consideration of these items will show that the element of safety is an integral part of each of these phases of industrial relations. Only the safe worker can derive fullest advantage from the personnel activities instituted to make the employee's relations with his employer mutually helpful and profitable. Ill-health makes a man a poor safety risk. The enjoyment of the benefits of safety, insurance and pension plans is contingent upon the continued safety of the worker. Only the safety worker can be considered as a possibility for promotion. In short, the employee's efficiency, his personal well being, and satisfaction with his work, his opportunities for advancement, all hinge on whether he continues to carry on his part of the work without injury resulting in temporary or permanent physical impairment. The safety program is therefore the core of the general personnel program.

A safety program, like any other thorough-going educational process, is carried

on both formally and informally. The formal items will include routine safety instructions, safety meetings, the work of safety committees, and such devices as bulletins, bulletin boards and articles in the employees' publications. Informally, the personnel staff will promote safety through individual personal contacts with both employees and supervisors at machines, workbenches, and in various private offices.

During the period of slack work, employees find difficulty in maintaining the rhythm necessary for safety and satisfactory production. A certain period of readjustment is necessary when a man returns to work. This is the dangerous time as far as accidents are concerned. Constant care and watchfulness must be exercised to see that he does not lapse into careless habits of work. In such times it follows that the safety division will have to continue its work with a reduced personnel. If other personnel workers can make it their business to take up the slack, the safety program can be maintained and the safety record of the plant will not be endangered.

The employment division will cooperate by emphasizing the importance of safety at the time of employment, transfer, and other contacts with employees. The medical division will assist in the analysis of accident causes, preparation of literature, talks before employee groups, and by personal contact. The training division will emphasize safe practices in every training program. Safety is such an important part in the industrial relations program that I believe the thread of safety and safe practices should run through all the contacts of personnel workers and employees.

In a period of retrenchment the safety program is even more vital than in prosperous times. From the standpoint of the employer, serious accidents cut into production costs more heavily at such a time than when production is at a higher level. From the employees' standpoint, the loss of wages is much more serious because of the difficulty of saving for a rainy day when wages are barely sufficient to keep the family going at the best. Management is naturally compelled to curtail all non-essential activities. While safety can readily be called a non-essential, frequently it must be demonstrated that the personnel staff is actually producing savings by its safety activities if unwarranted reductions in the staff are to be prevented.

Activities in Slack Times

When work is slack there are certain specific things which can be done to further a safety program which are not possible during peak operations. These may be listed as follows:

1. Machinery should be checked over for hazards which can easily be overlooked under maximum production conditions.
2. Personnel workers who are handy with tools can make necessary repairs to guards, thus saving maintenance costs.
3. All safety equipment which normally is in constant use can be checked over and inspected during slack periods.
4. It is possible to watch operations more in detail than is possible under normal operating conditions and hence provide safeguards against hazards which might easily be overlooked.
5. There is more time for safety training.
6. Systematic inspection of elevator cables, chain hoists, and similar equipment can be conducted during such a period.
7. This is a good time to inaugurate a program of inspection of drawings of all new dies and tools, including safety device features.

WEDNESDAY MORNING SESSION

October 5, 1932

The session opened with a presentation of the Report of the Nominating Committee consisting of Hoyt L. Fracher, Detroit Steel Products Co., R. A. Shaw, Murray Body Corp., and R. F. Thalner, Buick Motor Car Co. The following officers were presented for consideration and were formally elected:

General Chairman, Carl Storck, Buick Motor Co., Flint, Mich.
Vice Chairmen, M. J. McCarthy, Fisher Body Corp., Detroit, Mich.
Dr. James H. Greene, Studebaker Corp., South Bend, Ind.
Secretary, K. A. Callam, Kelsey-Hayes Wheel Corp., Detroit, Mich.
News-Letter Editor, Nils Juell, Hayes Body Corp., Grand Rapids, Mich.
Program Committee Chairman, Hoyt L. Fracher, Detroit Steel Products Co., Detroit, Mich.
Statistics Committee Chairman, C. W. Bishop, Lycoming Manufacturing Co., Williamsport, Pa.
Engineering Committee Chairman, V. H. Kupferer, Studebaker Corporation, South Bend, Ind.
Slides and Safety Kinks Committee Chairman, Marvin A. Heidt, Budd Wheel Corp., Detroit, Mich.
Membership Committee Chairman, M. A. Kroger, Chevrolet Forge Div., General Motors Corp., Detroit, Mich.
Publicity Committee Chairman, W. A. Bechill, Chrysler Corp., Detroit, Mich.
Health Committee Chairman, Dr. A. F. Lecklider, Fisher Body Corp., Detroit, Mich.
Members at Large:
L. E. Averill, C. H. Dockson Co., Detroit, Mich.
C. M. Dotterrer, Graham-Paige Motors Corp., Detroit, Mich.
R. A. Shaw, The Murray Corp. of America, Detroit, Mich.
R. F. Thalner, Buick Motor Co., Flint, Mich.

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The Medical Department Presents the Case for Safety

By *DR. A. F. LECKLIDER*

Medical Director, Fisher Body Corp., Detroit

The speaker said in part: I am to endeavor to show our management and our directors where, in the eyes of their medical department, it is worth while for them to spend their money, their thought and energy in formulating and backing up a safety program. Times, I am informed, are now less prosperous. There is a tendency everywhere toward wholesale economies and the elimination of all activities classed as non-essential or non-productive.

I have noted many of the economy measures put into effect and have felt the pinch two times a month myself. All these measures have seemed to be only partly successful in keeping the Ship of Industry on an even keel. In the same hour when someone of these measures, productive of a few dollars and performed with backbreaking efforts, goes into effect, two finger amputations and a fractured leg come into the hospital. By this event your small decrease in cost of quarter panel finishing is shot for four and a half days; your first class hand sawyer is transformed into a third class trucker, who becomes again, as the depression comes into full swing, a first class client at the doors of your welfare department. No proper technique on the stumps of fingers will enable those stumps to completely surround the hand of a lever or a hammer again.

I do not know of a single serious injury which has not resulted in a social problem case. All are potential social problems, many of them with aspects en-

will be expected to pass with satisfactory grades. Tell him that, where necessary, rules will be enforced but that company prefers employees who will voluntarily comply with the rules.

(3) Company furnishes protective equipment and safety appliances. (a) Rubber gloves, fuse pullers, goggles, line hose and blankets. Fusees and flagging equipment, warning flags, torches and barriers, gas masks, machine guards, etc. Location and use of this equipment should be explained to the new man. Defects peculiar to each piece of equipment and the best method of inspecting the equipment should be explained.

(4) Should explain to the new man use of first-aid kits and the importance and necessity for first-aid in treatment of all minor injuries. Should show him where first-aid supplies are located. Should explain briefly the use of each article in the first-aid kit.

(5) Should show location and explain use and method of operating fire extinguishers on the property. The group should be questioned concerning this equipment, its use and method of operation.

(6) The new employee should be informed that a complete report should be made of accidents that occur. Why a detailed report is required by the safety department and by the claims department should be explained. A copy of each accident report form used by the company should be discussed with the new men.

In the conclusions drawn at the end of each of these conferences the leader should point out that as such instructions are important to the new man, it is important that they be frequently reviewed with old employees. Frequently in conducting meetings of this character it has been determined that some old employees do not understand the proper use of fire extinguishers, cannot state clearly the company policies concerning safety, are of the opinion the only reason for requiring a report of accidents is to protect the company from false claims, have never been instructed in the proper use of gas masks, or other equipment they may be called upon to use in some emergency.

There are scarcely any objections to this plan that cannot be solved. Recently in a large ice company an objection was offered to that part of the plan which required this instruction to be given before the applicant was accepted, on the grounds that often because of sudden changes in the weather at the beginning of the ice season, additional help was needed immediately. The difficulty was solved by the general manager requiring the plant superintendents to develop a "waiting list"—employees who had been instructed by the safety director and might be called when needed. While this conference method may not fit all conditions and circumstances in the electric railway industry, it is quite probable that this plan may be used with such modifications as may be necessary and thus reduce the number of accidents due to lack of proper instructions.

ADJOURNMENT

TWENTY-FIRST ANNUAL SAFETY CONGRESS
NATIONAL SAFETY COUNCIL

Food Section

Officers 1931-32

General Chairman—W. A. Sullivan, Loose-Wiles Biscuit Company, Kansas City, Mo.
Vice-Chairman (Membership)—Henry J. Mineur, The Borden Company, New York City.
Secretary & News-Letter Editor—M. E. Houser, B/G Sandwich Shops, Chicago, Ill.
Chairman Program Committee—R. E. Prouty, Aetna Life Insurance Co., New York City.
Chairman Poster Committee—Thomas Stribblar, Wagner-Taylor Co., Philadelphia, Pa.
Chairman Statistics Committee—J. J. Zeitner, Continental Baking Co., New York City.
Chairman Engineering & Publicity—J. J. Lyons, John F. Jelke Co., Chicago, Ill.
Executive Committee—The Officers and
Will Cooper, Executive Offices, Stevens Hotel, Chicago, Ill.
Alexander Dienst, The National Sugar Refining Co., Long Island City, N. Y.
Frank A. Hasse, Corn Products Refining Co., Chicago, Ill.
Vern D. Sutton, Postum Company, Inc., Battle Creek, Mich.
Ernest D. Fowler, Americus Hotel, Allentown, Pa.
Robert E. Day, Kellogg Co., Battle Creek, Mich.
R. W. Upshaw, Anheuser-Busch, Inc., St. Louis, Mo.

TUESDAY MORNING SESSION

October 4, 1932

The first session of the Food Section convened in the Wardman Park Hotel, with General Chairman Will A. Sullivan presiding. Chairman Sullivan welcomed the delegates, and then introduced the first speaker.

Common Sense Accident Prevention

By GLENN L. GARDINER

Assistant to the President, Forstman-Woolen Co., Passaic, N. J.

Common sense, said the speaker, is often found to be an uncommon faculty. A study of the causes back of the majority of accidents proves rather conclusively that common sense is uncommon. He cited a striking group of accidents all of which had been foolishly caused. He then said in part:

In a study of 2,622 accidents, an accurate determination was made of the length of service of those injured. It was found that those who had been employed one month or less were being injured at the rate of 160 per month per 100 employees. (This does not mean that 160 accidents were caused per month, but that they occurred at the rate of 160 per month). Those who had been employed for three months had accidents at the rate of 70 per month per 100 employees. Those who had been employed from three to eight months had a rate of 16 accidents per month per 100 employees; and those whose experience ranged from eight months to one year had 12 accidents per month per 100 employees.

After the first year, the rate dropped rapidly. For those employed from one to five years, it was 15 accidents per year per 100 employees. For those employed from five to ten years it was 11 accidents per year per 100 employees. Those who had served from ten to twenty years suffered 5 accidents per year per 100 employees, and those who had been employed from twenty to thirty years made the best showing of all, with a rate of only 3 accidents per 100 employees. After thirty years of service, the rate took a slightly upward trend.

Another study showed the relation of what might be called the labor recruiting rate to the accident frequency rate. (Do not confuse the term "labor recruiting" with the term "labor turnover.") In the study referred to, the total number of employees increased gradually from 340 at the beginning to 590 at the end of the period. One would naturally think that the number of accidents would follow fairly closely the total number of employees exposed to the hazards of the plant. Such was not the case. Instead, accidents happened with the greatest frequency during the months when conditions required the hiring of the largest number of new employees, and a drop in those months during which there was also a drop in the number of new employees hired.

"Right now, the very commendable efforts of the industries to keep as many as possible of their people employed may result in the assignment of men to work which is new to them and for which they are not fitted and lead to accidents. When business picks up, and it most certainly will, there will be a great deal of shuffling around until things become stabilized. All of those classes of employees that have been termed new will be entering our plants in large numbers. If it is possible to devise ways and means of preventing injuries among them we should get busy and formulate our programs now and be ready to tackle the problem as soon as it arises."

The careful selection of employees is all important. Employee selection should be exercised in the plant having but a handful of workers no less thoroughly than in *one having thousands. The principles involved are precisely the same.* Every selected employee should measure up to the physical, mental and moral requirements of the job for which he is hired. It follows that all of those who have the responsibility *of hiring men should examine themselves carefully to determine if they are fully* familiar with the job requirements.

Physical examinations prior to employment are desirable. They should not be undertaken with the idea of excluding subnormal applicants from employment altogether, but to ascertain what particular work each one can do with the maximum of safety for himself and the minimum of risks for the employing company. There may be some who object to physical examinations, but these objections are based usually on the belief that industry will take an unfair advantage of the workmen *through information obtained from the examinations. Just as soon, however, as it is* demonstrated that the examinations are not being made for an ulterior purpose but to fit the men to jobs at which they will be safest and at the same time most likely to succeed in a financial way, the objections will cease.

Closely allied with the determination of physical fitness is the question of mental qualifications. Modern employment technique includes many different kinds of tests. Such tests should be as brief as possible and actually suitable for the purpose for

which they are intended, namely, the detection of certain specific characteristics and qualifications. Any tests that are unduly long and fail to give information that cannot be obtained otherwise will defeat their own purpose. There is room for a lot of common sense as well as technical skill in employee selection which, if it means anything, should be fitting employees to their jobs.

Of no less importance are moral qualifications. It is not suggested that industry should perform the functions of a Sunday School, or that employment managers should try to give a moral rating to each applicant for employment. It is obvious, however, that one who makes untruthful statements, or is evasive rather than straightforward in answering questions, or is known to disregard accepted standards of conduct, cannot be given a task that requires individual initiative and the acceptance of a measure of personal responsibility. Moreover, such a person will not team up well with his fellows. He cannot be counted on for much help in bettering your accident records.

"When an applicant is accepted for employment a contract of hire either expressed or implied has been made. It is assumed, on the one hand, that the employer has examined the qualifications of the applicant and has found them satisfactory, and on the other, that the applicant has familiarized himself with the conditions under which he will work and has considered them acceptable. What an opportunity to start a man off right so far as accident prevention is concerned! The applicant is in a receptive frame of mind. Now is the time to explain the *safety objectives of the* company, and the part he will be expected to play in this effort if he becomes a member of the organization. This is a dignified and important part of the employ*ment program. Time* spent on it will be justified by the results."

Discussion: Mr. Prouty emphasized that it is well to have a re-examination of a man's physical fitness when he returns to work after an absence, even though he is an old employee. Also the foreman should realize his responsibility in the matter and not assume that the man can do the work as he formerly did. The discussion developed also that in a certain plant a man who was found to have a communicable disease sued the plant doctor on the basis of "privilege communication." The plant in question now has all applicants for positions sign waivers before physical examination takes place.

