1932

TRANSACTIONS

National Safety Council

Incorporated

TWENTY-FIRST ANNUAL
SAFETY CONGRESS

UNIVERSAL SAFETY

Washington, D. C.

October 3 to October 7, 1932

The Wardman Park and
Shoreham Hotels

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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

Annual Banquet

WEDNESDAY MORNING SESSION

October 5, 1932

The Annual Banquet of the National Safety Council was held in the Wardman Park Hotel, with C. W. Bergquist, president of the Council, presiding. After the invocation, by Dr. James Shera Montgomery, chaplain of the United States House of Representatives, Chairman Bergquist announced the election of officers of the National Safety Council (which had taken place that day) as follows:

President—James I. Banash, Consulting Engineer, Chicago.

Vice-President for Public Safety—R. I. Catlin, Assistant Vice-President, Automobile Department, The Aetna Life Insurance Company, Hartford, Conn.

Vice-President for Engineering—J. E. Culliney, Manager of Safety, Bethlehem Steel Corporation, Bethlehem, Pa.

Vice-President for Membership—Howard B. Fonda, Burroughs Wellcome & Company, (U. S. A.), Inc., New York City.

Vice-President for Safety Councils—John E. Long, Supervisor of Safety, The Delaware & Hudson Railroad Corporation, Albany, N. Y.

Vice-President for Business Administration—G. T. Hellmuth, General Claims Attorney, Chicago, North Shore & Milwaukee Railroad Company, Chicago.

Vice-President for Industrial Safety—George H. Warfel, Assistant to Vice-President, Union Pacific Railroad Company, Omaha, Neb.

Vice-President for Health—Dr. Cassius H. Watson, Medical Director, American Telephone & Telegraph Company, New York City.

Vice-President for Education—Albert W. Whitney, Associate General Manager, National Bureau of Casualty & Surety Underwriters, New York City.

Treasurer—Will Cooper, The Stevens Hotel Company, Chicago.

Managing Director and Secretary—W. H. Cameron, Chicago.

The newly elected president of the National Safety Council, James I. Banash, was then introduced by the chairman, and briefly addressed the members, as follows:

"Since Edison's discovery of the incandescent lamp half a century ago, the entire trend of civilized existence has been toward acceleration. This of course means that we have tremendously increased not only the speed of transportation of people and material but also the tempo of production, through the perfection of machinery and the elimination of unnecessary physical effort.

"But—has the speed of HUMAN reaction been increased in direct proportion? Has the human mind been geared to respond accurately to these changing physical conditions which have introduced all the new and complicated hazards confronting us today?

that manifests itself in the form of lap joint cracks, grooving at flanges and the failure of drum heads. The general use of high pressure brought to fired pressure vessels, particularly boilers and oil stills, an entirely new set of diseases. The exact causes, and in some cases the correction of these difficulties, are considered by some to be obscure.

Without entering into a discussion of the various causes of boiler cracking, commonly known as caustic embrittlement or inter-crystalline corrosion, the following points are definitely agreed upon by many authorities: (1) Cracks develop in the riveted areas. It appears that this condition invariably follows the use of feed waters containing high percentages of sodium bicarbonate without an appreciable amount of sodium sulphate. The condition also has developed with boilers fed with water containing condensate from leaky caustic evaporators and boilers fed with distilled sea water treated with chemicals that produce high concentrations of sodium alkalinity. These cracks are nearly always found below the water line and particularly where metal has been abused in fabrication. Failure may announce itself by leakage at seams or by a sudden explosion. (2) To guard against this boiler disease, the feed water used should be controlled by the chemist who is competent and familiar with the treatment of the water. It is also important that the carbonate-sulphate ratio recommended by the A. S. M. E. Boiler Code Committee be maintained. (3) Any leakage in riveted seams should be thoroughly investigated by an inspector experienced and competent to detect evidences of embrittlement.

When it is necessary to use water containing magnesium or calcium chloride, nitrates or sulphates or combinations of sodium chloride or magnesium sulphate or where the water contains mineral acids, careful inspection must be made at frequent intervals to determine the extent of the scale deposits and the presence of corrosion under the scale. Treatment of such feed water should be in the hands of a trained chemist. Very severe internal pitting affecting both tubes and shells or drums can result from oxygen or oxygen and carbon dioxide in the feed water. To avoid internal corrosion from this cause, all connections and glands should be kept tight and objectional gases should be eliminated through a vented open heater or some form of de-aerator.

Scale Removers Are Dangerous

It is not only foolhardy but definitely dangerous to use scale removers and feed water treatments without an exact knowledge of their chemical analyses and their action on the particular water to which they are applied. Feed waters vary through such a wide range that their use may result in heavy deposits of scale or internal corrosion with no scale whatever. To treat a scale-forming boiler water with the same chemical used to correct a corrosive water is analogous to treating dyspepsia with toothache medicine.

Every intelligent power house man should be alive to the rapid and frequently serious corrosion resulting from moisture combined with deposits of soot and ashes. To prevent external corrosion, keep all heating surfaces clean and free from moisture. This requires not only an absolute freedom from leaks in the boiler, its appurtenances and steam piping, but also the roof above it. Boilers fed with individual stacks require special consideration to prevent rain and snow water from entering their last passes. Boiler surfaces should also be kept dry and free of deposits of soot and ashes, particularly when idle.

Regular periodical inspections by trained, experienced engineers is absolutely essential to the safe and efficient operation of fired pressure vessels. Special inspections in addition to regular routine inspections should be made of the following conditions: (1) the investigation and elimination of leaks. (2) The examination of defects to determine the repairs required and after repairs are completed to determine whether they have been successfully carried out. (3) When considering the purchase of second-hand equipment, to prevent the acquisition of defective or sub-standard equipment.

Dust—An Engineering Problem

By LEONARD GREENBURG

Yale University, New Haven, Conn.

The speaker said in part: From the broadest viewpoint the dust produced in industry may be regarded as all of the particulate matter actually used as a part of industrial processes. It may be helpful to classify this material from the health viewpoint as follows: (1) Those dusts of a toxic nature or possessed of toxic properties. (2) Those dusts which are chiefly irritants of the upper respiratory tract. (3) Those dusts which, when respired, produce changes in the lung tissue, that is, pulmonary pathology which may or may not be associated with tuberculosis.

Powdered lead and arsenic salts and compounds may be cited as examples of the first group; wood dust and certain organic fibres are representative examples of upper respiratory tract irritants; and silica and granite dust may be cited as among the important members of the third group of dusts.

The toxic dust group is composed of those materials which, when taken into the body, produce pharmacological changes of varying degree dependent on the quantity absorbed. The degree of damage done to the organism depends as a rule on the quantity of the substance taken up by the body, its relative degree of toxicity and the susceptibility of the host. The route of absorption of toxic dusts is of fundamental importance. Ten years of research work in this field have led to the conclusion that in general the respiratory tract is the chief absorbing organ for most of the particulate poisons. Absorption through the respiratory tract, in the case of lead dust for example, is at least ten times more rapid than that by way of the intestinal canal. Moreover, a toxic dust deposited in the lungs is removed practically entirely by way of solution in body fluids, whereas dust taken into the intestinal canal may, in a large part, at least, be excreted directly.

It becomes obvious from these facts, that the prevention of poisoning in industries where such toxic dusts are generated, consists in the prevention of atmospheric pollution, which in turn resolves itself into prevention of dust formation or of dust dissemination or the simultaneous prevention of both formation and dissemination. In fact, no matter what type of hazardous dust is concerned the objectives of the hygienist are the same and the efforts of the engineer are directed along more or less similar lines.

The health problems brought about by the third group of dusts, the pulmonary irritants, are commanding the largest share of the industrial hygienist's attention at the present time. As a result of the industrial dust studies which have been conducted during the last twenty years there has emerged a small, but exceedingly valuable body of fundamental data which serves to guide the hygienist in his evaluation of the problem in a given factory or process. Briefly, we know that the industrial health hazard resulting from the inhalation of dust depends on four factors: (1) The chemical and mineralogical nature of the dust. (2) The size of the particles. (3) The quantity of dust breathed, (a) the concentration of the dust and (b) the duration of exposure.

We are indebted to the British investigators Gye, Kettle, Cummings and Collis for emphasizing the importance of the mineralogical nature of dust from the health viewpoint, and now as a result of the studies in the United States, South Africa and Australia it is generally held that the health hazards associated with the respiration of a given type of dust, all other things being equal, is to a certain extent correlated with its quartz content. It is not to be inferred from anything said by the speaker that dust counts and quartz content bear a mathematically interchangeable position. For example, without actual proof it should not be said that a dust concentration of 10,000,000 particles of 20 per cent quartz is equivalent in hazardousness to 5,000,000 particles of 40 per cent quartz content. What we do know is that if we compare a series of dusty trades in which the concentration of dust is known, the more hazardous have a higher quartz content and the less hazardous present a lower quartz content. Asbestos appears to be a striking exception to this rule. Here we have a dust often containing very small percentages of quartz and yet it is responsible for definite cases of pulmonary fibrosis terminating fatally.

