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TH[redacted] Con-[redacted] Sessions. [redacted] Industrial Section [redacted]. It is supplemented by a smaller volume containing the sessions of the Street and Highway Traffic Section, the Child Education Section, and Home Safety.

[redacted] automatically to the Industrial mem-[redacted] volume is [redacted] chiefly interested [redacted]. It may also be secured on request by other Council members.

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THE PLAN OF PUBLICATION is the same as that followed for the last three years. It is a condensed record. The papers of each session or division of the Congress have been assembled, edited with care and discernment to eliminate extraneous matter and abbreviate the less essential portions, and the concise remainder is presented for study and reference. Although not "complete" in the sense that every word is reproduced, it is an interesting and valuable record which emphasizes the memorable parts of each paper or address. The original manuscripts are on file in the Council Library, available for additional reference as desired.

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

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1932	Gloyne, S.R., and Wood, W.B., Pulmonary asbestosis complicated by pulmonary tuberculosis; abs. J. Ind. Hyg. 14:66-67.
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1933	Stock, G.A., Pulmonary asbestosis. M. Bull. Vet. Admin. 10:126-129.

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TWENTY-THIRD ANNUAL SAFETY CONGRESS
NATIONAL SAFETY COUNCIL

Dust in Industry

FRIDAY AFTERNOON SESSION

October 5, 1934

The session devoted to a discussion of Dust in Industry was called to order by Dr. E. G. Meiter, Director, Industrial Hygiene Laboratory, Employers Mutual Liability Insurance Co., Milwaukee, who presided. Dr. Meiter briefly welcomed the delegates and then introduced the first speaker.

Types of Dust That Cause Occupational Diseases

By LEROY U. GARDNER, M.D.

Director, Saranac Laboratory for the Study of Tuberculosis, of the Edward L. Trudeau Foundation, Saranac Lake, N. Y.

The speaker said in part: Experience has demonstrated that the lung tissues can tolerate very large amounts of most kinds of foreign dust particles without serious interference with function. The lung may be intensely pigmented by colored dusts with no evidence that respiration is impaired. But dusts composed, in whole or in part, of silica have been shown to be dangerous because they stimulate the growth of the connective tissues of the lungs and bring about the formation of scar tissue. This destroys the normal elasticity of the organ which is necessary for respiration and it thickens the delicate membranes so that a free interchange of gasses is impeded. Fortunately, these results only follow the prolonged inhalation of very large quantities of silica.

Experiments have demonstrated that the injection of silica into the tissues of animals kills the cells where the substance lodges and excites an inflammation. When healing takes place a very dense and characteristic kind of scar tissue forms. Most non-siliceous dusts produce no inflammation and very little scar. It has been shown that such changes do not follow the injection of silica unless the particles are very fine, three microns or less in diameter, and unless enough of them localize in one area. With larger particles the rate of reaction is so slow that little change occurs within a year. As a general rule, the finer the particles, the more rapid the cellular response. The reaction to fine silica begins within four or five hours and it continues for a period of years.

If the silica is combined with bases in the form of silicates, it rarely produces such active and progressive changes. The silicate of magnesium, asbestos, does cause the formation of scar tissue in experimental animals and in the human body, but most other silicates are not generally recognized as injurious. Recently it has been claimed that a hydrated silicate of aluminum and potassium, called sericite, is responsible for most of the cases of silicosis. This silicate, a transformed feldspar, is often associated with quartz and it has been identified in the lungs of persons suf-

fering from silicosis. However, at least two types of sericite have failed to excite significant changes when injected into animals. Experiments with this substance are still in progress. Kaolin, an alumino-silicate of potash, has also produced quite characteristic changes in the lungs of rabbits. But our present knowledge does not permit us to assume that silicates as a class will produce serious tissue damage.

Most observers now believe that uncombined silica, or quartz, is poisonous to the tissues because it is slowly dissolved in the fluids of the body. Certainly the majority of the experimental observations suggest a chemical injury, but it is difficult to understand how enough of such an insoluble substance as quartz could be dissolved within eight hours to produce a well marked, acute inflammation. If solubility were the only factor one should discover a more active response after the injection of the more readily soluble silicates, but such is not the case. Formerly it was held that silica produced its effect mechanically. The hard sharp quartz particles were believed to abraid the lung surfaces and excite the formation of scar tissue as a manifestation of healing. This theory is no longer tenable for when animals are injected with other hard, sharp particles like diamond, carborundum or aluminum oxide, there is no inflammation and practically no formation of scar tissue. Ultimately it may be shown that the irritation of silica is due to some unrecognized property possibly related to its atomic structure.