Report of the Nominating Committee

Will Cooper, Stevens Hotel, Chicago, Chairman of the Nominating Committee, then presented the committee's report and officers were elected for the ensuing year as follows:

General Chairman—HENRY J. MINEUR, The Borden Company, New York City.
Vice-Chairman—FRANK A. HASSE, Corn Products Refining Company, Chicago.
Secretary and News-Letter Editor—J. J. ZEITNER, Continental Baking Company, New York City.
Engineering Committee Chairman—J. J. LYONS, John F. Jelke Company, Chicago.
Membership Committee Chairman—ROBERT FLEMING, Kellogg Company, Battle Creek, Mich.
Poster Committee Chairman—THOMAS STROHIAR, Wagner-Taylor Company, Philadelphia.
Program Committee Chairman—W. C. WASHBURN, Sheffield Farms Company, Inc., New York City.
Publicity Committee Chairman—RUTH E. CADE, A. E. Staley Manufacturing Company, Decatur, Ill.
Statistics Committee Chairman—T. A. SCHENDEL, Premier Malt Products Company, Peoria, Ill.
Members at Large—
WILLIAM F. BARRETT, Horn and Hardart Baking Company, Philadelphia.
W. P. BELL, California and Hawaiian Sugar Refining Corp., Crockett, Calif.

D. M. Clark, Society of Grain Elevator Superintendents of North America, Chicago.
Morris Cohen, Schulze Baking Company, Kansas City, Mo.
Will Cooper, Executive Offices, Stevens Hotel, Chicago.
Alexander Dienst, The National Sugar Refining Co., Long Island City, N. Y.
Paul Goodnough, The Quaker Oats Company, Chicago.
E. W. Green, Oahu Sugar Company, Ltd., Waipahu, Oahu, T. H.
C. E. Griffin, The Axton-Fisher Tobacco Co., Louisville, Ky.
Elmer Heimbach, Manager, Hotel Allen, Allentown, Pa.
S. B. Horrell, The Carey Salt Co., Hutchinson, Kan.
Robert McDade, Atlantic Sugar Refineries, Ltd., St. John, N. B., Canada.
Adolph Pfeffer, Adolph Pfeffer Rice Milling Co., Houston, Texas.
G. L. Rhys, John Morrell & Co., Ottumwa, Iowa.
William A. Sullivan, Loose-Wiles Biscuit Co., Kansas City, Mo.
Vern D. Sutton, Postum Company, Inc., Battle Creek, Mich.
C. W. Turning, James H. Harper Co., Duluth, Minn.
R. W. Upshaw, Anheuser-Busch, Inc., St. Louis, Mo.
Earl Whitelock, Washburn Crosby Co. Inc., Buffalo, N. Y.
Charles F. Wiehrs, The Southern Cotton Oil Co., Savannah, Ga.

TUESDAY AFTERNOON SESSION

October 4, 1932

This session of the Food Section was held at the Department of Agriculture Experiment Station, Arlington, Va. Here a series of dust explosion tests was carried out before the delegates, demonstrating the force of certain kinds of dusts when exploded under various conditions. The fundamental idea in presenting these test explosions was to demonstrate the relative dissipation of the force of the explosions by means of openings and other escape vents in the explosion chamber. The tests *were conducted under the supervision of David J. Price, U. S. Department of Agriculture,* who gave a detailed explanation of each as it was prepared and took place.

Descriptive Statements of Dust Explosion Tests at Arlington Farm Testing Station

By DAVID J. PRICE

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

In the work on dust explosions and resulting fires in industrial plants, the Chemical Engineering Division of the Bureau of Chemistry and Soils has obtained records of 560 explosions of this character. In 184 of these explosions 434 persons were killed and 866 injured. In 449 cases the property loss amounted to approximately $46,000,000. The dust explosion hazard exists in about 28,000 industrial establishments employing approximately 1,325,000 persons and manufacturing products of an annual value of more than ten billions of dollars.

The Department of Agriculture has given special attention to the development of safety codes for dust explosion prevention in grain handling and manufacturing establishments. The Dust Explosion Hazards Committee of the National Fire Protection Association has been under the leadership of the Chemical Engineering Division of the Bureau of Chemistry and Soils since its origin. This committee is composed of representatives from the industries directly concerned, insurance and safety

organizations, state and federal officials and construction and equipment engineers. The Dust Explosion Hazards Committee has prepared the following nine safety codes: (1) Flour and Feed Mills; (2) Sugar and Cocoa Pulverizing Systems; (3) Terminal Grain Elevators; (4) Pulverized Fuel Insulations; (5) Starch Factories; (6) Spice Grinding Plants; (7) Coal Pneumatic Cleaning Plants; (8) Wood Flour Manufacturing Establishments; and (9) Inert Gas for Explosion and Fire Prevention.

These safety codes provide a practical means of translating into actual plant practice the results of research work such as you will see here today. They have been adopted by the National Fire Protection Association and the National Board of Fire Underwriters and have been approved as American standards by the American Standards Association. These codes have been published by the Bureau of Labor, Statistics of the U. S. Department of Labor as Bulletin No. 562, entitled "Safety Codes for the Prevention of Dust Explosions."

It is gratifying to safety engineers to observe that the losses of life and property in the grain handling industries as the result of dust explosions have decreased in the ten year period 1921-1931. The average loss per explosion has gradually decreased from approximately $520,000 in 1921 to about $28,000 in 1931. (The records indicate that there were thirty-nine dust explosions in industrial plants in 1931. On the basis of the reduction in loss of $500,000 per explosion, this would mean a saving of $19,500,000 in 1931 in property values without any reference to the saving of human life). The yearly losses have dropped from $4,160,000 in 1921 to $1,100,700 in 1931.

The reduction in losses from dust explosions in the grain handling and associated industries has been due in a very large degree to the splendid cooperation which the Department of Agriculture has enjoyed with all the agencies directly concerned, and with national organizations such as the National Fire Protection Association, National Safety Council, National Fire Waste Council, National Board of Fire Underwriters, and other similar associations and organizations engaged in explosion and fire prevention.

The structure in which the dust explosions are produced consists of a room, gallery, and tower. *The room, 4 x 5 x 5 feet, has a volume of* 100 cubic feet. The gallery, 2½ x 2½ x 20 feet, has a volume of 125 cubic feet. The tower, 3 x 3 x 12 feet, has a volume of 108 cubic feet. Total volume is 333 cubic feet.

Vents on the room consist of hinged metal doors and pivoted sash. The metal doors range in size from 0.1 square feet to 1.55 square feet and the sash contains approximately 7 square feet of glass.

The gallery has 8 roof vents, each one square foot in area covered by hinged doors. There are also 8 fixed glass windows with an area of 1.3 square feet each. The opening into the tower, which is the full size of the gallery, may be closed when the gallery is used as a unit.

The tower contains one swinging panel about 7 square feet in area, 3 hinged doors, each 1.55 square feet in area, and adjustable vents on top ranging from 0.1 square feet to 2.75 square feet, and 4 fixed glass windows with an area of 1.7 square feet each.

In these tests, grain elevator dusts, soap powder, starch dust, milk powder, baking powder, sugar dust, wood charcoal dust, wood dust, and cork dust were used. In order to produce each explosion it is necessary to have dust in suspension in air and a source of ignition. The dust cloud is produced when a jet of air strikes the dust in the cups and throws it into suspension. The dust cloud is ignited by an electrically heated coil.

Some of the most disastrous dust explosions, said Dr. Price, have occurred in terminal grain elevators in connection with grain handling and storage operations. The first test, an explosion of grain elevator dust in the entire structure, will show the possibility of venting an explosion without damage. In this test approximately

Heavy Machine Shop Division, Group A, Lycoming Mfg. Co., Plant No. 1, Williamsport, Pennsylvania. The same division, Group B, United States Rubber Company, Shoe Hardware Company, Waterbury, Conn.

"Your Hour"

The next part of this session was a special feature entitled "Your Hour," led by T. H. McKenney, Supervisor of Labor & Safety, Illinois Steel Company, South Chicago. Question cards had been distributed and returned with safety problems, which Mr. McKenney read from the floor, and then asked for solutions. Questions and answers were as follows:

Question No. 1: "It was expected that poor working schedules would cause more accidents, but this has not been the case; why not?" One reply was that plants are not pressed for production. However, a strong percentage of the delegates were of the opinion that spreading the work and putting new men on new jobs was causing accidents. A vote of delegates on whether or not frequency of accidents has decreased during 1930 and 1931, resulted in a vote showing a decided decrease.

Question No. 2: "What practical means can be used to detect defects which may develop in crane wheels?" The replies included: visible inspection for cracks, flat surfaces, etc.; tapping wheels with hammer; also gauging the flanges. One well known company makes a monthly inspection of all parts of the crane.

Question No. 3: "Have any troubles or injuries been encountered due to metal caps on safety shoes?" Several well-known companies do not permit any safety shoes except those with steel toe. Flammable material in a composition toe is considered objectionable. Practically every man went on record as favoring metal tipped toes and a vote showed unanimous approval of steel toes.

Question No. 4: "What procedure should be followed if superintendents, foremen and workers do not co-operate in the accident prevention program?" The answers included the following: Our management is always with us but a good organization will also offset opposition to safety. Putting objectors at the heads of safety committees will often effect a cure. Safety must begin at the top. A safety engineer who cannot sell his wares to his men should move. The safety engineer must sell his wares to the management, and all executives are susceptible of being influenced if properly approached. Both the emotional approach and the discussion of safety on a cost basis are valuable to make the management listen.

Question No. 5: "In the investigation of accidents and near accidents, what is the best method of procedure—through the foremen, by a committee, by a safety inspection, or otherwise?" Many delegates favored an investigation by the department superintendent and his men, foremen, etc., with the safety engineer as secretary and assisting in the questioning. Another suggestion was by means of a trial. An immediate investigation is advisable, since conditions soon change, especially if someone is especially at fault.

Question No. 6: "Now that we are agreed that responsibility for accidents rests with the head of the department, what is the safety department doing to lighten the load of the foreman?" It was agreed that the safety department should help the foremen in every possible way. It is important to combine safety and training.

The final feature of the program was the presentation of the film strip entitled "Safety Kinks," by J. A. Oartel, Chief of Safety Bureau, Carnegie Steel Company, Pittsburgh. Mr. Oartel presented a great variety of machines and devices with appropriate remarks.

ADJOURNMENT

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TWENTY-FIRST ANNUAL SAFETY CONGRESS
NATIONAL SAFETY COUNCIL

Mining Section

Officers 1931-32

General Chairman—W. H. Comins, National Lead Co., St. Francois, Mo.
Vice-Chairman in Charge of Membership (Coal Mining)—Thomas E. Lightfoot, Koppers Coal Co., Pittsburgh, Pa.
Vice-Chairman in Charge of Membership (Metal Mining)—P. M. Arthur, American Zinc Company of Tennessee, Mascot, Tenn.
Vice-Chairman—J. W. Alt, Calumet & Hecla Consol. Copper Co., Calumet, Mich.
Vice-Chairman—Frank B. Dunbar, Pickands, Mather & Co., Mather, Pa.
Secretary and News-Letter Editor—Daniel Harrington, United States Bureau of Mines, Washington, D. C.
Chairman Statistics Committee—W. W. Adams, United States Bureau of Mines, Washington, D. C.
Chairman Entertainment Committee—J. T. Ryan, Mine Safety Appliances Co., Pittsburgh Pa.
Publicity Committee—M. R. Bird, Explosives Engineer, Wilmington, Del.
R. Dawson Hall, Coal Age, New York, N. Y.
Chairman Poster-Slide Committee—J. J. Forbes, U. S. Bureau of Mines, Pittsburgh.
Chairman Engineering Committee—W. T. Metzger, Hudson Coal Co., Scranton, Pa.
Chairman Program Committee—Chas. F. Hazelton, Pickands, Mather & Co., Cleveland, Ohio.
Members at Large—
M. F. Fairlie, The Mining Corporation of Canada, Ltd., Toronto, Ont., Canada.
H. C. Henrie, Phelps Dodge Corp., Bisbee, Ariz.
R. N. Hosler, Coal Mine Section, Pennsylvania Compensation Rating & Inspection Bureau, Harrisburg, Pa.
George Martinson, Pickands, Mather & Co., Hibbing, Minn.
C. A. McDowell, Pittsburgh Coal Co., Pittsburgh, Pa.
D. D. Moffatt, Utah Copper Co., Salt Lake City, Utah.
Howard I. Young, American Zinc, Lead and Smelting Co., East St. Louis, Ill.

TUESDAY MORNING SESSION

October 4, 1932

The sessions of the Mining Section convened with General Chairman W. H. Comins, National Lead Company, St. Francois, Missouri, presiding. After welcoming the delegates, Chairman Comins asked for the report of the Statistics Committee which was presented by W. W. Adams, U. S. Bureau of Mines, Washington, D. C., Chairman, in part as follows:

Statistics Committee Report

Although employment in the mining industry was reduced 28 per cent over the previous year, companies reporting to the National Safety Council represented 34,000,000 man-hours during 1931. Accident frequency at these plants was reduced over 6 per cent and accident severity 8 per cent during the year. Figures of larger scope, now available for certain branches of mining since the early returns were furnished to the Council, show that anthracite mines reduced their accident frequency 2 per cent in 1931 over the previous years, bituminous coal mines lowered their frequency rate 12 per cent, metal mines 20 per cent, non-metallic mineral mines 10 per cent, and mills and smelters 27 per cent.

The number of accidents and the number of man-hours worked have greatly declined in recent years at both metal mines and coal mines. Some of this decline was doubtless the result of poor markets, but much of it represents increased efficiency due to improved operating methods. Metal mines have succeeded in reducing accidents at a more rapid pace than the decline in man-hours, and the result has been a gratifying reduction in accident frequency per million man-hours of exposure. Coal mining, on the other hand, while also marked by fewer accidents, at least fatal accidents, and fewer man-hours of exposure, has not reduced accidents quite as fast as man-hours, hence the accident frequency rate for coal mines over a term of years has shown a mild upward trend. Nevertheless, the rate last year seems to have gone down, and there are indications that the rate for 1932 is also declining; which may indicate that the tide has turned and that the coal industry, as well as the metal industry, will reduce its accidents to an extent equal to or greater than it lowers the number of man-hours required to mine a given quantity of coal.

The report of the Poster Committee, presented by J. J. Forbes, U. S. Bureau of Mines, Pittsburgh, Pennsylvania, chairman, showed that during the year over 350 safety posters had been issued by the National Safety Council suitable for use by members of the Mining Section.

Report of the Secretary

The report of the Secretary, D. Harrington, U. S. Bureau of Mines, Washington, D. C., revealed that "1931 has established a record of low rates of accident occurrence in both coal and metal mining." Approximately 1430 persons were killed in coal mines in the United States in 1931 against an average of 2409 annually for the previous 25 years. The 1931 fatality rate of about 3.27 persons killed per million tons of coal mined is the lowest rate achieved in any year of the present century; and for the first eight months of 1932, the rate was lower than for the similar period of 1931. Explosions caused only 86 fatalities as compared with 264 in 1930, and as compared with an average of 341 annually from 1922 to 1930 inclusive. From January 28, 1931, to November 3, 1931, or over nine months, the bituminous mines of the United States did not have a major explosion disaster (one in which five or more lives were lost). While numerous factors contributed to this long period of avoidance of major explosions, at least three major disasters unquestionably were prevented by rock dusting.