So far as the size of the dust particles is concerned it is generally held that dust over ten microns in size is seldom produced in industry and is seldom found in the lung tissues. Again asbestos is a striking exception to this rule. The lower limit of the particle size of dust which is significant is a much more difficult matter to evaluate. The point in which we are interested as public health workers is the differentiation in dust content between the ordinary normal atmosphere and the air of dusty factory workrooms such as we know (from statistical studies) to be dangerous to health.

In a single dusty trade such, for example, as granite cutting, it has been found possible to compare the mortality of workers exposed to different concentrations of the same dust. Such comparisons clearly show that there exists a direct relationship between the dust concentration breathed and the duration of trade life.

The industrial hygienist is chiefly concerned with the study of health hazards in industry and their control, and in this work the engineer and engineering techniques play a major role. In 1921 Dr. Winslow and the speaker published a lengthy contribution dealing with the problem of industrial dust in the "Journal of Industrial Hygiene." In this paper we said:

"There are, in general, four different methods of protecting the worker against the influences of industrial dusts, which may be classified as follows: The substitution of wet processes for dry processes; the conduct of dust producing operations in enclosed chambers; the removal of dust by hoods equipped with exhaust draft; and the use of respirators and helmets." Today, nearly 12 years later, the problem has undergone no fundamental change. Indeed there has been an accumulation of data which serves to add to the validity of the statements made in our earlier work.

The problem of a mitigation of the dust hazard, be it toxic or irritant dust, may be recapitulated as follows: (1) Substitution of non-hazardous substances so that any dust which may be formed is of a relatively non-hazardous character. (2) Suppression of dust by the use of techniques which prevent dust formation. (3) Prevention of dust dissemination, by (a) enclosures and exhausts, (b) dust removal at point of origin. (4) Provision of separate sources of air supply for the worker in dusty atmospheres.

In the whole field of industrial hygiene the substitution of non-hazardous substances for those of a hazardous character stands preeminent as the solution of the problem at hand. It must be obvious, even to those who have had little or no actual intimate contact with such problems, that where a dangerous gas, liquid, or solid can be replaced by a non-hazardous substance the most satisfactory possible solution of the problem is achieved. Indeed, if the substitute is not completely harmless but relatively less so, it is a desirable substitute provided, of course, it is feasible from the view-point of the industrial process at hand.

In 1920, Dr. Winslow and the speaker advocated the substitution of dry grinding with synthetic (carborundum) grinding wheels for the process of wet grinding on natural sandstone wheels as the solution of the dust hazard in an axe factory in the State of Connecticut. The substitution of synthetic abrasives of low quartz content in place of sand would be of material aid in the solution of the problem of the health hazard in certain sandblasting processes.

The chief methods available for the prevention of dust formation consist in wetting the material with water as in the white lead industry and in the mining industry as conducted in South Africa. In the white lead industry the lead grids or buckles are placed in the grinder and water is added during the complete tumbling and grinding

process. A final step in the process consists in the introduction of oil which forces the water out of the mixture and results in the desired end product. In the South African gold mines, silicosis is a very important health hazard, and for many years the South African research workers have been studying this problem and attempting to mitigate its health hazards. Water has been used extensively and, while it has not by any means resulted in a complete solution of the problem, it has been of immense aid in lowering the content of atmospheric dust.

Still another example of the suppression of dust is the use of a foaming compound made in Germany. The method consists of supplying the drill holes with a foaming mixture which serves to convert the drillings into a mud, thus preventing the contamination of the atmosphere. The mud does not interfere with the efficiency of drilling but collects on the outside of the drill holes. On drying, this mud is converted into a hard cement-like substance and does not release dust into the air.

While it is not possible to completely enclose certain dusty processes, it is often possible to enclose them to a very large degree. Such enclosures, when kept under negative air pressure so as to maintain leakage inward and prevent outward leakage, often serve to reduce greatly the dust hazard. The hygienic sandblast cabinet is a form of enclosed device and the results of studies made with such equipment disclose the fact that atmospheric pollution is kept at a comparatively very low level by this type of equipment. Naturally, when the hygienic cabinet or tumbling barrel is being loaded with work, there is real opportunity for atmospheric pollution, but this again is a matter of careful engineering design and care in maintenance and use of the equipment.

When it is impossible to suppress the formation of dust and when it is also impossible to enclose the process and keep the dust from seeping into the breathing zone of the worker there still remains one highly satisfactory method which the engineers may use for the removal of dust. This consists in the provision of local exhaust hoods provided with suction ventilation. In a study of this problem made by the speaker in 1919 and published in the Public Health Reports, it was demonstrated that the minimum velocity at the throat of such exhaust hoods should be 1500 feet per minute. It was evident from these studies that the design of the hood was of vital importance in achieving the desired end. It should be so constructed as to enclose the grinding wheel in so far as possible, the dust should be removed as nearly as possible from the point of origin on the wheel, and the branch pipe should be so located as to catch the dust and thus make use of the velocity with which it is delivered in the hood to aid in its removal by the exhaust air stream.

Another example of localized dust removed at the point of production is the Kelly dust trap. This apparatus is used for the removal of the dust in rock drilling and consists of a split metal can placed over the drill holes. To this hood is connected one end of a flexible hose, the other terminating in the suction apparatus. A hole pierces the top of the hood for the passage of the drill rod. In practice, the hood serves to confine the dust produced by the drilling operation, the dust thus being carried off by the suction current to an air-cleaning device. The air is then discharged relatively dust free into the general atmosphere.

The method of dust control by removal from points of production by means of enclosures provided with suction ventilation is probably the most common type found in industry. When the enclosure and ventilation system are properly designed and maintained the method yields excellent operating results. The design and construction of such systems demand the serious consideration of the trained engineer and this field possesses exceptional opportunities for the well-trained engineer.

When it is impossible to limit or remove the dust produced by industrial processes and the worker is forced to labor in a dusty atmosphere, it becomes necessary to resort to personal protection, namely, the use of respirators or positive air pressure helmets. Many types of respirators are in every day use. They operate on the filtration principle, the filtering medium used commonly being sheets of filter paper, sponge or layers of cotton flannel. The filtering efficiency of paper and cotton flannel is high, but in spite of this the use of the ordinary respirator is attended with much risk since the contact of the device with the face of the worker is a poor one and usually dusty air leaks in around the edge of the mask.

The positive pressure helmet, on the other hand, completely surrounds the head of the worker and this makes it possible to provide him with a supply of clean outdoor air by means of the tube connected with the helmet. The positive pressure helmet is often cumbersome to use and is frequently objected to on the ground that the movements of the worker are limited by the length and weight of the hose which serves to convey the worker's air supply. In spite of these objections, which are often real and important, the positive pressure helmet serves a very useful function in the protection of the worker who is forced to enter the dusty atmosphere. Recent studies on the efficiency of positive pressure masks and helmets made in conjunction with the abrasive blasting research indicate that with a fresh air supply of six cubic feet per minute the worker is well protected against the inhalation of injurious dusts.

ADJOURNMENT

General Round Table

MONDAY AFTERNOON SESSION

October 3, 1932

The General Round Table Session convened in the Wardman Park Hotel with Frank E. Morris, Assistant Chief Engineer, Liberty Mutual Insurance Co., Boston, Mass., presiding. Chairman Morris immediately introduced the first speaker.

An Effective and Economical Safety Program for the Small Plant

By A. D. LYNCH

Director of Personnel, The Ohio Brass Co., Mansfield, Ohio

The speaker said in part: There is a commonly accepted theory that 85 per cent of accident prevention is a problem of education and training, of so-called safety consciousness and real interest on the part of the people; and also that the physical protection of machinery and hazards is only about 15 per cent effective in accident prevention. If we assume the general acceptance of this theory, then we have still the task of explaining how a certain part of industrial management can so believe and still fail to act, for we still have many thousands of industrial plants without organized safety programs.

Statistics covering performance in any individual plant may be misleading if one does not know all the surrounding conditions and circumstances. Nevertheless I want to give the experience of our plant over the past six years because this experience constitutes a very definite proof of the value of safety training. Our plant is today almost identically the same as it was in 1926; it is the same in machinery and equipment and makes the same line of products. Factory officials and major executives are the same, with exactly the same foremen on the job; and the employed force of workers, although reduced somewhat, is composed almost 100 per cent of men who were employed in 1926. Improvement in accident experience therefore must be credited entirely to training, as plant housekeeping and physical safeguarding have always been on a high plane.

The following table shows our accident experience from 1926 to date:

Year	Type of Safety Work Carried on	Lost-Time Accidents
1926	No safety training carried on	279
1927	Safety training for foremen	156
1928	Safety training for everybody	20

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 micra 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

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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 pointed 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.

Clinical and Statistical Aspects of Silicosis

By ALBERT E. RUSSELL, M. D., F. A. C. P.

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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 posttussic 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

Instructor in Industrial Sanitation, Harvard School of Public Health and Harvard Engineering School

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

Associate Professor, Industrial Hygiene, Harvard School of Public Health, Boston, Mass.

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 166 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.

V

Circumventing Prejudice

When a person harbors a deep-seated prejudice it is difficult for him to give rational consideration to a point which involves the prejudiced view. Often a prejudiced person asserts himself early in the discussion and would later compromise his position if he could do it gracefully. The function of the leader is to bridge the gap or make it easy for a person to abandon a firmly held belief without sacrifice of pride. An effective approach for the leader to use is to agree with as much as he can of the prejudiced opinion and lead the group to acknowledge this. Probably a cardinal principle in reconciling the differences between any opposing views is to emphasize the points of agreement (and these always exist) in this way minimizing the differences and making it easier for persons to shift from one view to another without loss of face.