When quartz particles are inhaled they produce three specific effects which are not excited by any other type of dust yet studied. They alter the behavior of the pulmonary phagocytes; they stimulate the formation of circumscribed nodules of scar tissue; and they subsequently increase the susceptibility of the lung to infection, especially tuberculous infection.

Phagocytes that ingest too many quartz particles are killed by this irritating substance. As the cells die they liberate their burden and several new phagocytes come out to take it up again. By a repetition of this process enough phagocytes accumulate so that many of them ingest only a few particles. Under such circumstances the stimulus is not strong enough to kill but merely accelerates the motility of the cells. They naturally tend to leave the air spaces, enter the lymphatic vessels and accumulate in the lymph nodes. This process becomes more rapid under the influence of the irritating silica and very considerable numbers of particles are consequently localized in the nodes.

After six or eight years the quartz in the nodes has caused a marked overgrowth of the fibrous elements in these structures. Ultimately the reaction develops to such an extent that the node is entirely replaced by a mass of coarse, glassy scar tissue fibres, often several times as large as the original node. Such nodules encroach upon and compress the lymphatic vessels. The drainage system of the lung is choked and effective removal of subsequently inhaled dust is gradually diminished. Dust now accumulates around the lymph vessels and sheets of scar tissue develop in this location.

These preliminary changes do not constitute the disease, silicosis; they involve only the lymphatic system. The respiratory tissues are not appreciably affected. In good stereo X-ray films these preliminary changes may be visualized as a thickening and beading of the shadows cast by the blood vessels together with a widening of the shadow of the root of the lung. The blood vessels are thickened because the most important lymphatic vessels course through their walls. The beading is due to the minute nodules of silicotic scar tissue in the lymph nodes within the lung. The root shadow is widened because of the silicotic reaction in the lymph nodes in this location.

If still more dust is inhaled it can no longer be effectively carried off through the lymph vessels. The phagocytes now carry it into the walls of the air spaces. Often the cells group themselves in nodules but sometimes they are scattered. In these locations the silica again stimulates the formation of scar tissue. The result is a general thickening of the septa between the spaces and nodulation throughout the functional portion of the lung. This change seriously interferes with function as interchange of gas cannot take place through the thickened walls of the air spaces and the tissues lose their normal elasticity. Less involved air spaces dilate and their walls stretch, producing the condition known as emphysema, which is also incompatible with effective respiration.

With the formation of silicotic nodules in the functioning parts of the lung the

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disease, silicosis, is said to begin. On the X-ray film such nodules cast clear cut, round shadows. As they increase in number and size they blot out the formerly accentuated linear shadows of the blood vessels. In a well marked case both lung fields may be thickly seeded with hundreds of such sharply defined, rounded, nodular shadows. Where there is emphysema, often at the bases, no markings are visible and the film appears black.

The condition of silicosis is a progressive one and it continues to develop after a man has left his dusty occupation. Serious results only follow, however, when he leaves with many nodules in the lung tissue itself. As such nodules increase in size they replace important functional elements. Obviously the continued growth of only a few nodules situated in the lymphatic system could have little effect other than to increase the obstruction already present.

The serious part of silicosis is its frequent complication by tuberculosis. This may arise from reactivation of a pre-existant latent infection or it may result from a new infection from without. The danger of infection increases with the amount of silicosis present. The course of the infection in the silicotic is usually chronic and it often fails to produce characteristic symptoms for months or years after its onset. Many times it is accidentally discovered in routine X-ray examination of groups of active workmen. However, evidences of disability are much more marked in silicotic individuals with infection than in those with uncomplicated disease. Occasionally tuberculosis may run a very acute course in the silicotic subject but this is also true in other persons. The cause of the susceptibility of the silicotic lung to tuberculosis is not perfectly understood, but it would seem that the action of the silica on the tissues creates a medium favorable for the growth of the bacteria. The tubercle bacilli multiply and a slowly progressive tissue reaction ensues, but the usual clinical symptoms of tuberculosis are often held in abeyance for a long time because the chances for absorption of poisonous products of infection are minimized by the obstructed lymphatic system. It is also possible that some of these poisons may be absorbed on the silica particles, as Cummins has suggested. Ultimately the infection gains the upper hand, symptoms develop and death from tuberculosis ensues.