In 1931 Alaska, Michigan and Texas had no fatalities in coal mines and every other coal producing state except Indiana, Montana, North Dakota and Maryland had fewer coal mine fatalities in 1931 than in 1930. Alabama, New Mexico, Ohio, Oklahoma, Utah and Washington all reduced coal mine fatalities 50 per cent or more in 1931 as compared with 1930 and usually the dominant factor in this reduction was the avoidance of mine explosions.

For the first eight months of 1932 the fatality rate is but 3.126 deaths per million tons of coal mined, which is a definite improvement on the rate of 3.384 for the first eight months of 1931, or the 3.27 rate for the entire year 1931. The anthracite mining industry also is showing definite progress in safety in 1932, with but 148 deaths for the first eight months, as against 265 in the first eight months of 1931; the 1932 rate in anthracite mining up to September 1, 1932, being 4.829 and that of the first eight months of 1931 having been 6.657.

During the past year many remarkable safety performances in mining have been achieved. In metal mining the Miami Copper Company worked more than 30 months or more than 30,173,000 man hours and produced nearly 13,300,000 tons of ore from underground workings without a fatal accident. The Utah Copper Company operated its open cut mine for a three-year period without a fatality and moved more than 75,000,000 tons of rock and ore, the man-hours of exposure being almost 11,000,000.

Coal mining companies, too, recently have achieved safety records almost unbelievably good; at least five fairly large producing coal mines have been able to operate a year or more without a single lost-time accident, these being the Dehue mine, The Youngstown Mines Corporation, Dehue, West Virginia; the Brier Hill mine, The Buckeye Coal Company, Brier Hill, Pennsylvania; The No. 1 mine, Phelps Dodge Corporation, Dawson, New Mexico; the Alloy mine, Electro Metallurgical Company, Alloy, West Virginia; and the Imboden mine, Stonega Coke & Coal Company, Imboden, Virginia.

The cement industry continues its excellent safety performances and now at least eight cement plants have joined the thousand-day club, having not had a lost-time accident in 1000 or more days. The Iola, Kansas, plant of the Lehigh Portland Cement Company has worked for six years without a lost time accident and in that period had nearly 2,300,000 man-hours of exposure and handled practically 1,350,000 tons of cement rock; and the Sandts Eddy quarry of the Lehigh Portland Cement Company, with an average of 33 employees, has not had a lost-time accident from February 17, 1926, to at least September 1st, 1932, the exposure being practically 666,000 man-hours during which over 2,300,000 tons of rock were produced. Another remarkable safety performance is that of the underground mine of the Alpha Portland Cement Company, Ironton, Ohio, which has not had a lost-time accident since September 21st, 1926—over six years. During the period its employees have worked 999 days with a total of 569,848 man-hours of exposure.

Fifty-four new chapters of the Holmes Safety Association were established last year, bringing the total number of actively functioning chapters now to over 150, with a membership about 50,000. Dozens of instances are at hand in which actual figures have been furnished indicating that after Holmes Chapters have been installed and kept in active working order, accident occurrence has been reduced materially.

Chairman Comins, at this point, introduced George Opp, Safety Engineer, The Detroit Edison Company, Detroit, who made an inspirational address, stressing the finer points, or what might be termed the altruistic phases, of accident prevention work. Mr. Opp spoke extemporaneously, and no record is extant.

Some Data on Lighting in Underground Mines

By C. W. OWINGS

Associate Mining Engineer, U. S. Bureau of Mines, Pittsburgh Experiment Station, Pittsburgh, Pa.

Lighting is of paramount importance in reducing accidents and in increasing safety underground. Light, by definition, is an essential condition of vision; it is that form of energy that produces vision. Light and life, both having "l" as the first letter, are, perhaps, significant of the necessity of light in order that man may live. In opposition to this thought, two words starting with the letter "d," darkness

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The importance of accident costs may be emphasized by comparing them with the cost of waste material, defective work, waste time and broken equipment.

Accident costs should be compiled every month and cumulative figures can be given at least every three months. These accident costs should not only be studied by the plant management, but should be "brought home" to other members of the supervisory group, including the foreman.

Costs may be advantageously compiled for each foreman's department. They should be compared from month to month and from year to year. The costs should also be compared with those various departments, between plants, between companies, and between industries.

The foreman may be made to take accident costs seriously by including such accident costs as an important element in figuring his bonus or his salary. It should be charged against his controllable expense. He should be made to explain all the details of every accident which might have been serious.

Cooperation

By WALTER A. SCHAEFER

President, Casualty Underwriters Ass'n of New Jersey, Newark

The speaker discussed many phases of the awards made under State Compensation Laws and outlined the difficulties of insurance companies in this connection. He pointed out in particular the steady increases in percentage of money payments made to injured employees in permanent partial disability cases. These percentages, as presented by him, were as follows:

1928 calendar year, 57.2 per cent of the whole.
1929 calendar year, 62.0 per cent of the whole.

No figures were available for the first six months of 1930, therefore, the next figures submitted were for—

1930-1931 fiscal year, 64.0 per cent of whole.
1931-1932 fiscal year, 64.6 per cent of whole.

The closing paragraphs of his paper may be quoted in part as follows:

Cooperation usually demands not only courage and self sacrifice but it requires wisdom as well. It seems to be a basic instinct to be concerned only about personal needs and to shrug the shoulders as to broad issues requiring co-operation.

I marvel that in a business like the insurance business there should be so little co-operation. Without the collective determination of rates our business could not exist. Beyond some co-operation in making up the rates we seem to stop and revert to the secretive, jealous, competitive methods of our barbarian forefathers.

The final feature of the Rubber Section Sessions was a "Court of Inquiry" presented by the Akron Rubber group, and directed by H. W. Low, Safety Engineer, Miller Rubber Product Co., Akron, Ohio. This was an interesting playlet depicting in dramatic form the circumstances and progress of an investigation of an industrial accident.

Those who took part in the drama, as outlined in the "cast of characters," were as follows:

Plant Manager—H. W. Low, Miller Rubber Co., Akron, Ohio.
Engineer—J. O. Lee, India Tire & Rubber Company.
Safety Engineer—W. L. Schneider, B. F. Goodrich Company.
Foreman—J. T. Kinney, Goodyear Tire & Rubber Company.
Witness—B. F. Gerpheide, Goodyear Tire & Rubber Company.

(This playlet has already been published in the January issue of the Rubber Section News-Letter; copies may be had on request.)

ADJOURNMENT

TWENTY-FIRST ANNUAL SAFETY CONGRESS
NATIONAL SAFETY COUNCIL

Safety Section, A.R.A.–Steam Railroad Section, N.S.C.

Section Officers 1931-32

Chairman—C. T. BAILEY, Chief Safety Agent, Oregon Short Line Railroad.
First Vice-Chairman—C. E. HILL, General Safety Agent, New York Central Lines.
Second Vice-Chairman—C. L. LAFOUNTAINE, General Safety Supervisor, Great Northern Railway.
Secretary—J. C. CAVISTON.

(NOTE: The following pages contain a condensed abstract of the records of the sessions of the Safety Section, ARA—Steam Railroad Section, NSC, as published in full by the American Railway Association in a booklet entitled, "Proceedings of the 12th Annual Meeting of the Safety Section, Washington, D. C., October 4 to 6, 1932.")

TUESDAY MORNING SESSION

October 4, 1932

The sessions of the Safety Section, American Railway Association—Steam Railroad Section, National Safety Council, convened in the Hotel Washington with Chairman C. T. Bailey, Chief Safety Agent, Oregon Short Line Railroad, Salt Lake City, Utah, presiding. The invocation was given by L. G. Bentley, Chesapeake & Ohio Railway.

Report of Committee on Relations with National Safety Council

By ROBERT SCOTT

Director, Insurance and Safety, Atlantic Coast Line Railroad

Mr. Scott said in part: Your committee finds pleasure in reporting that much satisfactory progress has been made in the direction of co-ordinating the work of both sections with the view of avoiding duplication of effort and expense and to the end that the cause of safety might be advanced.

The first annual meeting of the Steam Railroad Section, National Safety Council, was held in Philadelphia in October, 1915, while the Safety Section of the American Railway Association held its first special session in Boston in September, 1921. Both of these sections have been functioning properly and well ever since they came into existence, and have been a powerful force in the reduction of avoidable accidents.

On September 2, 1931, a meeting was held in Chicago at which there were present members of the committee on relations and officers of both sections. At this meeting

it was decided to recommend the proposed merger to executive officers of the American Railway Association and the National Safety Council, both of which have approved the procedure, the continuance of which must necessarily depend upon the results obtained and subsequent safety conditions.

It is fully recognized by both sections that there is a broad and fertile field in which each one can carry on its labors. There is also the realization that safety on the railroads is essentially the problem of railroad men. On the other hand, steam carriers are so closely identified with the public that they can, to fine advantage, avail themselves of such facilities as are offered by the National Safety Council toward securing moral active support in matters of public safety.

Thus, this meeting, held at the same time and place with the National Safety Council, is strongly indicative of the work of your Relations Committee. It is believed further things will be accomplished in bringing about co-ordination of effort in these and all other organizations having as their aim the advancement of safety for the benefit of mankind.

"Joining Hands"

Following Mr. Scott's report, the ceremony of "joining hands" was carried out, being participated in by representative officers of the Steam Railroad Section, National Safety Council, and of the Safety Section, American Railway Association. The National Safety Council was represented by George H. Wartel, Assistant to the Vice-President, Union Pacific System, General Chairman of the Steam Railroad Section, and the Safety Section by C. T. Bailey, Chief Safety Agent, Oregon Short Line Railroad, Chairman of the Safety Section, American Railway Association.

Mr. Wartel said in part: My friends, I believe it is entirely fitting that we should begin these sessions together with a ceremony of "joining hands." It is significant of a wedding ceremony, although I must confess that I have not brought a ring with me. However, I do not know that we could be any more firmly married by any ring presentation or any other formality that might be gone through with. I want to assure you, on behalf of one of the high contracting parties, that I do here and now promise on behalf of the organization that I represent, to honor, love and cherish the partner that we have taken, and I assume that the partner is willing to make the same pledge, to the end that together we may accomplish more, may do what all who team up for a life purpose seek to accomplish, to make the world better for their having been in it, to, by example, by precept and by mutual encouragement, accomplish more than either of us could ever accomplish apart.

And so, on behalf of the National Safety Council, I am glad to here formally ratify the merging of the Steam Railroad Section of the National Safety Council and the Safety Section of the American Railway Association.

Mr. Bailey then said in part: Mr. Wartel has expressed the sentiments of one of the high contracting parties to this agreement. I acquiesce thoroughly in the sentiments he expressed. I feel that this consolidation is a step in the direction that we have all been striving for during a number of years. I feel that the accomplishments of this consolidated safety effort on the part of American Railway safety workers will be far reaching. It has opened a vast field for our endeavors and I feel that when we have accepted these responsibilities, the objects we attain through our activities will be more far reaching than ever.

The Chairman's Annual Report

Chairman C. T. Bailey then gave his annual report of the activities of the Section during the past year. This was largely a catalog of the various standing committees, with a resume of their activities, all being mentioned and commended highly. In particular, Mr. Bailey had the following to say of the sustained every-year safety program the railroads have been following:

"A resolution was adopted in Salt Lake City early in 1924, calling for a reduction of at least 35 per cent in accidents by the end of 1930. The general reaction to this endeavor was gratifying. The goal set has been more than accomplished. At the annual meting held in Denver in 1930, it was decided to continue the plan of having a goal to shoot at, and our all-the-year—every year—safety program has been carrying on with the slogan 33 by '33.

Gratifying progress has been made by all Class I railroads in the campaign of reducing the frequency of casualties on American railroads 33 per cent by 1933. In fact, the frequency of reportable injuries to the I. C. C. for employees on duty per million man-hours in 1931 was 19.64 per cent less than in 1930, and the same proportionate decrease is apparent for the first six months of 1932. In 1923, there occurred on Class I carriers of this country 30.89 personal injuries to employees on duty reportable to the I. C. C. per 1,000,000 man-hours worked. In 1931, this had been reduced to 7.51 per 1,000,000 man-hours worked, a total reduction of 75.66 per cent. These accomplishments in reduction of personal injuries are the result of the all-the-year-every-year-safety program."

The Cooperative Objectives of the National Safety Council and the Railroad Industry

By ARTHUR H. YOUNG

Industrial Relations Counselors, Inc., New York City

The speaker said in part: It is clear that the safety objectives of the railroads divide themselves quite naturally into two parts. The first we might term the internal objective, and the second, the external or public objective. Let us consider the co-operative objectives of the National Safety Council and the railroads in terms of the first, or internal problem.

Long before the days of the airplane and the automobile, the railroad industry and the public at large both recognized the absolute necessity for safety in railroad operation. This was attested by the regulatory measures imposed by both Federal and State Legislatures. Almost every conceivable kind of legislation was created at one time or another to protect passengers using rail transportation. There was little thought of public obligations and the problem was one which rested entirely upon the shoulders of railroad management. The public demanded that railroad operations be made safe and secure, not, it is true, from the standpoint of the railroad employee, but rather for the benefit of railroad users.

The first step in the evolution of railroad safety then was an engineering development working toward the elimination of physical hazards. This was followed by the establishment of physical and mental standards requiring railroad employees holding responsible positions to prove their capability before they were placed behind the throttle or in any other place where their judgment was required to protect lives and property. Still the pressure which brought these regulations into effect emanated from a point of view focused on the protection of everything but the employee's life and limb. Perhaps no other industry can so easily prove the correlation that exists between safety and efficiency of operation as the railroads. Human breakdown meant disaster to the railroad and it is most interesting to observe the paradox that existed at one time in the earlier history when everything possible was being done to insure safety of operation for the sake of efficiency and economy while at the same moment railroading as an occupation was classed as extremely hazardous.

The National Safety Council has played an honorable and important part in this fine work. The early organization of the Council's Steam Railroad Section brought together for the first time the interests of the railroad safety men. Through the Steam Railroad Section, which has always been one of the largest and most active groups within the Council organization, there has been developed concentrated information having to do with the prevention of accidents peculiar to railroad opera-

tions. Through its News-Letters and its various committees it has functioned as a specialized clearing house, yet it has had at its disposal the machinery and facilities of a much larger organization devoted entirely to safety. The National Safety Council has gathered the experience of employers in all industries for 20 years and in this time has gathered together a mass of information on accident prevention methods which will probably never be duplicated anywhere. The Steam Railroad Section has had access to and has helped to accumulate this experience which furnishes the background for the comprehensive and practical service for management.

I hope I may not be accused of digressing from my subject if I ask your indulgence to sketch hastily a few of the fine services the Steam Railroad Section members receive.

The production and distribution of the 63 National Safety Council safety posters every month is almost a business in itself. It requires a constant study of accident producing hazards, it requires a thorough understanding of advertising art and a creativeness and ability to express ideas. It would interest those of you who have not had intimate contact with the Council to know that every poster, just as every other publication, is not made ready for distribution until practical operating men have given their final judgment and approval.