A policy of this sort, if pursued consistently, tends to engender a broader tolerance of divergent views in other people and promote a more honest and disinterested consideration of the points of difference. It may be said that the person who goes through the mental process of abandoning an opinion and taking on a new one (providing, of course, that the reasoning justifying the change is sound) has received more benefit from the discussion than one who has simply placed the stamp of group approval upon his previously held beliefs. So the presence of prejudice in a conference, while presenting difficulties for the leader, tends to enliven the proceedings and strengthen the conclusions which are finally agreed upon.

VI

In discussing these several elements of technique I have selected just four or five which I thought would be of interest. They serve to illustrate, I believe, the nature of this conference technique. You can readily see that it cannot be reduced to a set of rules—it is tempered too much by the judicious application to the particular situation. I might say that it is possible to train conference leaders but it is difficult to teach them anything about the technique. That is, we recognize good and bad technique in specific instances and by supervising the practice of the embryo leader he can readily be given a background of experience which is difficult to acquire by trial and error alone. But it is practically impossible to generalize and state a formula. And, after all, is this not the case with any art?

In these four talks I have attempted to set up a coherent conception of the conference process. I realize fully the limitations upon such a venture and I cannot hope to leave more than a broad picture of the philosophy which underlies this work. We have discussed the purpose, the principles, the application, and the technique of the conference process. The pervading notion in all of this has been the necessity for common, sound thinking—a very obvious conclusion. Unfortunately a subject such as this always suffers under the analytical process which is applied in logical presentation. The minute we attempt to departmentalize and classify knowledge, it loses much of its cogency. The story of Mark Hopkins on the log teaching all of wisdom, as he knew it, without formal plan or classification but as the inspiration of the moment suggested it, is always conjured up when thoughtful teachers contemplate the ideal school. We can take a lesson from it. It is the idea of the whole concept, or as Professor Dewey saw it when he outlined his *complete* act of thought.

ADJOURNMENT

Accident Prevention Equipment Manufacturers' Section

Officers 1931-32

Chairman—LAWRENCE E. DICKSON, Standard Safety Equipment Company, Chicago, Ill.
Vice-Chairman—R. T. SOLENSTEN, Elliott Service Company, New York, N. Y.
Treasurer—FREDERICK WAHLERT, Pulmosan Safety Equipment Corp., Brooklyn, N. Y.
Secretary—E. L. WHEELER, F. H. Wheeler Mfg. Co., Chicago, Ill.
Chairman Better Business Relations Committee—F. RUTLEDGE DAVIS, Davis Emergency Equipment Co., New York, N. Y.
Chairman Membership Committee—GEORGE S. SHULL, Safety First Supply Co., Pittsburgh, Pa.
Chairman Exposition Committee—I. W. MILLARD, Industrial Gloves Corp., Danville, Ill.
Chairman News Letter Committee—J. H. REID, Chicago Eye Shield Co., Chicago, Ill.
Chairman Publicity Committee—R. T. SOLENSTEN, Elliott Service Co., New York, N. Y.
Executive Committee—MEMBERS AT LARGE
H. W. MOWERY, American Abrasive Metals Co., New York, N. Y.
HOWARD B. FONDA, Burroughs-Welcome & Co. (U. S. A.), Inc., New York, N. Y.
ED. H. SYKES, Mine Safety Appliance Co., Pittsburgh, Pa.
BUELL W. NUTT, Safety Equipment Service Company, Cleveland, Ohio.
C. A. PARTENHEIMER, American Optical Company, Chicago, Ill.
FRED H. KLEIN, Wilson Products, Inc., Reading, Pa.

BUSINESS SESSION

October 2, 1932

The business session of the Accident Prevention Equipment Manufacturers' Section was held in the Wardman Park Hotel with Chairman L. E. Dickson, Standard Safety Equipment Company, Chicago, presiding.

A general discussion was held regarding the desirability of developing closer cooperation with the National Safety Council and the means of bringing this about. As business conditions did not seem to justify frequent meetings of the Executive things and therapeutic exercises and steps are taken to restore them before serious consequences may occur.' The concractile power of the lens commonly experienced between distant vision and close work is of paramount importance to the pilot, who must needs watch his instrument panel, reading it accurately at a glance, and then fix on a distant beacon eight or ten or even fifty miles distant.

The special sense of equilibria so intimately associated with the middle ear is of just as much importance as that of sight. Hearing is important, of course, but not as vitally so as that division of the middle ear devoted entirely to equilibria. The influence of atmospheric pressure, particularly on those mountainous divisions where ten or twelve thousand feet and back to sea level are commonplace events, produces a trauma on the eustachian tube which demands occasional outside assistance to give relief.

Focal infections are prone to influence and affect those various special senses and for that reason special attention is paid to the teeth, gums, throat, a sluggish bowel and all the usual abodes of infected foci.

Some form of recreation is insisted upon and the efforts extended in obtaining active physical exercise repay more than ordinary dividends in the increased tenacity and efficiency of a normally functioning bowel.

Realizing that the nervous temperament of man influences in a striking manner his ability to concentrate and apply himself, a careful survey and scrutiny of those conditions of environment, economic or physical, is made at all times. There is much of a fiduciary relationship between a medical advisor and the pilot, especially in this latter capacity. He must act in the role of father confessor and stern disciplinarian.

This is meant as no reflection against the majority of pilots. As a lot, there is no more loyal, sober, and industrious type of individual than that seen in the veteran pilot. He is red blooded, to be sure, but there is none of the wild reckless abandon in evidence that is so commonly played up in fiction and even in everyday associated press dispatches. It is not without a peculiar significance that the majority of the old time airmail passenger pilots (men with from 5,000 to 15,000 hours in the air), are men whom you have heard little or nothing of. I know from experience that any brother medical colleague would be frankly envious of the cooperation these men give me. These men know their jobs depend upon themselves. They know it is absolutely necessary that they keep in shape, and in the rather elaborate process of selection of first pilot material now in vogue on our lines, we are dealing with a hand picked group of men.

ADJOURNMENT

A. S. S. E.—Engineering Section

Officers 1931-32

General Chairman—M. G. Lloyd, U. S. Bureau of Standards, Washington, D. C.
Vice-Chairman—H. S. Smith, Union Carbide and Carbon Corp., New York, N. Y.
Vice-Chairman—S. E. Whiting, Liberty Mutual Insurance Co., Boston, Mass.
Secretary—W. Dean Keefer, National Safety Council, Chicago, Ill.
Assistant Secretary—Gene S. Wood, New York, N. Y.
Members at Large—

- Cyril Ainsworth, American Standards Association, New York, N. Y.
- C. B. Auel, Westinghouse Electric and Manufacturing Co., East Pittsburgh, Pa.
- J. I. Banash, Consulting Engineer, Chicago, Ill.
- E. W. Beck, United States Rubber Co., New York, N. Y.
- E. F. Blank, Jones and Laughlin Steel Corp., Pittsburgh, Pa.
- J. E. Culliney, Bethlehem Steel Co., Bethlehem, Pa.
- Ernest Hartford, American Society Mechanical Engineers, New York, N. Y.
- A. P. Huckestein, Pennsylvania Department of Labor and Industry, Pittsburgh, Pa. (Western Pennsylvania Chapter)
- S. V. James, Underwriters' Laboratories, Inc., Chicago, Ill.
- A. S. Johnson, American Mutual Liability Insurance Co., Boston, Mass.
- R. McA. Keown, Industrial Commission of Wisconsin, Madison, Wis.
- B. B. McCulloch, Bureau of Safety, Chicago, Ill.
- H. W. Mowery, American Abrasive Metals Co., New York, N. Y. (Metropolitan Chapter)
- E. E. Place, American Mutual Liability Insurance Co. (Boston Chapter)
- A. S. Regula, Industrial Relations Counselors, Inc., New York, N. Y.
- A. D. Risteen, The Travelers Insurance Co., Hartford, Conn.
- F. M. Rosseland, Newark Safety Council, Newark, N. J.
- G. E. Sanford, General Electric Co., Schenectady, N. Y.
- W. R. Smith, United Engineers and Constructors Inc., Newark, N. J. (Northern New Jersey Chapter)
- R. F. Thalner, Buick Motor Company, Flint, Mich.

TUESDAY EVENING SESSION

October 4, 1932

The first session of the American Society of Safety Engineers—Engineering Section was held in the Wardman-Park Hotel with General Chairman Doctor M. G. Lloyd presiding. The session, being held in the evening, was a unique idea, and 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. Graff, National Bureau of Casualty & Surety Underwriters, New York City; and R. E. Donovan, Standard Oil Company of California, San Francisco.

ADJOURNMENT

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. Callam, 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-

The Employee's Plea for Safety

By M. A. KROGER

Chevrolet Forge Division, General Motors Corporation, Detroit, Mich.

The speaker appeared in the habiliments of a worker just out of the shop, dressed in overalls and jumper and carrying his dinner pail in hand. It should be remembered that all parts of the program presented up to this point had been in the nature of a drama depicting various phases of the safety program in an industrial plant. A little playlet entitled "Profit or Loss," presented at the opening of the first session, had depicted the plant general manager so thoroughly discouraged over his failure to conduct a profitable business that he was upon the point of resigning. Safety work had been largely discontinued on the plea of economy, disorganization resulted, and accidents had become more frequent.