The only other type of dust which is generally recognized as a cause of [redacted] more readily soluble than quartz. Apparently the protective [redacted] mechanisms seem inadequate to prevent the inhalation of many such fibres and even quite long ones may penetrate into the finer bronchial tubes. These structures have irregularities in their walls which seem to hold the fibrous dusts. In this location the asbestos particles are surrounded and ingested by phagocytes. The cells do not seem to be particularly irritated for they are not especially numerous nor do they migrate rapidly into clumps as in the case of phagocytes dealing with quartz. Apparently most of them carry their burden of asbestos fragments directly into the walls of the tubes in which they lie. The mildly irritating dust sets up a proliferation of the connective tissue cells in the walls resulting in collar-like thickening of the tubes. Contraction of the new connective tissue narrows or closes the tube and thereby shuts off the ingress of air to the more peripheral air spaces. These spaces then collapse, a condition known as atelectasis. This in itself is a cause of fibrosis or scarring of lung tissue. The result is a fibrosis of numerous relatively small areas in the lung due to the collar-like constricting fibrosis about many small terminal bronchial tubes. The lymphatic system seems to play little part in disposing of asbestos dust and very insignificant amounts of this dust are found in the lymph nodes.

Not a few cases of asbestosis die of tuberculosis or bronchopneumonia but the prevalence of the former infection is probably much less common than in silicosis. Surveys of large groups of asbestos workers fail to reveal such a high incidence of tuberculosis as found in similar studies on silica workers.

The inhalation of unusual amounts of non-siliceous dusts apparently fails to produce significant alterations in the lung. It is of course possible that injurious ones may ultimately be discovered, but none are recognized today. The non-siliceous particles enter the lung and are ingested by phagocytes as in the case of quartz. The cells are not stimulated to move very rapidly and as a consequence many of them remain within the air spaces for a long time. Some, particularly those con-

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taining relatively few particles, make their way into the lymphatic system and accumulate in the lymph nodes. In sufficient concentration, or perhaps because they are mixed with small amounts of silica, they set up a low grade, non-progressive chronic inflammation. But this reaction results only in a little thickening in the lymph nodes and about the lymphatic vessels. The lung tissue may be variously pigmented, black from coal or red from iron, but there is no formation of scar tissue that interferes with function. The susceptibility to tuberculosis of the person with such pigmentation is not increased but it is apparently quite definite that pneumonia is unduly prevalent in coal miners and that chronic bronchitis results from the inhalation of cement. The X-ray films of men working in non-siliceous dusts shows either nothing at all or a more or less marked accentuation of the linear shadows cast by the blood vessels. This, of course, is due to the chronic inflammatory changes about the lymphatic trunks in walls of blood vessels.

The effects of mixtures of free silica and non-siliceous materials are less clearly defined and should receive more serious attention. It would seem unwise to assume, as has been done in the past, that the non-siliceous substances serve only as inert diluents and that only the quartz component of a dust is of significance. Experimental and clinical data are accumulating which suggest that at least some other dusts may materially modify the action of quartz, both in its capacity to produce nodular fibrosis in the lungs and to increase the susceptibility to tuberculosis. For example, animals inhaling heavy concentrations of a mixture of equal parts of pure silica and hematite dust for eight hours a day over a period of 14 months have shown not even the slightest indication of nodule formation in the lung, whereas pure quartz dust, inhaled for only two hours a day, produces definite nodulation. It also seems to be true that animals inhaling such a mixture are much less susceptible to tuberculosis than those exposed to pure quartz. In the case of the human iron miner, some lungs show definite silicotic nodulation, others only a very few nodules and many no nodules at all. All exhibit heavy deposits of iron particles with a cellular connective tissue reaction. When these findings can be correlated with chemical analysis of the lung tissues and the approximate amount of rock work which these miners have performed, some relationship between the exposure to silica and the fibrous nodule formation may be established. Tuberculosis in these iron miners is apparently less prevalent and much less severe than in men exposed to pure silica. What has been said of iron miners is also probably true of foundry workers and coal miners. It is generally accepted that men in the latter occupations have less tuberculosis than the average for the age period; Cummins believes that they have the infection but that it is so atypical and benign in its manifestations that it escapes diagnosis.