But the ability to provide these posters for educational work among employees would not in itself justify the faith, confidence and support of thousands of Council members. In my estimation one of the finest services rendered by the Council is that of the Industrial Engineering Division which correlates the activities of the sections, continuously supervises and carries on research projects, and furthers the constant interchange of ideas among all the members. An average, even in these quiet times, of 500 inquiries each month, asking for help on individual specific safety problems, comes into the Council headquarters, and in spite of the tremendous amount of data on hand many of them require special and detailed work to ferret out the answer. Sometimes, out of these many inquiries, there comes to light a constantly recurring problem which requires thorough scientific research of permanent and enduring value. You men who have the privilege of Council membership and do not use this fine consulting service are missing an opportunity to capitalize on the dearly acquired knowledge of someone else. Conversely, you men who have solved a difficult problem and have not made it available to the Council and thousands of members should feel guilty of neglect. We should always remember that safety is a human problem and experimentation in methods of preventing accidents is often measured in terms of life destruction.

Most of you already know of the splendid work over a period of many years in the development of safe practices pamphlets and of their reference value to every safety man. I can say advisedly that no other organization could possibly gather the data represented in these pamphlets nor could the same practical and intelligent help be obtained on a voluntary basis by outside authority in their compilation.

A most distressing and discouraging aspect of the Council's membership problem is lodged in the attitude of many of the members themselves. This is by way of saying that the Council has to spend much of its energy educating members in the extent and use of its service to which they are entitled. I earnestly appeal to you members to make an annual review of the Council's service. It would be an ideal condition if all the members of all of the Sections used every service to its maximum and it would be interesting to see the results in terms of accident prevention. A real understanding of the Council's membership service is the first essential in the development of the program designed to get maximum benefit from the small investment required.

A phase of this strange attitude developed a short time ago when the president of one of the large railroads authorized the withdrawal of its membership from the Council. The president said, "We were forced to withdraw all our contributions." For some peculiar reason, no one had ever taken the trouble to explain to this railroad president what the actual service of the Council was, and although he knew of the Council's work in a general way, he had no conception of its comprehensive activities. When interpreted to him, he unhesitatingly renewed the service and incidentally gave rather pointed orders that the material available should be used to the limit.

Let me remind you that one of the objectives of the Council's Steam Railroad Section is to give to you men the very best tools which co-operative action can create for the prosecution of your safety program among your employees. I must not pass from this discussion of the Council's part in your internal safety problems without mentioning the Railroad Employees National Safety Contest started five years ago and set up for the purpose of furnishing competitive incentives to reach the goal you yourselves, set in 1923. As I study the Green Books that have been used, I can readily understand why this contest with its attendant publicity has aroused the interest of railroad executives throughout the country. On numerous occasions I have heard railroad executives express their deep interest in these annual contests and their appreciation for the incentive to increased effort in accident prevention sponsored by the awards.

Now we pass to our second co-operative objective—the public or external safety problem.

From a purely commercial standpoint, safety is perhaps the biggest selling point the railroad industry has in its appeal to the public. However, it is not only in the use of railroad transportation service that the public is interested in safety. Not so many years ago there was no such thing as a grade crossing problem for in the horse-and-buggy days the railroad could add horse sense to what was lacking in human sense for the protection of road users. Now we witness the spectacle of about one out of every five persons acting as his own engineer and driving a powerful machine over paved highways at terrific speed and subject to no other control than his own sense, which is largely lacking. There is little recognition among individual automobile owners and operators of the principles of mutual responsibility in the prevention of traffic accidents. When the motorist is made to accept his share of responsibility he will also be willing to accept his share of cost as a taxpayer in building physical safeguards, but, contradictory as the statement may seem, when this day comes it will probably be unnecessary to build these physical safeguards.

The pertinent question before you men and before your industry is, "Who is going to get the idea of mutual responsibility across to the public?" There are numerous complexities and involvements in this job. Even a superficial analysis of this problem would indicate the need for an arbiter or at least an interpreter of the points of view held by the railroads and the lay public. After all, the real question is not, "Who is to blame for crossing accidents or any other type of accident involving the railroad?" but rather, "How can they be prevented?"

That is our co-operative objective. To reach it, however, may I say again, we must have an understanding of our mutual responsibilities. You will agree that it is difficult in human relationships to convince a man that he should pay for something for which he thinks you are responsible. The grade crossing is the most popular example. The imagination of the public is easily caught by the demagogue who believes he can advance his personal popularity by selling a grade crossing separation project to the public at the cost of the railroad. The railroads, on the other hand, feel they have much to support their contention that the expense of a tremendous engineering project should be at least shared by the public who demand it. The reasoning reaches an impasse. There has been developed a public habit created through the years that railroads should pay for all improvements looking toward operating safety and backed by the common belief that inasmuch as the railroads created the grade crossing problem, they should also solve it. The railroads in their turn say that the paved roads and the automobile created the grade crossing problem. It is certainly likely one group will not be able to convince the other and

it is probable that some unbiased influence must come into the picture to bring the opposite points of view into focus. Court decisions, whomever they may favor, leave in their wake a string of resentment.

The National Safety Council has the confidence of the public and it is hoped the Council has the confidence of the railroad industry, also. Safety must be made reasonable and interpreted as such. Through a process of education the public must learn to share responsibility. Let me remind you that the Council as a non-partisan influence has done more than any other agency to bring about a national consciousness of the safety problem and all of its aspects and ramifications.

Let me remind you specifically of a few of the Council's public safety activities which influence the public attitude toward safety. Every daily newspaper in the United States is reached regularly by the Council with special publicity releases. More than 12,000 copies of *Safety Education* magazine with Lesson Outlines are distributed monthly in our primary school systems, influencing the actions of little children for safety. Hundreds of civic organizations have directly affiliated with the Council and are taking leadership parts in their communities for public, street and home safety. The Council has given active and strong support to the National Conference on Street and Highway Safety and is energetically and increasingly encouraging the enactment of legislation like the Drivers' License Law which forces the individual to accept responsibility when driving on the public highways.

More important, perhaps, than all of the specific activities I could name that now tax the Council's resources and leadership, is the stark fact that the Council is known not to have any economic interest whatever to activate its plea for accident prevention. It stands as a monument to co-operating, unselfish, idealistic efforts to preserve our greatest national asset, which is human life. It is on this foundation that it has won respect and confidence.

Safety Today

By THOMAS H. CARROW

Superintendent of Safety, Pennsylvania Railroad, Philadelphia

The speaker said in part: Safety today is an operating matter that requires the same analytical, thoughtful attention that every other operating matter requires, and the success of any railroad, any division or department of a railroad in safety, will be proportionate to the constructive attention given it.

Prior to ten years ago, the so-called safety movement consisted almost exclusively of propaganda, persuasion and evangelical appeal. As the subject developed, our knowledge increased and we soon found that safety had to be treated exactly like any other important problem. Every aspect of it had to be analyzed and a conclusion reached exactly like you would in an engineering problem. The first step in safety, then, was the acquisition of knowledge. The second step was developing ways and means of imparting the knowledge; and the third and last and the most important step of all was to induce the action that the knowledge ought to cause people to take but which people do not take unless they are obliged to take it.

Instead of speaking of reductions in accidents, in the future the average railroad officer is going to ask his operating officials, "How far short are we from the best record it is possible to make?" Not whether you have made a reduction of 50 or 75 or 80 or 90 per cent, but how poor is your performance today? Not, how good is it, but how much further must you go before your performance is acceptable to the management of this railroad?

Last year 621 employees of the American Railroads were killed and 21,417 were injured. The total casualty rate was 7.50; that is to say, to remember it easily, 7½ per million man-hours. Compared with 1923, the reduction is 75 per cent.

Let us see how these accidents are distributed among departments. In the maintenance of way department we are having approximately 5,200 casualties per year, which makes up 24 per cent of all the employee accidents on the railroads. In the maintenance of equipment department we find approximately the same number of injuries, that is to say specifically 43 per cent, and their casualty rate is roughly 7 per million man hours: the reduction since 1923 is 86 per cent, an almost unbelievable figure. There were 2,200 casualties to transportation employees last year, mostly station laborers, freight handlers and other outside platform men.

It is interesting to note the variation in rates among the various railroads. In the maintenance of way departments the variation ranges all the way from 2 to 15. In the maintenance of equipment departments the rate ranges from 2 to 10. The variation in the rate in the train service on the railroads ranged from 4 to 20. In a list of 14 railroads in Class A, the road that occupies the top of the list has a rate of less than 2 per million man hours while the one at the bottom of the list is more than 12.

What may we expect the employee casualty rate to be for the year ending December 31, 1939? I am prepared to say that it ought to be less than 4 casualties per million man hours; it is now 7½.

This is predicated upon several propositions. First, nearly all accidents are preventable. The second proposition is that half of all roads are now worse than the average and it will be comparatively easy to bolster them up to as good as or better than the average. The third proposition is that a number of roads regularly make rates less than 3. That is a very impressive thing that there are several railroads that haven't gone over 3 in this country in the last two or three years. The fourth proposition is that it pays from every standpoint to have a good accident record.

Any management of a railroad that considers these four propositions will certainly put the machinery in motion to achieve desired results.

Singularly enough, the percentage of reduction that is required to achieve a rate of four employee casualties per million man-hours will not be as great as it was to achieve the present one as compared with 1923.

Address

By R. H. AISHTON

President, The American Railway Association

The speaker said in part: I watched your ceremony of "joining hands" this morning with a great deal of interest. I feel that this action that has been taken during the past year, and which you have consummated and sealed today, offers the possibility of great returns in what you are all striving for, and by your unity of effort will, I know, bring about greater safety to the public. All I can say is, don't let little things interfere with this great opportunity. I feel that from this union you have ratified and agreed upon will come great things for the attainment of which both organizations have been striving. You both have accomplished great things. United you will accomplish greater things.

The obligation of the railroads has always been to furnish adequate, safe, and efficient service, and continued service. Railroads, like no other industry, are rigidly regulated, but the crucible of science, regardless of regulation and all that kind of thing, has shown to railroad managements that safe railroading is good railroading.

On behalf of the railway executives of this country (I am authorized to speak for them), I want to again extend my sincere and their sincere and hearty congratulations on the work that has been accomplished and the plans for the future for the Safety Section.

For the past decade you have been climbing along the hill toward your goal of complete freedom from accidents. The pathway at all times has been steep and for three years past, three bitter years, it has also been narrow and dark—narrow because

in the stress of economy it has been necessary drastically to restrict all expenditures, and dark because the economic depression kept our backs and shoulders bowed to the storm which has raged around us—but during all this stress, you gentlemen of the Safety Section have carried the banners of safety and safety first flying, and your shock troops have been supporting and defending them and there has been no let-up. While there have been let-ups in other directions, there has been no let-up in this safety movement, even with your depleted forces.

Now, as we approach the crest of the hill, the slogan "33 by '33" floats down to our ears from the throats of thousands whose lives have been spared by the drive for safety. I see the light growing clearer ahead and as we lift our heads and throw back our shoulders, I see a smoother, broader, lighter pathway with more moderate slope stretching away to the green meadows above. The storm clouds are breaking, the warm rays of the economic sun are gradually coming through; doubt and despair are nearing their end.

TUESDAY AFTERNOON SESSION

October 4, 1932

Report of Committee on Prevention of Highway Crossing Accidents

By H. A. ROWE

Manager, Claims Department, Delaware, Lackawanna & Western Railroad, New York City

The speaker said in part: The Committee is again gratified to be able to announce a further reduction of grade crossing accidents, fatalities, and injuries in 1931 as compared with 1930. Thus we have had three consecutive years of progress in the curbing of crossing crashes, the records being as follows: 1931, total accidents 4,100, killed 1,811, injured 2,957; 1930, accidents 4,853, killed 2,020, injured 5,517; and in 1929 there was a slight reduction.

The year 1928 was the peak year in railroad crossing fatalities, since which time the reduction of such fatalities has been 757 per year, the 1931 record being but one more killed than in 1922, when the careful crossing campaign was inaugurated.

The outstanding accomplishment of crossing accident reduction can be better grasped when we note that motor vehicle fatalities on streets and highways in 1922 were 15,676 but in 1931 there was an increase of 18,913 deaths or 139 per cent. During this same 10-year period there was an increase of but one death at railroad crossings.

A very important feature of the committee work has been the careful crossing campaign which has continued to enlist the interest and cooperation of many organizations and the general public. This has been furthered by general publicity, the regular posters initiated for this special campaign and other literature.

During the past year the National Safety Council has been active in its educational campaign for the prevention of accidents, and in its May, 1932, issue of the *National Safety News* contributed a most useful and illuminating frontispiece. The crossing accident situation was stressed in the same issue of the *News*, and in many other respects the National Safety Council has shown deep interest in cooperating in the prevention of crossing accidents.

Opportunity is presented for a fuller enjoyment of the facilities offered by the 41 Community Safety Councils associated with the National Safety Council. Collectively, 30 Councils reach 808,000 school children through 3,141 meetings. Railroad safety representatives, cooperating with such local Councils, have an excellent opportunity of extending the gospel of careful crossing over railroads. These Councils hold vast numbers of other meetings and should be regarded as fertile soil.

On May 18, 1932, the Committee put into effect a check of various railroad crossings throughout the nation, to determine the character of the traffic over such crossings, both train and vehicular, to note the performance of duty by railroad employees, and the care or lack of care exercised by vehicle drivers. The survey was made by 66 railroads in 47 states for an 8-hour period at 302 crossings, at which all types of protection were represented, including the triple standard cross-buck signs. While the survey was in progress, 4,394 trains and 330,434 motor vehicles passed by.

Of the drivers thus under observation, 75 per cent exercised reasonable care; 13 per cent were classed as definitely reckless and 12 per cent were on the border line between care and lack of care. Seventy instances were noted in which motor car drivers had particularly narrow escapes from injury. There were 143 instances where drivers of school buses failed to bring their buses to a stop at crossings.

It was noted that 3,215 of the train movements over crossings were preceded by proper warning whistle signals. In 681 such movements the warning by bell was adequate. Allowances were made where the crossing signals were omitted because of municipal ordinances. A number of instances were found where the signals given by approaching trains were sufficient to warn, but not in strict accordance with A. R. A. Standards.

Address

By HONORABLE W. N. DOAK

Secretary of Labor, United States Government, Washington, D. C.

The speaker said in part: I am interested in the safety movement, especially on the railroads. In an address I gave the other night, I said I was very glad that I had graduated from the university of hard knocks, that I had come up through all kinds of hardships, and that by choice I had entered several years ago an occupation that was considered the most hazardous of occupations, but an occupation which has been removed from that hazardous class and has become one of the leading non-hazardous occupations in the country today.

I want to congratulate the safety first men on these railroads on the wonderful work they have done in educating the railroad employees as to the value of safety. I know all railroad men are grateful for the interest that has been taken by the management themselves.