Into this situation comes, now, an employee who charges the general manager with responsibility for all that has occurred. In a very vehement manner he tells the general manager that he is leaving the employ of the company, because of the fact that the morale of the men in the shop is all shot to pieces and because a man has been killed in an accident.

He explained that the safety man has been well liked and has been doing a good job until recently, but that nobody could do any kind of a job unless he has adequate support from the management. He wants to know why safety committees, motion pictures and other safety work have been discontinued in the plant; and when the general manager explains that it was because of a matter of economy, the employee insists that safety work has cost the company very little and that this item has been a very small contributing factor in the failure of the company to operate at a profit. The man killed in the accident, said the employee, was his friend and he had been instrumental in getting this man his job with the company. The employee is convinced that it was because of the neglect of safety work in the plant that his friend has been killed, and he charges that the accident has been directly the fault of management. He paints a moving picture of the bereaved home of the dead man, his sorrowing wife and children.

"Bring back the safety committees," says this dynamic employee, "get busy with all the old safety work again, and the men in the shop will put you back on the right side of the ledger. Let Jim go ahead with all his work as safety engineer, let him hold his safety meetings, and make it a point yourself to listen to him. Jim has a lot of ability. I'm leaving, I'm through, but give Jim a break in this safety work."

The incident closed with the general manager, recognizing the truth of all this employee has said, telling him to go back to his job, and definitely promising to resume all the old safety organization work and put the plant back on an accident prevention basis.

FRIDAY MORNING SESSION

October 7, 1932

For the record of this joint session with the Power Press Sectiôn, see page 354 in this volume.

ADJOURNMENT

Cement Section

Officers 1931-32

General Chairman—W. L. White, Jr., Medusa Portland Cement Co., Cleveland.
Vice-Chairman—David Adam, Lawrence Portland Cement Co., Northampton, Pa.
Secretary—A. J. R. Curtis, Portland Cement Association, Chicago, Ill.
News-Letter Editor—Jack Dempster, Canada Cement Co., Ltd., Port Colborne, Ontario, Canada.
Chairman Poster Committee—A. R. Couchman, North American Cement Corp., Martinsburg, W. Va.
Chairman Program Committee—J. B. Zook, Great Lakes Portland Cement Corp., Buffalo, N. Y.
Chairman Membership Committee—H. A. Reninger, Lehigh Portland Cement Co., Allentown, Pa.
Chairman Engineering Committee—Frederick B. Hunt, Nazareth Cement Co., Nazareth, Pa.
Members at Large—
Charles P. Benner, Lehigh Portland Cement Co., Allentown, Pa.
W. W. Hamilton, Alpha Portland Cement Co., Easton, Pa.
W. M. Powell, Medusa Portland Cement Co., Cleveland, Ohio.

TUESDAY MORNING SESSION

October 4, 1932

The first session of the Cement Section convened in the Shoreham Hotel with General Chairman W. L. White, Jr., Medusa Portland Cement Company, Cleveland, Ohio, presiding. Chairman White immediately presented his annual report.

Annual Report of the Chairman

By W. L. WHITE, JR.

Medusa Portland Cement Company, Cleveland, Ohio

The speaker said in part: Speaking from personal experience, I find that one of the most difficult things in safety is to keep alive the interest in this wonderful work. You, as leaders, must make up your minds that it is going to be harder than ever before to carry on and attain what we all look forward to, that is, the complete elimination of accidents. We have a long rough road to reach our goal.

In the minds of many people, a physical examination denotes the ultimate in industrial health service. But a well rounded program of industrial health includes also careful consideration of the previous occupational history and its bearing on the mental and physical status of the employee; periodic re-examinations to check the condition of the human machine; a correction of physical defects found on such examinations with the placement of the worker where these defects will be minimized; a study of industrial environment, including occupation poisons and other occupational disease hazards; ventilation, illumination, sanitation of the industrial environment, and other factors which contribute to the health of the employee; and an advisory health service for both the employee and his family. There should also be active participation of the medical and health departments of industry in community health programs.

While it is recognized that management must assume the responsibility for the health and safety of industrial workers, the administration of industrial health work is a problem which must be shared and not interdicted through the medium of executive authority if good results are to be obtained. It is significant that three national movements originated about twenty years ago; these groups are industrial relations personnel work, industrial safety, and industrial health and medicinal work. In general the objectives of all of these three types of endeavor are the same, namely, protection for industrial employees, provision of safe and healthy working conditions, and the smooth functioning of personnel relationship in industry. Subtract any one of these three types of endeavor and you leave the picture of continuity of employment curtailed in such a way that it is not complete. In working out the casual relationships in accident and illness occurrences, it is necessary that there be good coordination and cooperation between the physician and the safety engineer, and the industrial relations manager.

Probably the ideal arrangement is to place all three departments on equal authoritative basis and make them all directly responsible to the general manager in any given plant.

The condition of the health of the worker may have a direct bearing on accident production in four general ways: (1) by the occurrence of correctible physical defects, which produce a chronic sub-standard condition; (2) through the incidence of minor illnesses, which temporarily produce lowered vitality; (3) because of mental incapacity or maladjustment, which endangers good judgment; (4) on account of working environment, or because of processes involving health hazards; or related factors.

Clearly then, since there are definite physical and mental causes, and definite physical and mental results of accidents, the services of a physician will be needed in both the prevention and treatment of accidents. The industrial physician should, therefore, be a party to the various important procedures related to the prevention and treatment of accidental injuries.

Wednesday Luncheon Session: At the close of the Wednesday morning session the delegates of both the Cement and Quarry Sections gathered in a joint luncheon at the Shoreham Hotel. This social hour was concluded with an address by Mr. E. J. Mehren, president, Portland Cement Association, Chicago. Mr. Mehren spoke extemporaneously. Unfortunately, therefore, no record of this interesting address is available for these Transactions.

ADJOURNMENT

Chemical Section

Officers 1931-32

General Chairman—John S. Shaw, Hercules Powder Co., Wilmington, Del.
Vice-Chairman in Charge of Program—John Roach, Deputy Commissioner of Labor, Trenton, N. J.
Vice-Chairman in Charge of Membership—A. L. Armstrong, Eastman Kodak Co., Rochester, N. Y.
Secretary and News-Letter Editor—Ralph O. Keffer, Aluminum Company of America, Massena, N. Y.
Chairman Poster Committee—S. H. McKenty, The Atlantic Refining Co., Philadelphia, Pa.
Chairman Statistics Committee—Ira V. Kepner, Pennsylvania Salt Manufacturing Co., Philadelphia, Pa.
Chairman Engineering Committee—G. H. Miller, E. I. duPont de Nemours & Co., Wilmington, Del.
Chairman Industrial Poisons Committee—Dr. Leonard Greenburg, Yale Medical School, New Haven, Conn.
Members at Large—
William A. Baxter, The Newport Company, Milwaukee, Wis.
F. E. Clancy, Jr., Mathieson Alkali Works, Inc., Niagara Falls, N. Y.
W. A. Cook, Connecticut State Board of Health, Hartford, Conn.
L. A. DeBlois, Consulting Engineer, New York, N. Y.
Dr. H. E. Howe, American Chemical Society, Washington, D. C.
S. D. Kirkpatrick, Chemical and Metallurgical Engineering, New York, N. Y.
H. L. Miner, E. I. duPont de Nemours & Co., Wilmington, Del.
C. E. Rice, The Dow Chemical Co., Midland, Mich.
E. C. Rogers, The Grasselli Chemical Co., Cleveland, Ohio.
E. J. Smith, Underwriters' Laboratories, Chicago, Ill.
R. C. Stratton, The Travelers Insurance Co., Hartford, Conn.
Stanley Warzala, Calco Chemical Co., Bound Brook, N. J.
S. E. Whiting, Liberty Mutual Insurance Co., Boston, Mass.

TUESDAY MORNING SESSION

October 4, 1932

The first session of the Chemical Section convened in the Wardman Park Hotel with Vice-Chairman A. L. Armstrong, Eastman Kodak Company, Rochester, New York, presiding. The first paper, prepared by Mr. Kepner, was read by C. E. Ralston, Safety Director, Pittsburgh Plate Glass Company, Pittsburgh.

with the registration of 800,000 motor vehicles. However, in 1930, these two types of vehicles came in active contact just 1,118 times, injuring 688 persons; and in 1931 there were 999 such collisions, with 641 persons injured.

In outlining the mechanics of safety work for the horse-drawn fleet, the speaker referred to methods pursued by his own company in a horse-drawn division comprising some 2800 miscellaneous vehicles. The actual safety program is really in three divisions, which may be called (1) Mechanical, (2) Animal, and (3) Human.

Accidents due primarily to mechanical failure or physical break-down are rare. The means for preventing such accidents is a careful and periodic inspection of all moving and supporting parts. Certain men of the stable force are given the responsibility for making periodical harness inspections. Each wagon driver, however, is largely responsible for the condition of his own harness set.