Mention should also be made of mixed dusts like certain slates and granite containing large amounts of free silica in combination with silicates. Experimentally these substances behave atypically and do not produce nodular fibrosis unless there is complicating infection. The same may also be true in human beings. Unquestionably such dusts are capable of producing typical silicotic nodules and they predispose to tuberculosis. From a theoretical standpoint they should receive much more intensive study to clarify our views on the whole subject. At the present time it appears that the action of their quartz component is modified and partially neutralized by the other substances which they contain.

Using Exhaust Systems and Respiratory Equipment To Protect Workers Exposed to Dust

By STUART W. GURNEY and DAVID S. BEYER

Liberty Mutual Insurance Company, Boston

The speaker said in part: A number of our states have had references to dust elimination in their labor laws for a good many years, but no state has as yet thoroughly enforced these laws. The codes of five states which we investigated provide that grinding, buffing and polishing wheels should be exhausted, although two of the states exempt from these provisions wh[illegible]

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This seems ill-advised, since a study of wet and dry grinding in Connecticut by Winslow and Greenburg has shown that the application of water does not by any means eliminate the dust hazard.

It may be remarked that, with everything else equal, a high static suction will give a higher velocity at the point of origin of the dust, fume or gas than a low one; but this alone is not a measure of the effectiveness of any exhaust system. Wisconsin has adopted the principle of specifying a limit to the number of dust particles of respirable size per cubic foot of air. After all, this is what we are primarily interested in, to keep the dust contamination down to a point where it will not be harmful.

These variations and conflicting provisions in state codes merely reflect the general lack of authoritative standards. It is accordingly fortunate that definite steps are now being taken by the American Standards Association to develop the proper basis for such codes. There are two committees working on this problem; the Ventilation Code Committee, sponsored by the American Society of Heating & Ventilating Engineers, and the Exhaust Code Committee, sponsored by the International Association of Industrial Accident Boards and Commissions. It is also arranged to appoint sub-committees to take up five specific subjects: Abrasive cleaning, chromium plating, granite cutting, rock drilling, and spray coating. In addition, a Sub-Committee on Fundamental Principles of Design and Operation and Maintenance of Exhaust Systems will be appointed.

The two most important considerations in an effective exhaust system are: 1. Velocity of air flow; 2. Arrangement of the inlets (from the standpoint of nearness to the dust source, shape, etc.).

Many an installation that is otherwise all right fails to remove the dust successfully merely because there is not enough air being drawn through the system. In a series of tests that were conducted under actual working conditions by Theodore F. Hatch, Department of Industrial Hygiene, Harvard School of Public Health, a machine used in dressing stone was employed, and it was noted that with an air flow through the hood of 230 cubic feet per minute, there were over one hundred million dust particles in the surrounding air. When the air flow was increased to a little over 230 cubic feet per minute, the dust concentration had dropped to forty million, a marked improvement. As the air flow was further increased, the drop in dust concentration was relatively slower, and it took a volume of about 380 cubic feet per minute to bring the dust concentration down to ten or fifteen million particles per cubic foot, which was considered reasonably safe for this type of dust.

It is accordingly possible sometimes to take an installation that is not satisfactory and, if the remainder of the system is well designed, by merely speeding up the blower or adding a larger one, to bring about the desired results.

Another very important consideration is to get the inlets of the exhaust system as close as possible to the source of the dust. The drop in efficiency as we get further away from the inlet is really surprising to one who has not studied the principles involved. It should be remembered that if we have the open end of an exhaust pipe or air duct in operation, the air tends to flow in from all sides, even from behind the opening. As we move away from the end of the pipe, the velocity drops very rapidly, so that even at a distance of five inches from the hood the velocity may be less than 10 per cent of that right at the hood inlet. This is the most important consideration to keep in mind and one which is frequently lost sight of in designing exhaust systems. It is not uncommon to see an exhaust inlet a few inches in diameter with which the person making the installation hoped to draw dust from a distance of several feet, but the air flow even a foot or two away from the entrance to the inlet may be negligible.

Still another important consideration having to do with the design of the inlet, is the addition of a flange. The effect of this flange is to cut down the air that would flow in from behind the opening, thus drawing it nearly all from the front. Thus the efficiency of the system is substantially increased and the scope of the exhaust extended appreciably, without increasing the power consumption or otherwise adding to the expense of keeping up the system.