You have done a wonderful work for the protection not only of the railroad employees but for the protection of the public. The public, I am quite sure, owes you very much for what you have tried to do to cut down accidents, which are not only expensive but dangerous both to the public and to employees, and your movement for the education of both railroad employees and the public at large, through this safety movement, has been a wonderful success. I hope you reduce accidents until we don't have any. But the accidents at grade crossings, of course, are not wholly the fault of railroads and employees. This great public that is competing with you railroad men is sometimes at fault. You are doing, however, a wonderful job and I hope you will meet with the same success in the future that you have in the past.

The Railroad Trespass Evil

By H. L. DENTON

General Superintendent of Police, Baltimore & Ohio Railroad

The speaker said in part: This problem is one of grave concern to the railroad police officer, and one which is constantly requiring his attention. During the past few years there has been a very large increase in the number of adult trespassers,

due to general business conditions. Many of these trespassers are good citizens who are going from one community to another seeking employment.

People as a whole do not see the railroad trespass situation from the standpoint that those of us who are interested in safety do. They see no harm in a man getting a ride on a freight train from one point to another, feeling that the railroad has lost nothing through such conduct. They do not seem to realize that the railroads' principal thought in eliminating the trespasser is from a safety standpoint, and I believe that this condition is not only prevalent among the public who are non-railroaders, but it is quite prevalent among the rank and file of railroad employees. There is also a malicious hazard, however, as we know from experience.

The average illegal train rider is not familiar with railroad safety devices, and he places himself in jeopardy continually when he is on a train. We have had many injuries to trespassers, some of them fatal, due solely to the fact that they do not know what is a safe practice and what is not a safe practice around the freight train. They ride on top of box cars, are injured by coming in contact with overhead structures, and they attempt to get on and off trains when they are moving too fast.

The adult is much harder to reach in matters of this sort than the juvenile. I believe that we have had some success on the Baltimore and Ohio, as far as the juvenile is concerned. The opportunity to reach him is somewhat different. It is our policy when a child is found on our right of way to secure his name and address and the name or number of the school that he attends. If the child lives within a reasonable distance of the railroad, the officer is instructed to take him home and to advise his parents that he has been found on railroad property and the danger of such trespassing. The visit of the officer to the home is followed up by a letter from the Division Head to the parents, and this letter not only gives the facts about the trespassing, but explains in some detail the danger which the child has incurred by being among the tracks on the right-of-way. The letter also asks for the co-operation of the parents in keeping the child off of railroad property, and encloses to the parents some literature that will help to impress upon the mind of the boy what might happen to him on busy railroad property. Another communication is addressed to the principal of the school which the child attends, advising the principal of the fact that the child has been found trespassing on railroad property and requesting his cooperation also, in explaining to the child the danger of such practice.

We find that communications addressed to the principals of schools are acted upon very favorably. The principal calls the child who offends to his office and endeavors to impress upon him the danger that he places himself in when playing around the railroad. Quite frequently, also, the parents of children are pleased to hear from us and so express themselves. We have had many letters from such parents in which they thanked us sincerely for our efforts to keep the boy out of danger and have described their home methods of discipline and instruction.

Uniformity in Defining and Reporting Accidents

By DR. M. O. LORENZ

Director, Bureau of Statistics, Interstate Commerce Commission, Washington, D. C.

The speaker said in part: We have a book of rules for reporting steam railway accidents which has been in force since 1922, and, generally speaking, we have a uniform observance of those rules among all railways.

The only question is as to the degree of variation in applying the rules in certain details to the officers of the various reporting companies. As to fatalities, I think we have practically complete uniformity and reliability. The Claims Department may handle more death claims than the number of fatalities reported to the Interstate Commerce Commission, but when account is taken of the number of persons dying after 24 hours following injury, these being reported to us separately as "subsequent fatalities," and of the cases not arising from the operation of a railway and hence not reportable, it probably will be found that we are getting complete reports of fatal railway accidents on a uniform basis from railways in the United States.

But it is not so clear in the matter of injuries. The interpretation of the three-day rule is not uniform. It is true, we have issued instructions regarding the precise way in which the counting of the 3-days shall begin and end. That is not where the primary difficulty lies. It is in the variation in practice in getting people back to work promptly and in the interpretation of the phrase "sufficient to incapacitate him from performing his ordinary duties for more than three days."

In our interpretation of doubtful cases, we have regarded some instances as not reportable where the victim was able to follow his regular occupation within three days but with the assignment of somewhat lighter duties. Possibly we should make it clearer that we mean that the employee should be able to go through the same kind of motions that were performed prior to the accident by that particular employee. This would take some flexibility out of the rule and lead to greater uniformity. Where a man's assignment on his return to work is changed for other reasons than his physical condition, the determination of reportability would, of course, depend on the doctor's opinion as to whether he could reasonably have been assigned to the previous activity.

It is true, if all railways are doing this to an equal degree, there would be a lack of uniformity not among roads, but merely as between the totals for present and past years. But probably this incentive to restrict reports to a minimum has not affected all roads to an equal degree because some managements are doubtless more enthusiastic about safety contests than others. This disturbing factor in our statistics will in the end prove beneficial in leading to more exact study of what should be a reportable accident. The lack of comparability in the annual totals for various years will be temporary and will come to an end when all roads have gone as far as they can or want to go in getting people back to work promptly.

I do not wish to be misunderstood in inferring that the marked reduction in injuries shown by the statistics in recent years is all a fiction. On the contrary, there has been a striking improvement, as shown by the fatal accident rate which I consider accurate. The number of employees killed per million man-hours in the prosperous year 1923 was 384 compared with 308 in the most recent prosperous year, 1929. In 1931 the figure was down to 212. Apparently the industrial depression has reduced accidents more than in proportion to the decline in employment, for the reduction from 308 to 212 can hardly all be due to safety efforts in two years.

Other factors to consider in interpreting the decline in the ratio of injured to killed are, (1) that better surgical care tends to prevent trivial injuries from becoming serious enough to be reported, and (2) that in recent years the intensive work on safety in shops, where fatalities are relatively few, would tend to reduce injuries more than fatalities in the grand total for all employees. From 1888 to 1924 there was a tendency for the ratio of injuries to fatalities to increase. It was approximately 10 to 1 in 1888, 16 in 1900, 28 in 1910, 58 in 1920, and 81 in 1924. The 3-day rule was not changed in that period. Possibly the explanation is that the preponderant safety effort to prevent casualties in connection with train and car movements reduced the deaths more than the injuries in the grand total for all employees, since injuries are relatively fewer in such accidents. Also, injuries may have been incompletely reported before 1915.

Whatever the relative importance of these various factors may be in affecting the comparability of the total casualty rate in railway accident statistics from year to year, I think we are getting more nearly accurate reports than ever before because of the close attention that is given to what is a reportable accident. I know that safety officials are earnestly seeking the facts and I think they will accept the responsibility of putting uniformity and reliability of the reports above suspicion.

Safety—Its Application to the Individual

By D. F. STEVENS

General Superintendent of Transportation, Baltimore & Ohio Railroad

The speaker said in part: The experience gathered from 25 years of railroad work has enabled me to classify the railroad worker in his relation to safety into three classes. In the first class I might place the employee who is inherently safe under any condition of routine service; second, the employee who has convinced himself that safety is a fine thing for every one else, but that he *himself does* not need it; and third, the employee whose attitude is almost openly antagonistic and who is generally a fatalist.

Men who may be classified as safe under any condition of routine service are usually characterized by loyalty, dependability and stability. I would say their home lives are usually such that they do not carry with them to their work any mental conditions that might aggravate or disturb them as they perform their duties, and as a result they can think clearly. They are the people who do not become easily excited; because their nerves are in good shape, and they are able to face any situation that normally arises with clear thinking. I believe that 90 per cent of the railroad people come under this classification.

The second class, those who feel that the safety work is for others but that they themselves do not need it, seem to me to constitute the biggest problem we have. They have about convinced themselves that they are superior to anything occurring to them, and refuse to give safety much thought. Generally speaking, employees of this class are unable to distinguish between the things that are safe and the things that are not safe. I have noticed one thing that is generally common with all. Their views on safety are on a parity with their views of other things. They seem to get along all right until something happens and then they are usually helpless.

This class of worker can only be converted by the untiring constant efforts of those who supervise his activities. Perhaps as an instrument to aid the safety campaigner can use the other members of the crews or gangs with whom they work, to constantly keep driving at them and break down their resistance to unsafe practices. These employees must be educated to differentiate between the safe and the unsafe.

Then we come to the third class, whom I have mentally classified as the fatalists or antagonistic to safety measures. These people constitute a problem all to itself, and in dealing with them there are only two avenues open, namely, intensive and persistent training, or dismissal. I have not yet convinced myself that any large percentage of them are susceptible at all to the first cure, and I have censored myself from time to time for not having dismissed more employees of this type, because in a number of cases I have later come to see them killed or injured in the service, due solely to their own actions. Of course, the thing that is still worse about this type of person is that because of his actions he not only subjects himself to the possibility of injury or death, but involves others as well.

I seem to see in this class of people certain distinguishing characteristics. Generally the man not only sees red in relation to safety matters, but his thoughts are along the same line in other matters. Frequently he is a nervous, fretful individual, with in many cases not a good home condition, and in most cases with his private habits not any too good.

With perhaps very few exceptions, the safety question finds ready response from the employee company, the labor organization to which the man belongs, his family, his friends, and generally speaking, himself, if you are able to reach him through the particular channel that appeals to him. In the final analysis, the success of these measures depends upon the force and sincerity of purpose that the supervising officer puts into the work. It is worse than useless for a foreman to talk safety to his gang, if they can see that he is daily doing things that are unsafe himself.

WEDNESDAY MORNING SESSION

October 5, 1932

Report of Committee on Train Service Accidents

By D. G. PHILLIPS

Superintendent of Safety, The Wabash Railway

*The speaker said in part: In the year 1931, out of 5,099 fatalities and 35,656 per*sons injured, according to reports to the Interstate Commerce Commission, 4,624 of these fatalities and 18,849 of the persons injured occurred in train service accidents. While it is true that a large proportion of these fatalities occurred in grade crossing accidents and to trespassers, it is also true that over half of the fatalities to employees on duty occurred in what is known as train service accidents and about one-third of the injuries to employees occurred in train service accidents.

We feel, therefore, that we are justified in saying that the prevention of train service accidents is probably the most important safety problem confronting us today, as far as accidents in and around railroads are concerned.

Under the heading "coupling or uncoupling cars or locomotives" in 1931 12 persons were killed and 394 persons injured. This may be compared for the year 1930, when 30 persons were killed and 604 injured. The year 1931, therefore, shows a decrease of 60 per cent in the number of fatalities and 35 per cent in the number of personal injuries; and these may be compared further with the record for 1920, when there were 151 fatalities and 2,430 injuries due to this cause.

The principal reason for personal injuries under this heading is due to employees stepping in between moving cars, usually at a time when coupling is about to be made, to determine if the knuckle has fully opened, to adjust location of couplers, or to adjust the coupling or uncoupling lever, with the result that they are caught between the couplers; or perhaps due to tripping or falling while performing this act, and are thus run over by the car. Our remedy for correcting this dangerous practice is for each and every railroad to make a positive and definite rule prohibiting employees from going between moving cars when nearing each other, to examine the employees to see that the rule is understood by them, and that supervisory officers see that the rule is enforced.

Under the heading "coupling or uncoupling air or steam hose," in 1931, 13 persons were killed and 175 persons injured, which may be compared with the record for 1930, when 7 persons were killed and 232 injured. The increase of 86 per cent in the number of fatalities is decidedly regrettable, although the record shows a decrease of 24 per cent in the number of injuries. The principal cause of employee injuries under this head is due to their failure to protect themselves by performing this work in accordance with the rules.

The remedy for this class of accidents where car men are employed rests in a full and complete enforcement of the blue signal rule which is quite uniform on all railroads. Railroad managements should improve this blue signal so as to make it as efficient as possible. The rule should also govern the placing of the blue signal so as to make sure that it is in a location where it will serve the best purpose as a signal to warn train, engine and yard men who might be guided by it. Where engine is coupled onto cars and trainmen are performing this work without blue signal protection, they should not permit themselves to get into a place where an unexpected movement of the cars might cause an accident, without first notifying the engine man and fireman so as to be fully protected.

Under the heading "operating hand brakes," in 1931 there were 18 fatalities and 824 persons injured, as compared with the record for 1930 when 26 persons were killed and 1,154 injured. The year 1931 shows a decrease of 31 per cent in

number of fatalities and 28 per cent in number of persons injured as compared with the previous year. The three most prevalent causes of these accidents are: first, losing hold, slipping or falling; second, sudden stopping, starting, lurch or jerk of train or car; third, struck by brake club because wheel threw around.

Prevention of personal injuries due to the causes mentioned rests very largely with the employee *performing* the service. It is true, climatic conditions at times make the roofs of cars and places where employees must operate the hand brakes, conducive to slipping and falling accidents. Sudden starting and stopping of the trains also are contributive causes. The employees whose work requires them to come in contact with these conditions, however, must not only know of them but at all times be alert and ready to guard themselves so that no accident will occur as a result. However, the importance of proper inspection and maintenance of hand brakes is a factor in reducing this class of accidents.

Under the heading "*operating* switches," in 1931 no persons were killed but 245 were injured; these figures compare with the record for 1930 when 2 persons were killed and 378 injured. The first direct cause of these accidents is due to strains and ruptures. The second cause is due to the switch lever coming in contact with some part of the employee's body, causing a bruise or contusion. The third cause is slipping and falling by reason by stepping on rails.

This last class of accidents is prevalent among switch tenders. I have found that 72 per cent of the men injured while operating switches on three of the important lines entering Chicago were *injured in this manner*. Switch tenders are prone to step on the rails rather than step over the rails, and in a great many instances it is necessary to step on the rails.

The proper and standard clearance of all switch stands, the proper maintenance of the switch, particular attention being given to the head *block* and also to the switch light, which should in all cases be properly focused, will greatly reduce accidents. Another important thing, switches should be properly oiled. There is a minimum of *expense in connection with oiling* switches and it should be looked after very carefully.

Under the heading "getting on or off cars or locomotives," in 1931 447 persons were killed and 4,086 injured; which figures may be compared with 1930, when 441 persons were killed and 5,910 injured.

With reference to getting *off* cars, the frequency of accidents from this cause indicates that men are getting off cars while the cars are moving at a high rate of speed, they are stumbling and falling, spraining their ankles and in other ways injuring themselves so that they are incapacitated. This situation must be controlled by proper supervision, and in these cases where the rules are violated discipline must be administered.

In passenger service, accidents occur by persons falling from vestibule platforms because vestibule doors are left open carelessly; by employees getting off passenger trains while these trains are moving *at a high rate of speed*; by passengers jumping on trains before they come to a stop because of improper supervision of the station forces and of train crews.