Two lamps are provided for each wagon, one at the back showing red to the rear through a two-inch bull's-eye and white to the front. The lamp on the front of the wagon shows white to the front, left and right through the same type bull's-eye. At the present time, kerosene is used in a specially designed burner. The real value of the light depends upon the type of lens that is used.

Passing from consideration of the wagon to the animal phase, here we certainly have a different situation. We have nature to contend with, and if it is not exactly in the raw, nevertheless it is sometimes raw enough. Training the horse is indeed a very important part of the safety program. Attention must be given to age, condition and previous breaking-in. A horse is not really a horse until he is five years old and the preferred age seems to be between five and seven years.

In communities sparsely settled, how often have we not seen some salesman taking great pride in having his horse come to his whistle? Such success may look fine to the animal trainer, but to the safety man it is a nightmare. The horse, even with his vaunted horse sense, does not seem to realize that the wagon he is pulling is wider than himself, and so long as he himself clears a parked car or an obstacle, he thinks he is all right. Other drivers, particularly when the route is being served in the early morning hours, sometimes leave the horse out in the middle of the street beyond the line of parked vehicles.

So far as safety work concerns the driver, it is fundamentally educational work that corresponds exactly with the methods used among motor vehicle operators. The difference is merely in operating details. The question of relative speed is a very important one in the training of wagon operators. Most men, because they own and drive automobiles, can estimate the speed of such a vehicle much better than they can that of a horse-drawn vehicle. Accidents, thus sometimes are caused by failure to gauge speed or to measure the distance necessary for turning.

Another factor that militates against us is the long founded and well intended belief that food products must be delivered in spite of any and all conditions. This gives birth at times to a practice of taking chances with traffic in the thought that momentary speed is necessary. Any food delivery safety program should concern itself with this factor, discouraging unnecessary speed as a decided waste.

Such activities as these, coupled with the customary accident prevention machinery, have brought about in our company a definite reduction of accidents in the face of a steady increase in the number of vehicles exposed. Our working morale is improved; there is a general increase in safety-consciousness; our men are responding by preventing accidents that only a few years ago were considered unpreventable and a necessary evil of the business. This has come about through the published acknowledgment of our executive board that accident prevention must be carried out; through the teaching that accidents are preventable and the demonstration of how this may be done; through a realization by superintendents that accidents may easily determine the difference between profit and loss; and through the acknowledgement on the part of our driving personnel that safety is wisdom, health and wealth.

ADJOURNMENT

Marine Section

Officers 1931-32

General Chairman—John S. Hunter, The Atlantic Refining Co., Philadelphia, Pa.

Vice-Chairman (In Charge of Posters and Slides)—Robert F. Hand, Standard Shipping Co., New York, N. Y.

Vice-Chairman (In Charge of Publicity)—Arthur M. Tode, Consulting Marine Engineer, New York, N. Y.

Vice-Chairman (For the Pacific Coast)—Byron O. Pickard, Pacific American Steamship Assn., San Francisco, Calif.

Secretary—Arthur R. Bush, International Flare-Signal Co., New York, N. Y.

News-Letter Editor—Henry Blackstone, United States P. & I. Agency, Inc., New York, N. Y.

Chairman Program Committee—Lewis L. Smith, Merritt-Chapman & Scott Corp., New York, N. Y.

Chairman Engineering Committee—Frank H. Cogan, The Delaware, Lackawanna and Western Railroad Co., Hoboken, N. J.

Chairman Membership Committee—W. E. Stewardson, Columbian Steamship Co., New York, N. Y.

Chairman Research and Statistics Committee—Benjamin H. Self, Travelers Insurance Co., New York, N. Y.

Members at Large—

G. Bartlett, Cosmopolitan Shipping Co., Hoboken, N. J.
George H. Bates, United Dry Docks, Inc., New York, N. Y.
D. R. Dunlap, Alabama Dry Dock and Shipbuilding Co., Mobile, Ala.
B. C. Edwards, Grace Line, New York, N. Y.
Charles H. Flathers, Eastern Steamship Lines, Inc., Boston, Mass.
F. P. Foisie, Shipping Federation of the State of Washington, Seattle, Wash.
F. C. Gregory, United States Employees' Compensation Commission, Washington, D. C.
W. P. Kain, Shipowners Claims Bureau, Inc., New York, N. Y.
E. J. Robeson, Jr., Newport News Shipbuilding and Dry Docks Co., Newport News, Va.
H. L. Seward, Yale University, New Haven, Conn., and American Bureau of Shipping, New York, N. Y.
A. J. Smith, Marine Office of America, New York, N. Y.
C. Story, Jr., Cities Service Transportation Co., New York, N. Y.
Fern Wood, Moore and McCormack, Inc., New York, N. Y.
John Wright, Export Steamship Corp., New York, N. Y.

It is important that we consider our 1931 injury experience in relation to the records of other industries. The excellent showing in severity of plants in our Tanning and Leather Division deserves commendation. Their severity rate of 0.56 was very low in comparison with the average of 1.72 for industry as a whole. It gave them a standing of third among 28 major industrial divisions. The rate of meat packing plants was also low, being 0.99; their rank among all industries being seventh. In frequency, however, we did not do so well. The numerous hazards of meat packing plant operations resulted in a rate of 29.13, against an average of 15.12 for all industries and gave us a standing of 24th. Tanneries and leather manufacturing plants, with an average rate of 13.73, ranked 13th.

Minor injuries are important, especially in the meat packing industry. As a matter of fact, their severity is above the average and is comparable with the severity of temporary disabilities of such industries as steel, paper and pulp, and others whose operations involve some bad accidents. Numerous temporary disabilities are quite certain to mean a high rate for permanent partial disabilities, and these are costly to the employee as well as to the employer. The frequency of permanent partial disabilities for packing plants in 1931 was 0.98, which is well above the average of 0.64 for all industries.

Large organizations in both branches of the section have been the most successful in reducing accidental injuries. In tanning and leather establishments with over 500 employees, frequency has dropped from 28.25 in 1929 to 19.05 in 1931, and severity is down from 2.28 to 0.65. The 1931 rates were sharply lowered in the large meat packing units as shown by a rate of 27.20 for frequency against 41.77 for the smallest plants and 0.87 for severity in comparison with 2.12.

It has often been said of small plants that they do not realize their accident situations because injuries occur infrquently. But many of our small plants are getting exceptionally good results. The Doyle Shoe Company of Brookton, Massachusetts, for example, worked 261,000 hours during 1931 without a single lost-time injury. In the meat packing industry, the Winona plant of Swift & Company, which employs 149 people who worked 344,000 man-hours during 1931, had only one temporary disability which resulted in three days of lost time. These company names are used by special permission.

Possibilities for raising the standard of accident prevention work in the industry, however, are not confined to our small plants. Large and medium sized units in shoe manufacturing, meat packing, tanneries and manufacturers of various other products had higher than average rates for the organizations of their size. In the largest plants engaged in meat packing, for example, rates ranged from 6.87 to over 77.00. Certainly the management of these plants with high frequency rates can improve them.

In conclusion, I wish to congraulate the companies whose plants made outstanding records during 1931, and in doing so demonstrated to us all the extent to which injuries can be eliminated from our operations.

ADJOURNMENT

Metals Section

Officers 1931-32

General Chairman—F. A. Lauerman, Republic Steel Corporation, South Chicago, Ill.

Vice-Chairman—Robert L. Schmitt, Louisville Car Wheel and Railway Supply Company, Louisville, Ky.

Secretary and News-Letter Editor—H. W. Darr, Bethlehem Steel Company, Johnstown, Pa.

Chairman Program Committee—S. W. Doran, Pratt and Letchworth Company, Buffalo, N. Y.

Chairman Membership Committee—J. K. Stafford, Mississippi Valley Structural Steel Company, Decatur, Ill.

Chairman Poster Committee—H. M. Croghan, Inland Steel Company, East Chicago, Ind.

Chairman Publicity Committee—A. Berquist, The Youngstown Sheet and Tube Company, East Chicago, Ind.

Chairman Statistics Committee—T. A. Schendel, Premier Malt Products Co., Peoria, Ill.

Chairman Engineering Committee—J. E. Culliney, Bethlehem Steel Company, Bethlehem, Pa.

Chairman Committee on Slides and Safety Kinks—J. A. Oartel, Carnegie Steel Company, Pittsburgh, Pa.

Chairman Health Committee—Dr. R. C. Engel, The Corrigan, McKinney Steel Company, Cleveland, Ohio.

Chairman Foundry Committee—F. G. Bennett, The Buckeye Steel Castings Company, Columbus, Ohio.

Chairman Railway Car Builders Committee—P. J. Brand, Pullman Car & Manufacturing Corporation, Pullman, Chicago, Ill.

Members at Large—

Harvey G. Hensel, The Youngstown Sheet and Tube Company, Chicago, Ill.
John P. Eib, Illinois Steel Company, Joliet, Ill.
E. G. Quesnel, St. Louis, Mo.
T. H. McKenney, Illinois Steel Company, South Chicago, Ill.
E. F. Blank, Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
J. A. Voss, Republic Steel Corporation, Youngstown, Ohio.
G. A. Davis, Illinois Steel Company, Chicago, Ill.
J. M. Woltz, The Youngstown Sheet and Tube Company, Youngstown, Ohio.
John P. Mudd, The Midvale Company, Nicetown, Philadelphia, Pa.
W. E. Megraw, H. H. Robertson Company, Ambridge, Pa.
A. C. Gibson, Spang, Chalfant & Company, Inc., Pittsburgh, Pa.
J. A. Coltrin, National Radiator Corporation, Johnstown, Pa.
R. R. Burns, American Radiator Company, New York, N. Y.