There are also other considerations of perhaps lesser importance. For example, air cannot be "pulled" from a distance by merely directing an exhaust pipe toward the point in question, but it can be "pushed" or blown, directionally, for a consider-

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able distance. This principle may be used advantageously in directing the dust toward the opening of the exhaust inlet and thus getting the desired results with a lower exhaust velocity and power consumption than would be required if suction alone were depended upon. This principle has been applied effectively in drilling material containing asbestos, where the exhaust inlet is placed at one side of the drill and a small air jet at the opposite side of the drill, blowing across the table, turns the particles that would fly out from this side and directs them back into the exhaust system. It is also being applied to foundry shake-out work.

Other considerations in designing exhaust systems include the elimination of unnecessary bends or curves, the provision of clean-out doors, and the proper construction of joints. Where there is a general ventilating installation and one or more exhaust systems, care must be taken to see that they do not conflict with each other.

After an exhaust system has been installed it should be tested by taking actual dust counts to see that the dust is really being cut down to the desired point, and such counts should be taken at intervals after the installation has been made, to see that it is still functioning properly.

The fact that the dust particles that cause the trouble are so small that they are invisible under ordinary conditions (less than 10 microns or 1/2500th of an inch in diameter) often makes it hard to convince the practical plant manager that there is any dust present; it also makes it impossible to tell, without the use of special instruments, whether the completed exhaust system is actually removing the dust.

It might seem like an insult to one's intelligence to say that after an exhaust system has once been installed it should be maintained in good operating condition. However, the numerous cases one encounters in the plants where this obvious necessity is not carried out, indicates that it is really one of the major considerations in connection with the elimination of dust or fumes. Cases are not unknown where the blower has in some manner become reversed so that the air is being ejected and diffusing the dust, rather than drawing it in; other instances where the efficiency of the system has been lowered or its value nullified by clogging up, disconnection or wearing out of the piping, etc., are all too common.

One concern, of which the writers have knowledge, has a "U" tube permanently installed in one of its main exhaust systems so that the foreman or safety man can tell at a glance whether there are any changes that would indicate a break-down in the system. All such installations should have regular inspections by some competent person as a routine part of their upkeep.

It will be sufficient here to discuss respiratory equipment very briefly. The simplest form of this equipment is the filter respirator. Such respirators have a definite value for temporary use such as sweeping up, cleaning out bins, shoveling materials, etc., but they require careful fitting and constant supervision to see that they are being properly used.

It is our opinion, after watching the sincere efforts in a number of plants to enforce the use of these respirators, that it is rather impracticable to require them to be used on full-time operation. One notices the men, under these conditions, surreptitiously pushing the respirator aside and gasping in free air like a fish out of water. Certainly, if they are to be used any considerable length of time, frequent rest periods should be allowed where the men can get out into the free air for a few minutes refreshment.

There are also the large air-fed helmets, with which most of us are familiar used for sandblasting, etc., which have been carried to a high state of perfection for the purposes to which they are adapted.

We believe, however, that much more use could be made advantageously of the type of apparatus that lies midway between the filter respirator and the air-fed helmet, namely, the light, air-fed respirator which covers the nose and mouth and leaves the rest of the face exposed. With a light hose attachment, this device offers considerable freedom of movement, and if air outlets were supplied so the hose could be quickly transferred from one outlet to another it would seem to be practicable to use them over a considerable area. They afford the advantage of a pure air supply without excessive weight and without the restriction to vision that is imposed by the filter respirator.

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The Medical Supervision of Workers Exposed to Dust

By W. J. McCONNELL, M.D.

Assistant Medical Director, Metropolitan Life Insurance Co., New York City

The speaker said in part: The harmfulness of dusts varies widely in accordance with the physical and chemical natures of each individual substance. Certain dusts are soluble or slightly soluble in the body fluids and their harmful effects are proportional to the toxicity of the compounds formed. Lead, mercury, and arsenic are examples of poisonous dust. Other dusts exert their harmful effects locally on the skin and mucous membranes and through irritation to the respiratory passages. Chromic acid and alkalies are examples. Attention recently has been called to the probably harmful effect of dusts arising from radio-active ores. A fourth group of dusts which are insoluble or very difficultly soluble in the body fluids may initiate harmful pathological lung conditions. These may be subdivided into non-fibrosis and fibrosis producing dusts. The organic dusts, mainly the vegetable fibers, such as cotton, jute, hemp, etc., are non-fibrosis producing dusts. The fibrosis producing dusts are limited, so far as we have evidence, to a few of the inorganic mineral dusts, such as free silica, crystalline silicon, quartz, and certain combined silicates. Of the fibrosis producing dusts, those having a high percentage of free silica are admittedly the most important because exposure over a period of years to such dusts distinctly predisposes the individual to tuberculosis.