Proper supervision and education are the principal remedies, as well as *proper* maintenance of equipment to see that steps are in good condition, vestibule doors in good condition, and in cold and stormy weather to see that the steps are properly cleaned, and that salt is used in all conditions during sleety weather, proper coordination between conductor and engineman with reference to stopping of trains, a check up on the length of the platform to see that passengers are not unloaded at obscure points, proper supervision of the sleeping car porters by the train conductor and the Pullman conductor with reference to care in unloading passengers, and the same supervision directed by the train conductor to the members of his crew with reference to proper unloading of passengers.

Under the heading "accidents (train service) *at highway grade crossings*," the

record for 1931 is 1,720 persons killed and 4,533 persons injured; the figures for 1930 were 1,980 killed and 5,377 injured. The following practical suggestions have been adopted by several lines and a noticeable reduction in highway crossing accidents has been the result.

(1) Switch crews and train crews working in stations should be prohibited from dropping cars across highways, their engines going down one track and *cars going down another track, without protection on the crossing* by a member of the train crew.

(2) Switch engines, switch runs and local way freights, backing cars over crossings at uncontrolled speed without proper protection on the crossing, should be prohibited.

(3) Passenger trains in switch movements, backing up with tail hose at the rear, over highway crossings, should reduce speed at all crossings that are not protected.

(4) Cars being kicked over crossing without engine attached should be protected.

(5) Switch engines, way freights, and switch runs, doing industry switching where it is necessary to shove cars by a building where there are alley-ways and where trucks and automobiles might be parked too close to the track, should be prohibited unless a member of the crew walks in advance of the movement to protect them.

(6) In certain districts where there are trunk line highways and where trains stop on these highways, with flat cars directly on the crossing during the nighttime, where headlights from an automobile either shine directly over the top of the car or underneath, lights should be placed in such a way that the car on the crossing will be illuminated.

If we can educate the army of employees on the railroad to give consideration to the safety of the driver of automobiles and pedestrain who cross our tracks, and in each instance where it is necessary, warn them, we will be going a long way toward avoiding a great many accidents and eliminating many fatal accidents.

Under the heading "operating locomotives," in 1931 7 persons were killed and 1,406 persons injured; these figures compare with the record for 1930, when 17 persons were killed and 1929 injured.

With respect to operating locomotives the first, greatest and most important means of preventing accidents or injuries is the constant observance and strict compliance with the operating rules and general regulations governing train service.

Still another division of these accidents falls under the heading "struck and run over, not at *public crossings*." In 1931, 1,730 persons were killed and 1,022 persons injured in this manner, and in 1930, 1,828 persons were killed and 1,276 persons injured. These figures are so large in proportion to the total number killed on the railroads of our country that special interest is attracted to this phase of the accident situation. By far the greater number killed and above one-half of those injured come under the head of "trespassers." It should be noted that on the railroads of foreign countries very few trespassers are killed or injured, but the sole reason is that these countries have strict laws against trespassing and these are enforced. It will be necessary to get the public generally to recognize the evils of trespassing before we shall be able to have laws enforced covering trespassing. We already have the laws, but the sentiment is such that the law is not enforced.

Accidents to employees from this cause come under three classifications: (1) the employee steps on or foul of the railroad track without first looking in both directions; (2) the employee walks too close to the end of a car in a live yard; (3) the employee walks on the track or foul of cars on the track. If we could eliminate the fatalities to employees occurring under the above mentioned three conditions, we would practically eliminate all employees killed on account of being struck and run over.

Safe Versus Unsafe Switching Practices

By P. F. NEFF

Inspector of Safety, Pennsylvania Railroad

The speaker said in part: Let us first get a common understanding of what an unsafe practice is. Many safety men have an idea *what* it is but a great many of them have a hard time trying to tell you *why* it is. What is considered an unsafe method by one person may not be so considered by another, therefore reasonable grounds for a conclusion should be given. Here is my conception:

An unsafe practice is the performance of an act wherein the method employed to perform it indicates the person is failing to use every precaution necessary to avoid an accident of any nature.

The reason, therefore, may be due to the following causes: (1) inability to anticipate the consequences of such a failure; (2) ignorance of the proper precautions to take; (3) having acquired the habit of performing it that way; (4) failure to receive proper instructions in the method to be used; (5) failure to understand previous instructions given; (6) if understood, failure to comply with the instructions, either willfully, physical inability, or material defects.

The why of an unsafe practice has many angles of approach, none of which can be ignored if the practice is to be eliminated.

(The speaker then showed a large number of lantern slides illustrating specific instances where unsafe practices were employed by workers on the railroads.)

Report of Committee on Train Accidents

By GEORGE H. WARFEL

Assistant to the Vice-President, Union Pacific System

After showing a number of tables giving comparable figures on the various types of train accidents over a period of ten years extending from 1922 to 1931 inclusive, the speaker said in part:

Head and rear collisions have always been the most spectacular of railroad accidents. I have wondered whether or not we safety men actually realize that head and rear collisions have been reduced more notably in the last ten years than in any other period and have been reduced more notably than any other class of accidents. We have a reduction of 65 per cent in ten years for all collisions, and 75 per cent in ten years for head and rear collisions.

There is another type of accident, however, which I believe when all is said and done, could be most definitely held up as a true index of safety performance on railroads. As a measure of safety work, derailment seems to be composed of the very essence of accident prevention work. One of the factors undoubtedly contributing to a reduction in derailments is the increase in average length and average speed of freight trains. The average length of all freight trains operated has increased 25 per cent, and the average speed of all freight trains has increased 33 per cent in the last ten-year period. Nevertheless we have had a reduction in the total number of derailments of 65 per cent.

If the Safety Section ever needed substantiation of their claims for the improvement made in the operation of railroads, substantiation of their casualty rates and of their references to persons killed and injured, this record on derailment should certainly give backing to every safety man in the country.

Nevertheless, we are perhaps inclined to be over enthusiastic about our 1931 performance. We have always been engaged in a military movement, we might say, in an aggressive attack upon carelessness and upon accidents. Since 1923, a wonderful campaign has been waged. Our flying squadrons, and these are the railroads whose rates have been greatly reduced, have advanced to far distant positions and it has been largely through the advance of these occasional squadrons that the average of our performance has been so greatly improved. We have made some new steps in 1931, and there is a thing we haven't taken into consideration: The ground that we have traveled over in this last year in pressing this salient forward, (to use an old illustration) was much easier ground to work over than it has been in preceding years.

Whenever the business of this country begins to really improve, whenever the business of our railroads begins to really improve, when the intensity of our traffic begins to concentrate again, we are not going to have such pleasant figures to look at as we are looking at today. On many railroads there will never be again the fraction or the percentage of velvet man-hours that we have had in the past. Great numbers of clerical forces have been reduced, consolidations have been made, and I doubt very seriously whether we will ever see again the organizations that we had on railroads three or four or five years ago.

Furthermore, this easy ground that we have gone over has had the result of making us possibly over confident, and if 1933, or this last year of the "33 by '33" should develop a wonderful come-back, we will have much more difficulty in coming in here with a reduction comparable to 1931 and 1932. We should be consolidating our positions now. We should be bringing up all the rear troops of education and enlightenment and pressure that we can, and get the nucleus force that we now have on railroads so thoroughly trained and so thoroughly imbued that they will carry out this safety program. There is no greater mistake we can make than to let our enthusiasm wane, let the enthusiasm of our men wane now in this easy period of our campaign, because there is going to be a counter attack.

The Economic and Other Values of Safety

By O. H. PAGE

General Superintendent, Atlantic Coast Line Railroad

The speaker said in part: Sometimes we hear the question, "What about this safety movement? What does it mean? What are you trying to accomplish?"

With the greatest pride, we may answer that question in language and figures of accomplishment on American railroads. In 1923, there were killed on the American railroads 2,056 employees and 147,936 injured. Quite an appalling situation. In 1930, those figures had been reduced by methodical means of safety to 972 killed and 33,107 injured, a reduction of a little over 77 per cent.

Again I mention with the greatest pride that the railroads of this country have reduced passengers killed by railroad accidents, all classes, from 229 in 1920 to 41 in 1931—82 per cent.

A meat packing concern found by the application of safety methods that they could cut down their cost per payroll for each $100 from $1.25 to 33c in three years, a reduction of 73 per cent.

It has been found by a stone company in its operations that by the application of safety methods, $62,000 a year has been saved.

One of our leading railroads has paid particular attention to safety work and it is shown that in 1923 that railroad paid out for personal injuries $432,000. But in 1931 that sum had been reduced to $135,000, a saving of about $300,000, or 69 per cent.

I have watched this safety movement very carefully and as I went about attending the different safety meetings I always tried to leave the thought indelibly impressed upon the employees, "This is your movement, something started and carried on in your behalf. You are the greatest beneficiary." And the response to that appeal has been fine and noble.

Experienced operating men will remember as vividly as I do that in the yards we used to look for accidents to be numerous, costing anywhere from $1,500 to $4,000 each. Yet, listen to this! In one month, passing through our 38 main yards on the Atlantic Coast Lines, 530,000 cars were handled without one dollar's damage. Another month nearly 632,000 cars were handled, with a damage of only $256. I am emphatic in saying to you that the safety movement, to my mind, has been the greatest factor in bringing about such notable savings.

I wonder if we agree on what is the most important thing concerning railroads today. What is paramount? I say to you without a shadow of doubt—public opinion, the good will of the people. Neither railroads nor any other industry can get very far without public opinion in its favor. This safety movement has been a great influence in building up public opinion. It is our custom to invite lawyers, doctors, preachers, school teachers, leading citizens of every walk of life to attend our safety meetings. Time and again, after those meetings, I have had those men say to me, "Why, this is a revelation. We had no idea what you were doing in these safety meetings. What a pity that this could not be carried on generally in a public way."

The Accident Investigation Work of the Bureau of Safety, I. C. C.

By W. P. BORLAND

Director, Bureau of Safety, Interstate Commerce Commission

The speaker said in part: You are already familiar with the accident investigation work of the Bureau of Safety of the Interstate Commerce Commission. However, there are certain fundamental features which are often overlooked and which should be kept in mind at all times. I refer more particularly not only to the necessity of having the investigator of accidents develop the immediate cause of an accident, but to the even more important necessity of having him develop the underlying causes which so often set the stage for what subsequently occurs, and to the further necessity for plugging away continually with the idea of impressing on the minds of everyone that there is no sound excuse for the occurrence of accidents.

I doubt if these results can be satisfactorily attained unless all accidents, however trivial they may appear on the surface, are carefully investigated by competent investigators whose primary interest is the prevention of accidents of a similar character. Formerly many accidents on railroads were investigated for the principal purpose of ascertaining the immediate cause, then determining what disciplinary action should be taken, and to what extent it should be carried. There the matter rested. Today we are paying increasing attention to the more important side of the question, which is the development of underlying causes with a view to profiting by the unfortunate experience of the past. This is a long step in the right direction.

When an accident of major importance occurs, everyone concerned is on the job for the purpose of finding out what happened and why it happened. General officers, division officers, safety inspectors, representatives of State and Federal Commissions, coroners, etc. Everyone is duly impressed with the seriousness of what has occurred and in many cases circumstances are such that lessons are learned that are highly beneficial for the future. The accident of minor consequence so far as casualties are concerned, however, attracts little attention: there is no commotion about it, and entirely too frequently no lesson is learned from it, although the small number of casualties is merely a fortunate circumstance, and such an accident should carry a far more important lesson that half a dozen accidents of so-called major importance.

It may be argued that no one has time to dignify minor accidents by careful and painstaking investigation, but the answer to any such argument is that if they are investigated carefully and with sufficient thoroughness to bring out any underlying condition or situation which may exist, the time soon will come when there will not be very many to investigate, and we may rest assured that the occurrence of major accidents will decrease just as rapidly as do the minor accidents. Furthermore, all employees involved are available for questioning, whereas in the more disastrous accident important witnesses are often permanently silent.

Railroad casualties have been decreasing for years, although just what the immediate trend is I cannot pretend to say; you may rest assured, however, that they will continue to decrease, but only if all accidents are treated with the importance they deserve. As to the steps to be followed by the various railroads in this humanitarian work, these must be worked out for each individual organization. They all have the same object in view, the saving of life and limb, and I do not believe that anything can impress itself to any better advantage on the rank and file of railroad workers in the way of accident prevention than to have the investigation of the minor accident, regardless of its character, as thoroughly and painstakingly handled as the investigation of the major accident. The investigation of the major accident obviously would take more time because of more facts to be developed, and more evidence of one kind or another to be considered, but aside from the question of volume there would appear to be no difference in the investigation itself. The result to be accomplished is the same in each, and only by handling it in the same manner can those results be best attained.

WEDNESDAY AFTERNOON SESSION

October 5, 1932

Value of "Safe Practices" Committees

By F. HARTENSTIEN

Assistant to General Manager, Lehigh Valley Railroad

The speaker said in part: In our efforts to reduce the number of casualties on the railroads it becomes natural for us to analyze their causes and if possible adopt ways and means to prevent repetition. After a careful study of this subject, and considering that 75 per cent or more of the injuries that occur on the railroads are the result of unsafe practices, it appears to be in order to make a change in our safety organization that is adaptable or more in keeping with the causes which are responsible for producing unsatisfactory safety records. With the hope and expectation that a change in the name of safety committees to that of "safe practices committees," will be conducive of better results, it is recommended to the members of the Section that such a change be made.

The change is recommended for the purpose of inspiring careful employees who are dependable safety workers to caution their co-workers when they observe them doing anything that is liable to result in personal injury. Also, to more clearly instill in the minds of committees and other employees that the causes of the majority of personal injuries on the railroad are from unnecessarily taking chances and their discontinuance will be a large contribution to the goal that we are struggling to make by the end of the year 1933.

If it is decided to change the name of committees it should be understood that reporting any unsafe conditions observed on railroad property must not be discontinued, but a careful analysis of the records indicate that a very small percentage of our injuries occur from defects and unfavorable conditions, and the change suggested should direct the attention of officers and employees to the real reason for the majority of railroad accidents.

In this connection, we as a railroad have changed the name of our safety committee, beginning with September of this year. The time has been so short that we are unable to state today whether there will be any real benefit derived from it or not. But each and every employee and official on our railroad that I discussed this matter with before placing it in effect, thought it would be a very good thing to change the name and it would keep our employees' minds on the real causes of personal injuries.

Report of Committee on Non-Train Accidents

By D. A. KLUMPH

Superintendent of Safety, Pere Marquette Railroad

The speaker said in part: I shall not give you here any comparative figures regarding non-train accidents. These figures are available from various other sources. It is our opinion that if you have each day analyzed your accidents that occurred in the previous 24 hours and immediately taken action after fully determining the cause of each to prevent a recurrence, you have been able to discover without delay if a certain type of accident is on the increase and take steps to overcome it before it becomes serious.

Great stress has been given to the need of safety rules. Most of the railroads now have safety rule books for the guidance of all employees which should be of great benefit in reducing non-train accidents, provided they are properly enforced as well as to know that each employee fully understands them.

But if we do with safety rules what many roads did with the standard A. R. A. rules we will find that safety rules do not prevent as many accidents as they should. With the A. R. A. operating rules on most of the railroads they were to have something to hold the men on if an accident occurred, instead of something about which the men could be educated by proper training so they could safely operate trains without accidents.