A. M. Lytle, The Newton Steel Company, Monroe, Mich.
A. E. Barr, Algoma Steel Corporation, Sault Ste. Marie, Canada.
R. A. Chaffin, Continental Steel Corporation, Kokomo, Ind.
L. S. Adam, Continental Roll and Steel Foundry Company, East Chicago, Ind.

TUESDAY MORNING SESSION

October 4, 1932

The first session of the Metals Section convened in the Wardman Park Hotel, with General Chairman F. A. Lauerman, presiding. The chairman welcomed the delegates and then presented his condensed report of officers and standing committees, in part as follows:

The present meeting marks the seventeenth consecutive year in which there have been sessions of the Metals Section during an Annual Congress. The News-Letter was generously supported by the members during the year, there being 41 different contributors who submitted 71 articles on matters of safety and efficiency. An unusually large number of suggestions were received as subjects for discussion during this Congress and many of these were incorporated in the program. The Membership Committee reported 482 companies holding memberships in this Council section, which is the good result of concentrated efforts to maintain the membership during the past year. The Poster Committee has assisted in preparing 86 posters suitable for use by members of the Metals Section and of this number 17 were on new subjects. Members contributed a representative group of excellent articles that were published during the past year in trade magazines. The Engineering Committee has been working on two Safe Practices Pamphlets, one being "Safe Practices in Operating By-Product Coke Plants", and the other "Safe Practices in Operating Open Hearths," both of which are progressing favorably toward publication. All other committees also have been active and have done good work.

Think it Over

By G. A. DAVIS

Manager of the Department of Safety and Relief, Illinois Steel Co., Chicago

The speaker said in part: We have made wonderful progress in the prevention of accidents. I am not going to discuss accident rates, but doubt if any of us are perfectly satisfied with our safety records. None of us should be unless our records show the minimum of accidents, which of course means no accidents.

If we are to make further progress in safety, it will have to be done by the department assisting in the promotion of accident prevention work. Every effort must be made to stop unsafe practices and prevent not only accidents but near-accidents. Unsafe practices will eventually cause accidents. As a general rule, the only difference between an accident and a near-accident is whether or not anyone is injured. In this connection, let me repeat, if in the prevention of accidents we mean the prevention of occurrences which might or do cause bodily injuries or loss of any kind, we are considering the subject of safety with a correct perspective. Sometime ago my attention was called to an incident which illustrates the point I am trying to bring out. In a steel manufacturing company, there was an explosion at one of the skull crackers. The safety supervisor started to the scene of the disturbance as soon as he heard of it, and as he approached he saw the assistant superintendent of the open hearth and a foreman leaving, and as they neared each other, the assistant superintendent said, "You can go on back, nobody is hurt." The supervisor replied, "What do you mean go on back, I want to know what happened." They went to the skull cracker where the supervisor learned that skull was being broken up during a rainstorm, causing the explosion. This was contrary to the operating rules and as it was discussed the assistant superintendent soon realized that the occurrence might have caused a serious injury. He was convinced that to succeed in safety work, all occurrences that might cause injuries or loss of any kind must be prevented. The skull cracker foreman and the crane-man involved in this explosion were disciplined and this department's attitude toward accident prevention changed, which has brought about a noticeable reduction in their accidents.

The cause of from 75 to 90 per cent of all accidents has been given as carelessness, either on the part of injured men or their fellow workmen. While in a broad sense this is true, yet a close analysis of a large number of accidents under this classification shows that they could have been prevented by proper supervision. There is a tendency to place the responsibility for a large percentage of accidents on injured employees or their fellow employees; but in many instances the responsibility really belongs to department heads and foremen for lack of supervision and direction of these employees in the performance of their duties.

We believe that this matter of supervision is vital to accident prevention work. The department heads and foremen must educate, guide, direct and otherwise supervise their men in the conduct of the work in their departments in a way that will insure the maximum degree of safety at all times. In fact, the prevention of accidents today must be classed as one of the operating responsibilities and must be placed on the same plane with production and other factors pertaining to operating activities. In the degree we are able to accomplish this in the companies we represent, in that degree will we be able to reach the minimum of accidents.

This will not affect the identity of the safety department, but will keep it busy helping to maintain safe operations at all times. The most effective workmen's safety meetings I have known were conducted by foremen, and the safety director simply acted as a secretary. Recently my attention was called to a remarkable safety record in a steel manufacturing company employing over 2,500 men. Upon inquiry regarding their methods of attacking the problems of accident prevention, I was told that each department head was held responsible for the safety of the men in his department, who in turn held his different foremen accountable. The foremen accepted the responsibility and by proper supervision accidents were few and far between. We will get better results as safety directors if we impress the foremen with their responsibilities in the prevention of accidents and let our work be of an advisory nature.

The Importance of Accident Facts in the Metals Industry

By W. D. SPEIGHT

Safety Director, Keystone Steel and Wire Co., Peoria, Ill.

The speaker said in part: In a review of our experience from 1929 to 1931 large decreases in frequency rates appear in all branches of the section. The reduction was largest for copper, lead, and other non-ferrous smelting and refining plants. These companies showed a decline of 54 per cent, a decrease which was exceeded only by laundries, among all the industries summarized last year; the decrease for foundries, in frequency, was 51 per cent; the drop in the rate for manufacturers of machinery was 45 per cent; railway car and equipment manufacturers had an improvement of 39 per cent; and steel plants 38 per cent. In fact, each branch of our section equalled or exceeded the average reduction of 38 per cent for American industry.

In severity, however, our showing was less favorable. Non-ferrous metallurgical plants, also, had the largest decrease in severity in the section—64 per cent; the

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

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. Budd, 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:

more remote installations, is not as widely practiced as it should be and the grounding of motor frames, switchboxes, extension light fixtures, etc. is often omitted almost entirely. Where the equipment is grounded, the ground connections are apt to be made rather indiscriminately; that is, some may be made by burying the end of a ground wire in the bottom of the drift or in the ditch, another may be grounded on a convenient water pipe and others on air pipes or on the haulage rails. It is only rarely that attention is given to providing a neutral or ground wire with the conductors. Of course, a water pipe should presumably make a very good ground connection, and so it would under conditions similar to those on the surface where the greater part of the water piping is buried and lies undisturbed. With the almost constant shifting and changing which is necessary underground, the ground connections on a water pipe may be rendered almost useless and form a hazard to pipe men.

The ideal system for grounding would, of course, be a neutral or ground wire included in each circuit with ground connections properly calculated for capacity and easily available for periodic testing. Changed conditions such as opening of new levels with consequent drainage may cause perfectly good ground connections to become inadequate or useless, as well as corrosion and mechanical injury, and therefore it is quite necessary to test them periodically.

The rails of a trolley haulage system form a return circuit and should be properly bonded at all joints and cross bonded at reasonable intervals so that they form a complete metallic ground connection at all points of the system. It is sometimes desirable to check the bonds for excessive resistance. Excessive sparking at rail joints is an indication of imperfect bonds.

A detailed inspection of all permissible equipment and of all haulage motors, motor generator sets, driving motors and controllers, and similar equipment should of course, be made only by competent electricians and mechanics, but it is advisable to have such inspections made at regular intervals and accurate records kept regarding them. It is advisable to have regular specifications and instructions covering such work and regular forms for records. Such inspections are justified from a maintenance and efficiency standpoint alone, and when once started will generally be made without any urging on the part of the safety inspector. He should, however, keep in close touch with the situation and in some cases it may be necessary to recommend such a detailed inspection.

The final session closed with the discussion of another installment of the "Question Box", led by H. T. Harper, Tennessee Copper Company, Copperhill, Tenn., the subjects discussed being: (1) What place do bonuses and penalties take in accident prevention work? (2) The uses of statistics in accident prevention work; (3) Methods of investigating accidents, and follow-up measures.

ADJOURNMENT

Paper and Pulp Section

Officers 1931-32

General Chairman—J. J. Plzak, Consolidated Water Power and Paper Co., Wisconsin Rapids, Wis.
Vice-Chairmen—George Roller, Rhinelander Paper Co., Rhinelander, Wis.
Arthur Murray, Container Corporation of America, Chicago, Ill.
Secretary—H. D. Banta, Hoberg Paper & Fibre Co., Green Bay, Wis.
Chairman Poster Committee—James M. McGivney, Brown Company, Berlin, N. H.
Chairman Program Committee—H. G. Gilson, Oxford Paper Co., Rumford, Maine.
Chairman Membership Committee—N. F. Bartlett, Hollingsworth & Vose Co., Boston, Mass.
Chairman Publicity Committee—James J. Hastings, Port Huron Sulphite & Paper Co., Port Huron, Mich.
Chairman Statistics Committee—E. E. Grant, The Crystal Tissue Co., Middletown, Ohio.
Chairman Engineering Committee—Ernest Augustus, The Mead Corp., Chillicothe, Ohio.
Chairman Health Committee—Dr. L. H. Frechtling, The Champion Coated Paper Co., Hamilton, Ohio.
Chairman Contest Committee—A. Scott Dowd, The Paper Industry, Chicago, Ill.
Members at Large—
W. J. Brennan, State Department of Labor and Industry, Augusta, Maine.
Kenneth L. Faist, The Champion Coated Paper Co., Hamilton, Ohio.
W. A. Gleason, Hammermill Paper Co., Erie, Pa.
John Lundrigan, International Paper Co., New York, N. Y.
W. J. Peacock, Northern Paper Mills, Green Bay, Wis.
Samuel Pruyn, Finch-Pruyn and Co., Inc., Glens Falls, N. Y.
Ben D. Rogers, Bird and Son, East Walpole, Mass.
F. H. Rosebush, Nekoosa-Edwards Paper Co., Port Edwards, Wis.