The effectiveness of dust control measures in preventing diseases produced by dusts can be determined only by careful physical examination of the workers so exposed under the guidance of competent medical supervision. The benefits which accrue to the employer and employee, alike, as a result of the physical examination of all applicants for employment, as well as periodical examination of those already employed, would indicate very careful consideration by industry of a program for control of sickness. Such a procedure protects the employer from engaging an applicant already physically or mentally impaired who later may claim disability for a condition either not associated with employment or contracted during a previous employment. The applicant's physical and mental condition is established and by keeping record of his subsequent illnesses and accidents, the question of responsibility for injuries and sickness need never arise.

The applicant is protected from engaging in work for which he is physically ill adapted which, if undertaken, might easily bring about serious impairment of his health. For example, an applicant with an arrested tuberculosis who seeks work in a certain dusty occupation, if allowed to engage in such work might readily convert an inactive tuberculosis into an active one; thereby endangering life or at least seriously impairing the applicant's future efficiency and earning capacity. Whereas the same applicant if assigned to a position that involves no such exposure, might be expected to continue for years as a useful and productive workman. The examination of applicants for employment likewise protects those that are already employed from the risks of communicable diseases such as tuberculosis and various acute respiratory and other infections being introduced into their midst by a new applicant.

Many of the younger individuals who seek employment have never before received a thorough physical examination and consequently are unaware of the defects from which they suffer. As a result of physical examinations, many defects are located which may be removed or corrected before they have caused irreparable damage, thereby increasing the efficiency of the worker and often averting definite and finally chronic diseases. Furthermore, incipient tuberculosis, unsuspected diseases of the heart, kidneys, and a host of other diseases of a similar nature, are discovered and the applicant referred for proper medical care and treatment which otherwise might have been postponed until too late.

Of even more importance than the initial physical examination of applicants is the periodic examination and care of old employees by an industry. Such a procedure serves to check the efficiency of preventive measures designed to prevent occupational diseases. It offers the most effective way of controlling the health of

large groups of workers by discovering early not only occupational diseases, but many other conditions that go undiscovered until the worker is acutely ill or becomes disabled. If the various contagious conditions go unrecognized others become infected, thereby causing serious economic loss, as well as endangering the health of a group of individuals.

The information obtained from physical examinations affords the medical supervisor the opportunity to make certain that employees are engaged in suitable work out of which they are getting maximum results, to correct the effects of undue exposure to harmful environmental conditions, and generally to lessen all occupational hazards. As a public health measure, it is impossible to over-estimate the value of periodic examinations in establishing interest in sickness prevention.

The set-up of a proper program for medical control of workers exposed to dust depends upon the number of employees involved and individual plant conditions. A series of articles under the title of "The Medical Department Manual" by Dr. Hart E. Fisher, appearing in current numbers of "Industrial Medicine," gives a comprehensive account of the organization and operation of a medical department.

1. The establishment of a medical department with adequate facilities and medical personnel who have qualified in the field of industrial medicine. A process analysis of all operations in the plant should be made and the medical supervisor should list all possible health hazards and familiarize himself with their physiological effects. If necessary, he should conduct research studies to determine the harmful effects of new substances introduced into plant processes about which little is known. In cooperation with other departments, he should investigate the causes of the hazards and devise measures of control.

2. The routine examination of all applicants for employment. The procedure should include a detailed history of the applicant's previous illnesses and accidents classified under (a) diseases of childhood, (b) general infectious diseases, (c) respiratory diseases, (d) venereal diseases, and (e) accidents and resulting physical defects. A detailed history of previous occupations engaged in is very important. A mere statement of the type of industry in which the applicant was engaged has slight value, if any. The exact duties performed in each occupation should be noted and information ascertained as to the probable length of exposure to hazardous substances. After the history has been taken and a photograph for identification purposes (if part of routine) is made, the applicant should be directed to the examining room where he is instructed to remove his clothing for physical examination. This examination should be made as complete as is considered necessary to determine the applicant's physical condition.