So it is with safety rules. Unless proper care is given in instructing the men as to the proper understanding and application of each rule and then a rigid enforcement of them is made, they will not accomplish what is expected in preventing non-train accidents.

In checking up your non-train accidents you found that some were caused by the violation of safety rules, but in more cases you find that the sole cause of the accident was failure on the part of the employee to use his head. It is accidents of this kind among employees, who were hired because of their physical abilities rather than their mental alertness, that we now find most difficulty in eliminating, and to my mind they will continue to contribute a greater percentage of the non-train accidents next year.

Now that we're beginning an upward trend in business that will require the services of more employees, it is suggested that it would materially help in the prevention of future non-train accidents as well as other accidents to give mental alertness of the new or re-hired employees more consideration.

Building Safety Morale in the Shops

By G. H. MILLER

Assistant Manager, Safety & Fire Prevention, E. I. duPont de Nemours & Company, Wilmington, Delaware

The speaker said in part: There are actually but two major requisites in successful industrial accident prevention work, a physically safe work-place and a force of workmen who carry on the work in a safe manner.

In addition to the fact that workmen should be eager to exercise the precautions necessary for their safety because they do not want to be injured, we believe we have determined another fact which should make accident prevention easy. In the case of most accidents, there is rarely much difference between the amount of precaution taken and *the amount which would have prevented the accident.* In fact, we have found that most industrial accidents would never happen if employees would exercise a small amount of additional care.

We are at present in our safety program, working on the theory that all that is necessary to prevent the majority of accidents in our shops and other work places, is to build the safety morale of the organization so high that all members, whether they be the shop superintendents, the foremen or the workmen, will exercise such precaution as will preclude accidents to any member.

It would be difficult to carry on with this line of attack if the *majority* of the accidents which occur today resulted from unusual or insidious causes; for if such were the case, a local organization and particularly the workmen might find it difficult to cope with them; but such is not the case. Accidents as a rule do not occur from unusual causes, but from the ordinary, garden variety of hazards over which the workmen and their superiors can have full control. It seems to us that the causes of accidents have not changed very much throughout the years.

For a considerable time we have recognized that accident prevention is by no means a separate function of management or a separate problem in industry. The problem is distributed throughout the organization and each man has his share. The success which the organization accomplishes will be measured according to the acceptance of this responsibility by each individual to the full measure of his relative position in the organization.

It is an interesting fact, and we believe one which is important to the acceptance of this idea, that the building of safety morale in railroad shops does not necessitate the expenditure of large sums of money, assuming of course, that we begin with a shop that has been well guarded from physical hazards. We recognize that there are factors which influence the general spirit or morale of the employee; such as wages, hours of work, opportunity for advancement, and welfare plans, but these are usually adjusted to the needs of the hour to the satisfaction of all concerned. The proposition that the chief aim in the minds of all workers, whether they be salary or wage earners, is financial can hardly be debated; but we know that behind the dominant demand of every man to learn to earn enough for the necessities of life and the comforts reasonably demanded by himself and his family, there is another very real desire, and that is for personal enjoyment of his work.

We mention this because our first hope for an early building of the proper safety morale in any organization need not strain the economic resources of the company. Our problem lies largely in the relationship which we establish throughout the organization, for our problem is to create a morale so high that the desire or will to work safely will be sufficient to preclude those errors in human conduct to which the majority of accidents may be properly charged.

One of our first problems in accomplishing this is to provide that management sell itself and its policies to the workers. This cannot be done by circulars or booklets, no matter how well they may be written or how beautifully they may be prepared, or even if they are printed in every language so that they may be read by each workman in his own tongue. It can only be done by that personal contact in which there will be opportunity for the workman to recognize the sincerity of the higher officers. Much of this must come through an unmistakable evidence that the boss sincerely feels that even the humblest wage earner in his employ is an integral part of his organization.

One of the difficulties encountered at the present time is that this spirit so intensively human and so far sighted, regardless of how firmly held and adhered to by the management, does not always dominate the contact of the workman's im-

mediate superior. It appears that one of the first requisites in creating the proper morale among workers is to insist that the foremen carry on their duties with such honesty and with such sincerity of purpose that no policy of safety of the company can be misunderstood. Instruction and supervision must be clean-cut and sincere. Proper instruction is not that which neglects to make certain that those who are to perform the actual tasks of work know absolutely how it is to be done in safety. Nor is proper supervision that which falters, even for a moment, to countenance unsafe practices.

There is an almost untouched possibility in the development of the homely attitude of even the unskilled and unlearned workman for his job. The development of this attitude through sincere and sympathetic understanding will be found demonstrated when the worker presumes to raise his head and offer a constructive criticism. There is a vast amount of usable horse sense among the uneducated workers doing routine work of the average shop which has been throttled, because an expression of opinion has not been encouraged, or if encouraged, the employee failed to see that any attention was given to the idea.

Contests and campaigns have a very definite place in the program of building safety morale. Accident prevention programs have a tendency to get into a rut or to grow stale unless stimulated from time to time; and it is very important to the successful continuance of the safety program to hold occasional contests or rallies or whatever you choose to call it, to re-stimulate the safety activities and to return them to their logical position of importance. Contests or campaigns of this character should be designed first to improve the physical conditions of the work place; but the major portion of the program must be designed to create additional safety morale among the workers.

We believe that if by some means we can build the proper morale in our shops we will reach the point where the employees will feel that they have more than a job paying a certain wage. They will take pride in the organization. They will feel that they must endeavor to help the fellow worker. They will believe that their company depends on them. They will realize that the success of the safety program is assured by their loyal interest, their support and intelligent work.

Exhibits of Lantern Slides

At this point in the program two special features were introduced where large numbers of lantern slides were used to illustrate the subjects. The first, entitled "Stripping and Erecting Locomotives," was given by J. W. Lemon, Superintendent of Shops, Missouri Pacific Railroad.

The second feature entitled, "Tackling the Worst Hazards in the Car Department," was given by W. R. Dunbar, Divisional Car Foreman, Delaware & Hudson Railroad.

Both these talk outlines, accompanied by brief introductory remarks, may be found in the complete proceedings of the Safety Section, as published elsewhere.

Safety to Employees While Handling Locomotives

By L. LaFOUNTAINE

General Safety Supervisor, Great Northern Railroad

The speaker said in part: In order that we may fully appreciate the frequency of accidents due to this cause, as well as know our experience in the past, here are the figures on number of employees on duty killed and injured over the past five-year period.

1927, killed 22, injured 4,467; 1928, killed 13, injured 3,402; 1929, killed 17, injured 3,160; 1930, killed 17, injured 1,929; 1931, killed 6, injured 1,383.

This shows a decrease of 69 per cent in the number of fatalities and personal injuries in 1931 as compared with 1927. The year 1931 compared with the previous year shows a decrease of 65 per cent in fatalities and 28 per cent in personal injuries.

Our accomplishments during this period in bringing about such a substantial decrease in number of personal injuries from this cause should be highly pleasing to everyone. However, practically all of the accidents coming under this heading are preventable accidents, and regardless of the number of such personal injuries, our best efforts are challenged until they are entirely eliminated.

Among the 35 classifications showing the causes of accidents to employees while operating locomotives, we find that injuries due to employees falling from engine or tender are the most prevalent, in fact, account for over 30 per cent of all fatalities and 25 per cent of all injuries. We appreciate that there are two essential reasons why it is necessary for employees to go up on the tenders of engines—one to take water, and the other coal. The first thing to be considered is the method to be employed in getting on and off the tender. With the advent of the larger locomotives, it has of course been essential to increase the capacity of the tank in a like proportion, which has made them a great deal higher than the old engine tender, and because of the increased height injury to employees by slipping or falling from them has proved more serious.

The vestibule cabs which are coming into more general use, also the design of front ends of modern tenders and the winter curtains which are quite uniform on all railroads, all seem to make access to the top of the tender from the engine cab less inviting. The method requiring the fireman to get down out of the engine from the gangway and go up to the top of the tender from a ladder at the rear, is in my judgment the proper and safest method and should be given consideration by all railroads. The rear of all engine tenders should be equipped with a proper designed ladder at each corner of the tender. A proper designed hook should be standard equipment and carried on each engine to enable firemen to reach standpipes in order to swing it over tender of engine or back into place when finished taking water, so that he will not be at any time placed in a position which might cause him to lose his balance and fall from the tender or engine.

The top of the water cistern should be kept free from all materials which might result in stumbling or falling accidents. On oil burning locomotives oil cisterns should be cleaned regularly and a slight coating of sand thrown on top of the oil cistern to prevent engine men from slipping when walking over the cistern. This is particularly important during winter months. Engine men should also use care to see that there is no oil on the bottom of their shoes before going on top of a tender, since a slipping accident may easily result.

It has been my experience that most of the personal injuries from taking coal have been due to the employees slipping while putting the old style coal shed pockets back into place or due to slipping or falling while returning to the cab of engine after taking coal. The newer design of coal sheds has largely eliminated the first hazard mentioned. It is to be understood that the rope or chains used in manipulating the coal pockets are to be properly maintained at all times.

The practice of any employee going back over the tender of the engine for the purpose of measuring water, etc. while engine is running at high speed should be discouraged. The frequency with which employees go out on the running board of engines while running is, I believe, in a large measure the outgrowth of conditions of a former time when this was apparently necessary. These conditions have largely passed away, due to the development and improvement of modern engines. There is only one solution for the elimination of this class of accidents, and that is by the adoption and enforcement of the rule, now in effect on one of our railroads, which forbids men from getting out on running boards of locomotives while in motion, except that where a helper engine is cut in ahead of the caboose toward rear end

of train, a trainman may go over the running board if necessary to get on top of the train to extinguish fire or pass signals. *If anything should develop on the* engine requiring getting out on the running board to fix it, and such work cannot be deferred, the train must stop between stations to permit it to be done.

THURSDAY MORNING SESSION

October 6, 1932

Power Apparatus in Maintenance of Way Work

By LEM ADAMS

Engineer, Maintenance of Way, Union Pacific System

The speaker said in part: The maintenance of way employees on any railroad are constantly beset with hazards of accidents. When the motor car is set on the track for the day's work there is a potential hazard of being struck by a train, an automobile at a grade crossing, or another track car. Hence we surround them with innumerable rules and regulations to safeguard their movements.

Men in this branch of railroad service must constantly be on the alert to protect themselves. Their tools are watched closely for the smallest defect that might result in injury from particles of flying steel, and the very best steels and heat treating methods are used to provide tools that will be as nearly fool-proof as possible.

Yet with all these precautions, we still have accidents. Perhaps a rail is struck with a spike maul when a spike is not properly hit, or a sledge hammer fails when striking a track chisel in cutting a rail, and we have a cut or eye injury from flying steel, or an adze strikes a knot in a cross-tie when adzing for gauge and a foot is cut. Or perhaps a bar slips, or the trip gives way when operating a ratchet jack for spotting track, and we have a broken arm or other serious injury. These things are especially prevalent when large groups of men are working in a rail renewal or ballasting gang.

With such a picture before us, we maintainence of way men have for years been thinking in terms of machinery to do the more arduous and dangerous operations. Then, too, we were thinking in terms of efficiency, for safety and efficiency usually go hand in hand.

(The speaker then showed a score or more of lantern slides illustrating various types of power equipment employed in maintenance of way work.)

This set of equipment is one of our best safety agents. However, all power operated tools are unfortunately not the safest to use, although they are great labor savers. Some tools in this class are the power saw, the sandblast for cleaning surfaces preparatory to repainting, the power drill for either rail or bridge work, and many others—but efficiency and accuracy of work demand their use, and with proper care on the part of the operators they can be handled safely.

Planning for Safety in Track Construction

By FRANK R. BRADFORD

Director of Safety & Fire Prevention, Boston & Main Railroad

The speaker said in part: *My object in being here is to show you a picture* illustrating one of the modern methods of main line rail renewal. The operation, which is notable in many respects, is the outcome of the idea that the old established methods of rail renewal were no longer justified from the standpoint of economy, advantage of the operating department, or safety to the maintenance of men.

In the year 1924, there were approximately 26 reportable injuries per million man-hours in our maintenance of way department, and succeeding years showed an almost constant increase, reaching the peak of nearly 34 per million man-hours in the year 1928. Toward the end of that peak year we set up the proposition that safety, efficiency and economy were interdependent and especially that safety was the end product or the result of the correct performance of the job. The foreman being the keyman in this correct performance, the need of re-instructing *him in his responsibilities immediately* became apparent. This was done through the medium of so-called foremen's meetings conducted at first monthly or bi-monthly, but now quarterly or somewhat less often, with the division engineer or the district track supervisor presiding.

At these meetings all phases of maintenance of way work are freely discussed, with particular stress on the correct way to do the individual job. Safety, as such, is seldom mentioned at these meetings, but we carry on a running record of every personal injury accident that occurs in a department without regard to the extent of injury, classified by the work being performed, the material being handled or worked and the tools or appliances being used, which is the basis of discussion tending to indicate the result of all methods and to develop better and safer workmanship as well as more efficient tools, equipment and operation.

These foremen's meetings are working toward the *standardization of practices* and procedure which not only is producing many beneficial results in efficiency and economy, but have reduced the frequency of all personal injury accidents nearly 90 per cent in the last three years. The I. C. C. casualty rate in the engineering department has dropped from 33.69 to 2.45 casualties per million man-hours in the same period.

Rail removal on the Boston & Maine involves the laying of rails 39 feet in length, weighing 130 pounds to the yard, each rail totaling 1,690 pounds; fully plated track, which means two canted tie plates per tie, each plate weighing 15½ pounds and measuring 8 x 12 inches; 9 rail anchors per rail, and rail joints weighing 145 pounds each, with four bolts per joint. With an average force of 133 men actually engaged in the laying, the average number of rails laid per day during twelve working days was 583, equivalent to approximately 22,700 lineal feet. On the basis of 8½ hours of working time, this was quivalent to laying a rail approximately every 53 seconds. The best single day's performance was 734 rails laid in 9½ hours of actual working time, which is equivalent to a rail approximately every 44 seconds.

From the safety standpoint, a record was set up which will be difficult to surpass. During the entire job there was no reportable accident, no lost-time accident, and only two very trivial injuries.

Whenever a special job of any considerable magnitude such as this one is to be done, it has become the regular practice to call a special meeting of the foremen and supervisors who are to carry out the work. The whole program as set up by the engineer's chart is outlined; the various parts of the work are assigned to specific foremen and crews and each particular assignment is thoroughly discussed as to necessary equipment, methods, allocation of men, inherent hazards, special precautions; in fact, everything is gone over that experience on previous work of a similar nature has taught.

Following the meeting, each foreman, and usually his supervisor as well, inspects all tools and appliances that are to be used on the job to make certain that they are in perfect order, and talks over with his men the particular part of the project they are to undertake. Though the men have perhaps never before used the machines that perform the special class of work to which they are assigned, these discussions, followed by the work itself, soon make them specialists on their part of the job.