TUESDAY MORNING SESSION

October 4, 1932

The first session of the Paper and Pulp Section convened in the Wardman Park Hotel with General Chairman J. J. Plzak, Consolidated Water Power & Paper Company, Wisconsin Rapids, Wisconsin, presiding. After welcoming the delegates, the Chairman discussed the question, "Are We Obtaining Our Objectives?" He said in part:

"In our peace abiding nation, since the year 1920, we have placed upon the altar of economical progress a most supreme sacrifice—1,062,000 lives. Far worse than war, and when a man has sufficient experience and poise to maintain concentration on that particular part of the job despite surrounding confusion. The reel shell is iron and weighs approximately 1200 pounds, and is driven by frictional contact with the revolving iron drum. Have the fourth hand cut an end about 20 inches wide; then keep your hand on the outside edge of the sheet. Pass the paper under the shell with the outside edge clear of the shell and the hand going in the direction of the journal. Putting paper on the reel is somewhat spectacular. If you are a beginner in the machine room, don't try to put the paper on the reel until you know your way around.

A most important part of the duties of a backtender and third hand is to constantly pass the hands over the surface of the paper as it is winding up. By this means the paper maker can detect wrinkles, cuts, calender spots, unequal finish, etc. Should the hands be wet or even moist with perspiration, they will stick to the paper and positively throw you off your balance into the reel. In this connection, it is interesting to know that the finger tips are far more sensitive and much more can be learned through them than the palms of the hands. Pressure is not necessary.

When helping feed the paper over the winder, the fifth hand must turn a reel having a gross weight of 4500 pounds. This he does by means of a crank. The strength of a chain is only equal to its weakest link. The human body is subject to the same governing principle and the inside wall of the groin muscle is distressingly weak. When turning the reel around keep the heels together, and there will be no need to undergo an operation for hernia.

The primary duty of a slitter is to cut paper; it performs this duty most excellently when revolving at a high rate of speed. If given the opportunity it seems to display a malicious propensity to cut flesh as well as paper. If the shavings become entangled with the slitter, stop the slitter before removing the shavings; by doing this you will once again demonstrate the supremacy of the animate over the inanimate.

The drums of the winder rotate in the same direction and do not form a nip, yet their close proximity makes them dangerous. If anything should be jammed between them friction would be created. Do not attempt to feed paper in the tape by inserting the hand between the drums. The winding paper and the drums do travel in opposite rotation and form a nip. After a break on the winder, always feed the paper around the roll with a closed fist. The bulk this presented will be too great to pass the nip and the danger will be eliminated.

Pro and Con Hour

The closing feature of the session was a general discussion entitled "Pro and Con Hour", under leadership of Arthur E. Winslow, Hollingsworth & Whitney Company, Waterville, Maine. Most of the discussion centered on the question, "Is rule 6A as applied to the 1933 Contest one that may lead to misunderstanding detrimental to the present or future contests, and if so, should any change be recommended?"

This rule reads as follows: "In the event that two or more mills in any group have perfect scores (no lost-time injuries during the contest, which is equal to 1000 points credit) the winner shall be the mill among those tied having maintained that continuous record for the greatest number of consecutive calendar days prior to the contest."

It was decided that the Executive Committee present the choice of a number of plans to all members of the Section in time before the next Contest begins, and the plan receiving greatest number of acceptances should be that used for the following Contest.

ADJOURNMENT.

Petroleum Section

Officers 1931-32

General Chairman—R. E. Donovan, Standard Oil Company of Calif., San Francisco, Calif.
Vice-Chairman—C. L. Hightower, Texas Pacific Coal and Oil Co., Thurber, Texas.
Chairman Atlantic Division—E. R. Alden, Vacuum Oil Co., Inc., New York, N. Y.
Chairman Great Lakes Division—J. C. Bernd, Sinclair Refining Co., East Chicago.
Chairman Mid-Continent Division—Louis R. Hodell, The Carter Oil Co., Tulsa, Okla.
Chairman Gulf Division—A. W. Breeland, Lone Star Gas Co., Dallas, Texas.
Chairman Rocky Mountain Division—T. N. Shaw, The Midwest Refining Co., Casper, Wyoming.
Chairman, Pacific Division—R. B. Hecox, Standard Oil Company of Calif., Bakersfield, Calif.
Chairman Poster Committee—L. W. Evans, Atlantic Refining Co., Frankin, Pa.
Chairman Engineering Committee—H. E. Dischinger, Shell Petroleum Corp., St. Louis, Mo.
Chairman Publicity Committee—J. L. Risinger, Magnolia Petroleum Co., Beaumont, Texas.
Chairman Program Committee—B. V. Osborn, Standard Oil Co. (Ind.), Casper, Wyoming.
Chairman Statistics Committee—J. W. Myers, Standard Oil Co. (N. J.), New York, N. Y.
Chairman Health Committee—Dr. C. M. Aves, Humble Oil and Refining Co., Houston, Texas.
Past General Chairmen—
R. S. Bonsib, Standard Oil Co. (N. J.), New York, N. Y.
V. R. Currie, The Texas Co., New York, N. Y.
Geo. F. Prussing, Union Oil Company of Calif., Los Angeles, Calif.
E. J. Senne, Vacuum Oil Co., Inc., New York, N. Y.
C. W. Smith, Standard Oil Co. (Ind.), Chicago, Ill.
D. J. Wallace, Mid-Continent Petroleum Safety Council, Tulsa, Okla.
Secretary—H. N. Blakeslee, American Petroleum Institute, Dallas, Texas.

TUESDAY AFTERNOON SESSION

October 4, 1932

The first session of the Petroleum Section convened in the Wardman-Park Hotel with General Chairman R. E. Donovan, Standard Oil Company of California, San Francisco, presiding. Mr. Donovan briefly reviewed the activities of the Section the discussion to worth while contribution and will avoid the expression of many extraneous viewpoints.

2. All views, opinions, and facts which have a bearing on the topic should be drawn out and the group must be made aware of the significance of the expressions and attempt to evaluate the importance of and give proper weight to those views that may be in conflict. Ample opportunity must be provided for the careful consideration of all of the facts and viewpoints that form part of a complete understanding of the subject under discussion, together with a chance for expression of view on solutions or conclusions that might be offered for group adoption. Fundamentally, this principle has for its purpose the building up of a composite viewpoint which measures and weighs all the collective factors as against the more limited viewpoint and factors possessed by the several individuals in the group.

3. This principle involves the reconciliation of individual views and conclusions to a point where a conclusion which properly weighs each contribution can be stated so that it is acceptable to all. This principle also involves the crystallization of the group thought as it is made and considered and its official expression for reconsideration by the group in order that a complete understanding and agreement of the meaning may ensue. This crystallization being official, insofar as the group is concerned, comes logically from the group leader. Unanimous acceptance of conclusions is not always achieved.

4. In the case of the fourth principle, a generalization is called for, which relates the specific conclusion to other conclusions, each of which has a definite relation to a general field in which it, as an item, belongs. Hence, there is a need for working in the composite conclusion to form a part of a complete structure rather than to permit it to remain an isolated, unrelated conclusion.

The logic of a group is that of several individuals combined, hence these supporting conclusions which are part of the whole must be fully discussed by a group when an individual through his own logic must be permitted to accept or reject them by his own decision. Therefore, it is a mistake to consider the process as covering in one application the whole range of conclusions which caused the group to be called together.

To sum up, it may be said that the conference process as an educational procedure is primarily directed toward helping the group members organize the knowledge which they possess, and to help them acquire the habit of constructive thinking relative to their responsibilities and problems. A conference discussion when properly directed stimulates active thinking. The conference gives group members an opportunity to think through problems for themselves, and when a group actually thinks a problem through and arrives at an intelligent conclusion, as a result of their own thinking, they are sold on the ideas developed in the conference and are usually ready to cooperate in putting them into practice.

ADJOURNMENT

Quarry Section

Officers 1931-32

General Chairman—John Prince, Stewart Sand and Material Co., Kansas City, Mo.
Vice-Chairman—Wm. M. Andrews, Lake Erie Limestone Co., Youngstown, Ohio.
Secretary and News-Letter Editor—V. P. Ahearn, National Sand and Gravel Association, Washington, D. C.
Chairman Poster Committee—H. F. Yotter, The General Crushed Stone Co., Easton, Pa.
Chairman Publicity Committee—J. R. Boyd, National Crushed Stone Association, Washington, D. C.
Chairman Statistics Committee—W. W. Adams, United States Bureau of Mines, Washington, D. C.
Members at Large—
R. E. Colville, United States Gypsum Co., Chicago, Ill.
Otho M. Graves, The General Crushed Stone Co., Easton, Pa.
Norman G. Hough, The National Lime Association, Washington, D. C.
S. M. Shallcross, American Lime & Stone Co., Bellefonte, Pa.
A. L. Worthen, The Connecticut Quarries Co., Inc., New Haven, Conn.