If the applicant has been or will be exposed to dusts which induce lung diseases, an X-ray picture of the chest is an important part of the examination. This part of the examination may be referred to an experienced roentgenologist, as the value of this method of diagnosis depends upon the type of pictures taken and the experience of the reader who interprets them. The examining physician also may need additional information obtained by laboratory analyses of the blood, sputum, and the urine. These aids to diagnosis should be provided or made available when desirable.

3. The rating and placement of applicants. In cooperation with the personnel department, the applicant should be rated and placed, not only on his training and past experiences, but also on his physical and mental abilities to fill vacancies occurring from time to time. The record of his physical and mental examination should be the confidential property of the medical department.

4. Periodical physical examinations. The frequency of periodical examinations necessarily must depend upon individual circumstances according to the need for such examinations as determined by the supervising physician. Where physical examinations are made for the first time, the employees of long standing should be given ample explanation of the benefits of such examinations and be given assurances that their jobs are secure.

5. Provision for the disabled. Employees who develop disabilities during the course of employment should be re-assigned to occupations which will not interfere with or aggravate the disability, or they should be provided for in other ways.

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the manufacturer. It is not enough to say in a code that certain hazards must not be permitted; the code must specify the actual type of safety device to eliminate the hazard.

Specifications for safety devices should be set up by competent and experienced engineers or safety directors. These specifications should be largely uniform so far as it is possible. There is no reason why one state should require 55,000 pounds tensile strength in a window cleaning device and another state should require 60,000 pounds tensile strength. If 55,000 pounds tensile strength is safe for a man's life in one state it should be safe for a man's life in all states. Manufacturers of safety equipment should see to it that the states adopt a uniform standard in safety equipment.

Safety devices in the shop have an almost incalculable visual value to employees. The very sight of guards brings to their minds the thought of the employer's backing and willingness to prevent accidents wherever possible. The employee cannot see any proof of money spent by his employer when it is expended merely for oral safety directions, meetings of committees or engineers; but there is a visible presence of the employer's interest shown in every safeguard used in a shop.

Again there is an added gain in the mental reaction of the employee in a well guarded shop. To illustrate, we are prone to be careless in our personal habits if we work or frequent a carelessly kept workroom or office. We do not mind throwing a cigaret butt or a paper on the floor of a dirty room or office, but we hesitate twice before doing so on a floor of a scrupulously clean and well-kept room. I believe that in a well guarded shop, the moral and mental stimulant to become a safe worker is greatly accentuated due to guarding and that we can expect the workers to react by conducting themselves as safe workmen.

There are plenty of instances where proof can be obtained as to the value of safety devices in accident prevention. A short time ago a project was completed within our own state, in the nature of road building, lasting only a few weeks, and yet during that time thirty-six pairs of goggles worn by the workmen were broken. Had these goggles not been worn, there is no question but that thirty-six persons would have had eye injuries resulting probably in the loss of eyes to some of them. At the Greater New York Safety Congress held last winter, statistics were circulated to the effect that the loss of an eye entailed a monetary loss of approximately $12,000. In the instance I speak of, the wearing of thirty-six pairs of goggles insured a possible money saving of some $432,000.

In the olden days the operator of a mill expected accidents just as surely as he expected breakdowns in his machinery. The situation is different now, however, for an accident in a mill means an investigation as to its cause, a rigid inquiry into somebody's carelessness, and in most cases, a punishment for the man in charge of the operation because of the accident. All we need to do to size up the value of safety devices is to imagine what industry would be like today if all our safety devices and safe practices were abolished and manufacturing plants returned to their former careless state of years ago.

Protecting the Feet and Legs, Hands and Arms, Face and Head of Industrial Workers

By H. R. BIXLER

Industrial Relations and Employment Department, Union Carbide Company, New York City

The speaker said in part: In a recent publication of the Industrial Commission of Ohio, under the heading "The Destructive Big Six," I find the following:

"An analysis of occupational injuries in Ohio in 1933 shows that a large percentage of the total of all mishaps in industry are directly traceable to six principal causes. The most prolific source of injuries to industrial workers is that of handling objects. This cause is charged with 26 per cent of the total injury claims for these six causes for the year 1933. Next in accident frequency is machinery, with 24 per

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Hand tools next, 15 per cent. Falls of persons, while fourth in order of frequency with 14 per cent, lead in severity. Stepping upon or striking against objects are fifth with 13 per cent, and the operation of industrial motor vehicles (while this is not directly related to our subject) is sixth with 8 per cent. In summing up the 1933 totals for these six causes, it is found that they were accountable for over 73 per cent of all injury claims filed, for over 44 per cent of all fatalities, for approximately 80 per cent of all permanent disability cases; and were charged with a time loss of over 50 per cent of the total for all causes."