In all these preliminary discussions, it would be difficult to separate or identify

any special safety instruction. But whether you consider them efficiency meetings or production meetings, the outcome is safety, produced through proper and adequate planning.

(The speaker then showed by means of a moving picture how the work just described was planned and then carried out on the job.)

The Bridge and Building Gang

By J. P. WOOD

Supervisor of Bridges & Buildings, Pere Marquette Railroad

The speaker said in part: That bridge and building work is more hazardous than some other occupations is attested by statistics gathered by insurance companies as a basis for rate making. This being true, it is essential that the men employed in this class of work should be very careful and use extra precaution in the performance of their duties. If accidents could be reduced to a minimum or eliminated entirely, it would place this occupation on a level with others carrying a lower rate of insurance.

From the nature of the work performed by bridge and building men, it being scattered over many miles of track, it is not always possible to have them in at the safety meetings which are usually held at a certain place and at a time in the afternoon when it is impossible for all to attend. They should, however, be encouraged to attend these meetings whenever possible, bring in items and take part in the discussions. If a man's interest can be aroused to this point, he will not only practice safety but will be on the alert for unsafe practices in others and call their attention to these inoffensively.

Records show that the handling of the various kinds of sizes of material entering into the construction of bridges and buildings is the cause of the most accidents to men employed in this occupation, followed by falls of persons, the use of hand tools, and the collapse of objects, in the order named. It is then up to the foreman in handling of materials to watch his men; seeing that they are placed in such *positions as to protect them from possible injury; questioning them as to any* movement which might cause them to lose their footing and slip or fall, and never permitting them to move backward while thus engaged if it is at all possible to move forward; to stand in the clear when using a crane, pile driver or other machine to lift heavy objects; to be sure that the right hitch is made when hooking to such pieces of material so that they are sure that the heads will not slip or become unhooked.

Another feature in the handling of material by machinery that should be given careful thought and attention by the foreman, is the use of signals to the operator of the machine, never permitting them to be given by the men indiscriminately, but designating one man on the ground to give them to a man on the machine, and he in turn transmitting them to the operator. By strictly adhering to this practice all concerned soon come to realize the importance of it and the benefits to be derived therefrom as a safe way. The careful foreman will also use extreme caution in placing his men, and in the selection of them for the various parts of the work to be performed, choosing such men as are best adapted by ability and experience to perform the several tasks.

Injuries caused by men falling are usually because of pure carelessness on the part of the person injured not looking where he steps; if there is snow or ice, by not moving it before attempting to perform the task assigned him; or not placing himself in such a position that he is sure nothing will happen. This applies also to where there are slippery places, boards or timbers when wet, not taking the time to remove tools or other objects when left lying where he might stumble over them. Even the collapse of a scaffold is primarily the carelessness of someone in not seeing that it is nailed or constructed properly, the floor planks of sound lumber and free from knots, or overloaded with material or men. These and many other small matters are the cause of the greatest number of accidents by falling.

The use of hand tools should be given serious consideration not only by the foreman of the gang but by the supervisor as well. He should at times when he is on the job where work is being done make a careful inspection of the tools being used by the men, see that none are battered, cracked, or otherwise in such condition that it might be the cause of an injury. When he does find such tools, he should instruct the foreman to forward them immediately to the shop for the necessary repairs. With some foremen this is not necessary, as they are usually ahead of the supervisor in not allowing tools to get very bad before sending them in.

Another matter that at times is not given the consideration it deserves is that of cutting the outfit short of the required number of hand tools. The practical man knows how long it sometimes takes to get tools to the shop, have them repaired and back again, and in the meantime the men are shorthanded. Many times he has to borrow from the track forces at a cost of time in getting and returning the tools, and he usually gets such as they are not using and perhaps should be where his are—that is, in the shop.

Injuries caused by falling objects may be attributed to tools left lying where the movement of a train, some slight jar, or a careless step by a man may cause them to fall on men who are working below. Sometimes material is jarred from a scaffold or is in such position that when picked up it slips from the hands of the man handling it.

It is vitally necessary that in erecting scaffolds great care should be taken to see that the feet of the standards are set on a firm foundation and brackets securely nailed. If necessary planks should be spiked to the ledges to prevent them from slipping, and no lumber should be used that is cross-grained or unsound or has any knots that might cause it to break under strain. All ladders should be carefully inspected when they are not in daily use, before permitting a man on them. The feet should be equipped with steel spurs to prevent them from slipping. No overload should be allowed on either ladders or scaffolds and care should be used in taking either down.

Machine operators should be constantly on the alert for loose burrs, missing bolts and broken strands in cables, and see that friction drums, brakes and operating levers are in good condition at all times, as any one of these defects might be the cause of a serious injury.

Present day methods require the use of many explosive and flammable substances, such as gasoline, kerosene, wood alcohol, paints, varnishes, turpentine and others. Extreme caution should be used in the storage and handling of these materials, particularly gasoline, as this is in more common use than any other. Men should not be permitted to use lights of any kind except electric, nor should they be allowed to smoke in any car or building where explosives or flammable substances are kept.

With the advance in our methods and appliances for doing work, the electric motor has come into common use in our shops and even out on the line. The use of high tension wires naturally followed, and creates a hazard to men working in places where these wires are strung. Extra caution should be used when working near an electric wire as the current passing through it cannot be seen, nor can one tell when it is going to strike or where. Operators of motors should be instructed in the use of the switch to start and stop them. Unless they are experienced electricians, under no circumstances should they be allowed to make any repairs or adjustments when anything goes wrong.

Signs of different kinds can be made and used in various places to keep constantly before the men the fact that there is such a matter as safety. At a small cost a sign can be made and placed on the outfit cars, showing the number of days

since this particular crew had an accident. Some years ago I had such a sign made and placed on cars under my jurisdiction and after some time our division engineer instructed me to have signs of that same kind made and placed on each car house of our division for the benefit of the section men. One day when I was in the scrap yard, I saw some old slow-order signs that had been discarded, and I immediately gathered them in and had my painter foreman paint on them "Be Careful—Safety First—Think of Your Family." These I changed from time to time so that the men were seeing something different frequently. Those signs are sent up when the men are out where they are working on a bridge or painting or whatnot. So that when they go out there, they have constantly something in front of them to remind them of safety. I think that it has had considerable bearing on safety in my department. It is something like 39 months since we have had a reportable accident, for which I am mighty grateful.

The personal factor enters into the cause of accidents to a greater extent than many realize. This may be attributed to a number of causes, such as sickness in the family, unpleasant home surroundings, worry over financial matters, defective hearing, faulty coordination between mind and muscle, habitual carelessness, etc. The supervisor should take an interest in the personal affairs of each man in this department, as by so doing he may be able to assist in some manner the men who are in need of sympathy or advice. Perhaps he may be able to untangle some financial affair. I believe many of us little realize how far-reaching a kindly word spoken at the right time and in a friendly manner goes toward making life brighter for those in trouble. Clear up the spirits of a man and he becomes a safer and a saner one.

The Extra Gang Problem

By H. A. PARISH

Assistant to General Manager, Chicago & North Western Railroad

The speaker said in part: Early in 1931 we had an elevation project in the course of construction through one of our important cities, and although we organized with all the efficiency that we could command we soon began to receive accident reports in great numbers covering a general detail of cuts, bruises, sprains, back injuries, injuries caused by spike mauls that were chipped, and other tools that were fractured in some way, and finally an individual case came to our attention where an employee failed to show up for work one morning, complaining of a sore back which he claimed he had suffered the day previous. We had this man examined and found a very serious arthritic condition that had existed for many years.

We then checked up on the different accidents that had occurred to this gang and determined that the proper thing to do was to have a physical examination conducted covering every member of the gang. There were 114 men in this gang and after the examination it developed that there were 37 of them who were unfit for service. Of the 37 who were found unfit and one who was sick in his bunk car, the doctor's report showed the following: syphillis, 3; hernia, 11; leg short two inches, 1; tremor all over body, 1; serious gland condition, 7; scars of old hernias, 2; serious cases of varicocele and varicose veins, 8; serious cases of hydrocele, 2; scars from abdominal operations, 2.

Every man shown under the doctor's report as affected was immediately dismissed from service and in this instance we established a practice that reduced our accidents among our extra gang men 90 per cent. The various labor agencies were instructed that before a man was sent out on a job he was to be directed to our district surgeon for examination. The fee for this examination, $1.00 for each, was deducted from the wages of the man if he was accepted. If he was rejected the company paid the fee.

In the organization of extra gangs I would recommend the following plan:

(1) As the supervision, such as foremen and assistant foremen, depends upon the kind of work being undertaken and district to be covered, I believe the organization for steel relaying gangs should be about as follows, where modern machinery is being used in the work:

(a) General foremen should be an experienced man in such work.

(b) A work train foreman should be employed to handle the distribution of materials, loading of old material and supervision of all work done with work train.

(c) A sub or assistant foreman should be assigned to the different operations in connection with the work—one to be in charge at the front with men removing old rail, etc., a second to be in charge to supervise adzing and placing of new rail, and the third to have charge of spiking, gauging, etc., at the rear.

This organization, I believe, sufficient for a crew of about 75 or 85 laborers, machine operators, flagmen and water carriers to be used if necessary.

The foreman with work train is a very important part of the organization, not only because material must be properly and efficiently distributed, but also because of the greater danger of injury to men employed in unloading or loading rails, etc. In larger gangs, additional track foremen are necessary. For heavy ballasting work the organization should be practically the same as for the rail gang, so that there will be general supervision by the general foreman, with one assistant foreman to do the track raising, one to supervise spacing and installation of ties, and one to do the lining and supervise the men in the rear who will be filling track with ballast, restoring banks, etc.

Our experience has taught us that after the selection of capable foremen, and laying out a general plan for doing the work safely and efficiently, a roadmaster's work has only just begun. He should be on the ground most of the time during the first week the gang is working, and by observation and consultation with the foreman in charge, he should help to get the gang balanced, which means to place the men so that the work will move along in an orderly manner by fitting the number of men to the operation they are to do.

Injuries caused by flying spikes, swinging of spike mauls, and careless handling of claw bars or lining bars can be avoided if the supervisors properly space their men and see that they are kept in place. A study of the conditions will enable the men in charge of the crew to so place the men that each will have his own particular job, know his place, and after a few days it will be found that there will be no difficulty in handling the crew.

For the purpose of our subject, I believe the main principles to follow out on the line, which will be of great value to this Section of the American Railway Association, are as follows:

(1) Sufficient supervision.

(2) Proper detailed organization, with a view of avoiding "bunching" of men, the men passing each other on the job.

(3) Prevention of defective or otherwise unfit tools on the job.

(4) Thorough inspection of all track cars used.

(5) Proper coupling between motor cars and trailers, and inspection of all machines used.

(6) Proper restriction of speed at which track cars, or other machines, may be run to and from work.

(7) Proper spacing of such track cars and machines when running to and from work.

(8) Avoiding overcrowding of men on trailers or motor cars.

(9) Preventing men getting on or off cars or machines or work train cars in motion.

(10) Avoiding getting men excited by unnecessary hollering on the job, etc.

(11) Have all laborers examined as to physical condition before employment.

The report of the resolutions committee was then presented by J. A. Long of the Delaware & Hudson Railroad, Chairman, and two resolutions were formally presented and adopted by the Section delegates.

The first was a resolution of condolence upon the death of J. Flanagin, Manager, Safety Department, Chicago, Milwaukee, St. Paul & Pacific Railroad.

The second resolution acknowledged with thanks and appreciation efforts of all who had participated in making the Washington Congress Session successful.

Report of the Nominating Committee

The report of the tellers who canvassed the election of officers for the Section, was made by J. J. Heavey, The Erie Railroad, and announcement was made of the election as follows:

Chairman of the Section—Charles E. Hill, General Safety Agent, New York Central Lines.

First Vice-Chairman—C. L. LaFountaine, General Safety Supervisor, Great Northern Railway.

Second Vice-Chairman—H. A. Parish, Assistant to General Manager, Chicago & North Western Railway.

Members selected for the Committee of Directions for the Ensuing Year:

Eastern Territory—F. Hartenstein, Assistant to General Manager, Lehigh Valley Railroad; H. A. Rowe, Manager, Claims Department, Delaware, Lackawanna and Western Railroad.

New England Territory—C. N. Woodward, Assistant to General Manager, New York, New Haven & Hartford Railroad.

Southern Territory—Robert Scott, Director Insurance & Safety, Atlantic Coast Line Railroad.

Canadian Territory—A. O. Beck, Director, First Aid & Accident Prevention, Canadian National Railways.

Members of the *Committee on Nomination* for the ensuing year: F. W. Curtis, Supervisor, Safety & Fire Prevention, Denver & Rio Grande Western Railroad, Chairman; E. G. Evans, Superintendent of Safety, Louisville & Nashville Railroad; C. F. Larson, Superintendent of Safety, Missouri Pacific Railroad; F. M. Metcalfe, Superintendent of Safety, Northern Pacific Railway; J. C. Pratt, Supervisor of Safety, The Redding Company.

The closing minutes of the session were devoted to the introduction of the new chairman, Charles E. Hill, and to appreciative and eulogistic remarks concerning the services rendered by officers of the section during the past year.

ADJOURNMENT

TWENTY-FIRST ANNUAL SAFETY CONGRESS
NATIONAL SAFETY COUNCIL

Textile Section

Officers 1931-32

General Chairman—E. E. Place, American Mutual Liability Insurance Co., Boston, Mass.

Vice-Chairman—Charles H. Eames, Lowell Textile Institute, Lowell, Mass.

Secretary and Chairman Program Committee—Ignatius MacNulty, American Woolen Co., Shawsheen, Mass.

Chairman Publicity Committee and News-Letter Editor—Myron B. Jonsberg, H. A. Hale, Jr. & Co., Boston, Mass.

Chairman Membership Committee—D. Frank Lord, M. J. Whittall Associates, Ltd., Worcester, Mass.

Chairman Poster Committee—Fred W. Seil, Aetna Life Insurance Co., Hartford, Conn.

Chairman Statistics Committee—F. J. Porter, The U. S. Finishing Co., Pawtucket, R. I.

Chairman Engineering Committee—G. W. Cook, Travelers Insurance Co., Hartford, Conn.

Members at Large—

Arthur Barlow, Armstrong Cork Co., Lancaster, Pa.

Russell T. Fisher, The National Association of Cotton Manufacturers, Boston, Mass.

Walter Humphreys, National Association of Wood Manufacturers, Boston, Mass.

John H. Southam, Sanford Mills, Sanford, Maine.

Paul W. Vietz, Plymouth Cordage Co., North Plymouth, Mass.

WEDNESDAY MORNING SESSION

October 5, 1932

The opening session of the Textile Section convened in the Wardman-Park Hotel with General Chairman E. E. Place, American Mutual Liability Insurance Company, Boston, presiding. Chairman Place gave a brief resumé of the activities of officers and standing committees, and then immediately introduced the first speaker.