WEDNESDAY MORNING SESSION

October 5, 1932

For the record of this joint session with the Cement Section, see page 152 of this volume.

THURSDAY MORNING SESSION

October 6, 1932

The first session of the Quarry Section convened in the Shoreham Hotel with V. P. Ahearn, Secretary, National Sand and Gravel Association, Washington, D. C., Secretary of the Quarry Section presiding in the absence of General Chairman John Prince. Acting Chairman Ahearn welcomed the delegates, read several brief letters from the General Chairman and others regretting inability to be present and also presented a brief report of the statistics committee, as prepared by W. W. Adams, Chairman. This report in part was as follows:

"Employment in the quarrying and related industries was more than 30 per cent lower than the previous year's level, according to records covering identical companies that were active in both years. These companies represented 9,300,000 man-hours of employment in 1931. Accident frequency at these plants was reduced about of a conference. There is no subject matter to be taught, no news to be disseminated, no instruction to be given, but the basis of every true conference is a problem to be solved, in which the experiences of the group members are used and the resulting solution represents the group thought rather than the opinion of one individual.

A conference, as we are thinking of it, is quite informal. A small group of fifteen, twenty or twenty-five persons is called together under the guidance and leadership of a conference leader. It is not the function of the leader to teach the group anything and he certainly must not lecture to them. In fact, it is generally recognized as desirable for him to avoid expressing his own opinion in most cases. It becomes his task to stimulate and organize the discussion of the group by questions, problems, illustrations, cases or any other device so that they will think in an orderly manner on the problem at hand.

He "pulls out" facts, data, experiences, or any other matter pertinent to the discussion and organizes these contributions of group members on a blackboard so that all may see and evaluate. He guides the discussion but does not dominate or control it. It is his business to see that the conference does not degenerate into a "gabfest" nor take a sidetrack which will lead away from the main question under discussion. The skilled conference leader capitalizes on the experience of his group in such a way that every member participates and points of difference are discussed and settled by the group.

Perhaps the ideal situation for conducting a conference is a group of fifteen to twenty-five individuals having mutual interests in the problem to be discussed and each of whom has had experience in it, who will be drawn together in a meeting preferably held in or near the place where the group works. It is desirable, where possible, to have the people sit about a table with the leader as a part of the group and with such a spirit of informality that the group members may come directly from their work and sit at ease with no feeling that they are being watched or checked on by the big boss. They should be encouraged to express their thoughts frequently and completely and they should be made to realize that perfect grammar and beautiful diction are secondary to the thought they are expressing. No man's thought or experience is to be barred from the group—rather he should be encouraged to give it full expression but the group opinion must prevail.

On the other hand, the group must realize that everyone's thought merits consideration and all must be weighed before the final decision is reached. Plant politics, prejudice, and closed minds have no place in a conference. Since this is a discussion group called together for thinking out some problems, such subjects as religion, social affairs, individuals' moral and ethical characters, reputation of firm establishments, etc., should not be permitted to become a part of the discussion.

I wish it clearly understood that the conference method is not presented here as a panacea nor is it implied that it will meet all training situations. However, there are many uses to which it may be put, of which these are typical:

(1) Securing a composite opinion in order to formulate or modify a policy.

(2) Modify the viewpoint of some or all the members of the group in order to get better teamwork.

(3) Analyze a job, identify responsibilities and discover better ways, means, and methods.

(4) Assist each individual member of the group to organize his experiences by coming into intimate contact with other workers in their field.

(5) Analyze situations involving joint responsibilities.

(6) Discover real sources of troubles or difficulties and bring the experiences of the group to bear on elements of the causes.

(7) Analyze accidents which have occurred to discover not only the immediate cause of the accident but the fundamental equipment or human weakness which was back of it and thus develop needed remedies.

ADJOURNMENT

Rubber Section

Officers 1931-32

General Chairman—J. R. Hanson, United States Rubber Co., Passaic, N. J.
Secretary—H. W. Low, The Miller Rubber Co., Inc., Akron, Ohio.
News-Letter Editor—Charles F. Smith, U. S. Rubber Reclaiming Co., Inc., Buffalo, N. Y.
Chairman Poster Committee—R. A. Bullock, Corduroy Rubber Co., Grand Rapids, Mich.
Chairman Membership Committee—A. M. Dietz, Pennsylvania Rubber Co., Jeannette, Pa.
Chairman Publicity Committee—M. A. Quirk, United States Rubber Co., Detroit, Mich.
Chairman Statistics Committee—Roland Kastell, United States Rubber Co., Passaic, N. J.
Chairman Engineering Committee—M. H. Kilgore, The Goodyear Tire and Rubber Co., Akron, Ohio.
Chairman Health Committee—Dr. J. Newton Shirley, Hood Rubber Co., Inc., Watertown, Mass.
Chairman Slides and Safety Kinks Committee—B. F. Gerpheide, The Goodyear Tire & Rubber Co., Akron, Ohio.
Members at Large—
E. W. Beck, United States Rubber Co., New York City.
J. T. Kidney, The Goodyear Tire and Rubber Co., Akron, Ohio.
W. L. Schneider, The B. F. Goodrich Co., Akron, Ohio.

WEDNESDAY MORNING SESSION

October 5, 1932

The opening session of the Rubber Section was called to order in the Wardman Park Hotel by Acting General Chairman J. R. Hanson, United States Rubber Company, Passaic, New Jersey. Chairman Hanson gave a brief report of the year's activities, including the reports of standing committees. Membership in the Section has been maintained at 45 companies, a very good report in view of general conditions. With the cooperation of the News-Letter, a mail campaign has been carried on for several months to interest outside companies in membership in the National Safety Council and results of the campaign are beginning already to be evident. The News-Letter has been issued regularly and has been found very helpful to members.

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 these 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 Products 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. Kidney, 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

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

(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

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. Seihl, 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.

possible to eliminate such occurrences. Mr. A. Koroleff, of the Woodlands Section of the Canadian Pulp & Paper Association, Montreal, has kindly furnished me with many of the following suggestions:

The physical examination of men before employment has been tried by the Ontario Paper Company with good results. Numerous cases of contagious diseases, hernia and other physical defects which might give grounds for compensation cases, if not rejected, or at least recorded, were readily detected.

The next step is to impress upon the jobber, the men in charge, and the lumberjacks themselves that accidents are a charge and a handicap to their industry which affects all connected with it. One case brought to my attention was that of a jobber with an exceedingly bad accident record, who was finally convinced of the needless waste it entails. He made a rule that any man injured so as to necessitate leaving camp could not come back to the job again.

A conspicuous display of safety rules and posters to show how the most serious accidents occur and how they may be avoided has also been recommended. Such educational measures or publicity drives have been of great value in reducing the carelessness causing forest fires, and have a well recognized place in safety work.

Minor accidents may produce major disabilities through delayed or poor treatment, and prompt and effective first-aid is generally recognized as of great importance. First-aid kits are universally recommended for all camps, with larger cabinets for headquarters and small field kits for the men able to use them intelligently. Instruction in their use is most essential and should be given at least verbally to all men, with demonstrations and written instructions by a physician to the more intelligent men, such as the jobber, cook, scaler, inspector, etc.

Steps beyond the first-aid bring us to the consideration of a company doctor on full time where there are sufficient men to justify it; 500 men has been suggested as a justifiable number. The duties of such a doctor are not merely to dispense medical service. He should be employed and paid by the company to reduce the number, duration and cost of accidents by all proper and effective means. He should be able to better sanitary conditions, in the camps and hygiene among the men; to prevent many accidents from reaching the compensation stage and to intelligently follow those that do, to see that there is no question of needless expense or lost time.

Discussion: Replying to a question, W. J. McCombs, manager, Engineering Department, Employers' Casualty Company and the Texas Employers' Association, said: "One of our logging company clients a year ago had a loss ratio of 65 per cent loss paid to premium. The rate of compensation insurance was $7.90 per $100 of payroll. In the last year this loss ratio was reduced to 11 per cent of premium. In Texas we have a State Fund, and the compensation rate automatically goes up or down according to experience. Our educational program is what cut this plant's loss down.

Every Monday all men were called together by their supervisor and the last week's accidents were discussed and instructions given for the following week. We gave twelve days intensive safety training to the foremen last year with this risk. All tools are examined weekly on this job. They quit using two-bladed axes because of the accidents they caused and are now using pole axes. Each Monday all track motor cars which carry the employees from camp to their job are carefully examined. All woods foremen have been trained and are competent to give first-aid. A bulletin board is maintained on the job in a very conspicuous place, which shows the accident record of each foreman day by day. This keeps up the interest and a foreman with a bad accident record is ridiculed. Each month the foreman having the worst record is given a large turtle to feed and care for during the following month. Posters of the National Safety Council are received regularly and new ones are posted every three days. New posters are discussed at each Monday morning meeting by the foremen. All first-aid cabinets are also examined at these weekly meetings.

ADJOURNMENT

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