One of the major considerations in the design of protective clothing for special uses, in addition to the mechanical features of such clothing and equipment, is that of the materials with which they are made. A specialist in the design of safety apparel offers the following comments:

"Primarily, three types of material are used in the manufacture of safety apparel. These are leather, asbestos, and fireproof duck. Duck of this kind should really be called "flame-proof." Flame-proof duck when exposed to flame or fire, even at high temperatures, will not ignite. There will, however, be a process of oxidation which will eventually consume the cotton in the duck. Fireproof duck is the cheaper of the three substances ordinarily used and is suitable where the hazard encountered does not require impervious protection. Asbestos, the second material, is also commonly used in the manufacture of protective clothing. Many people think that asbestos is a heat insulator, while actually it is a heat conductor. Asbestos can be compared in this relation to any other mineral and while it will not conduct heat as readily as metal, it certainly will conduct some heat. Such equipment, therefore, should have some heat insulation, as for example, a cotton lining in an asbestos glove. Asbestos, of course, is absolutely fireproof. The third material commonly used in the manufacture of protective clothing is leather, which for most safety apparel is horsehide or cowhide. Leather can be either grain or split leather. The grain leather is comparable to the tough outer layer of skin, while the split leather can be compared to the bottom layer of skin. In tanning leather it is necessary to use oil. While there must be a certain amount of oil in the leather, the buyer of protective apparel must be careful that there is not too much oil in it, since such leather, when used near hot operations, deteriorates rapidly."

In the estimation of this specialist, leather is the best article for all-round wear and hard usage. He believes, for example, that a leather legging should outwear at least three fireproof duck leggings, and from two and a half to three asbestos leggings. This same comparison applies to leather gloves. He recommends using leather for all general purposes except those where its weight will defeat its purpose by tiring the user or making him too hot while working.

Many types of specially designed protective clothing are made of rubber, or of a composition of some other material with rubber. Such equipment is usually designed for protection in connection with operations involving hazards because of acids, fumes and vapors, work in wet areas, and those operations involving the handling of liquids. Special rubber protective clothing and equipment has been designed for electrical hazards and include rubber gloves, boots, overshoes, sleeves, coats, hats, and line covering material, such as blankets, line hose, insulator hoods and protectors.

Felt is used in some types of protective clothing as a protection against heat, where the use of clothing made from fireproof duck, asbestos or leather is not desirable. One industrial concern having electric furnace operations uses paper-mill pressed felt to make protective jackets and trousers for its furnace operators, because of its protective features, comfort of the wearer, and relatively low cost. This material is pure wool felt and offers good protection from radiated heat on account of its low thermal-conductivity; while it will burn, it will do so very slowly and without flame.

Referring to the first two sections of our subject, without attempting to go into the physical details of material requirements and mechanical design, let us say that protective clothing for the feet and legs of industrial workers would include shoes, toe guards, spats, leggings, knee pads, thigh guards, and aprons, for most operations. In protecting the hands and arms safety gloves, hand pads, mittens, finger cots, arm protectors, sleeves, jackets, and the like are commonly used. In addition, for complete body protection, are found protective suits, consisting of

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jackets and pants, or complete jumper suits. Protective ointments are also used for the skin in operations involving acids, fumes and vapors.

The third division of our subject, for protecting the face and head of industrial workers, is one which is receiving increasing attention because of the hazards involving the eyes and respiratory organs. While eye protection has long been a part of industrial accident prevention work, the necessity for the use of goggles is not fully recognized since we learn from the National Safety Council that there were 300,000 industrial injuries to the eyes in the United States last year, each resulting in at least one day of disability. Of this number 70,000 were compensable cases, which means seven days or more of lost time, for which the average cost was $375, and $125 additional for medical cost. In 2,000 cases there was complete loss of vision in one eye, while 75 persons lost the vision of both eyes. The total estimated loss of 3,600,000 days per year from work was attended with a total cost in time lost, compensation and medical bills of approximately fifty millions of dollars.

Perhaps the most authoritative source of valuable information for safety engineers at this time concerning the protection of face and head of industrial workers is the head and eye safety code, which is now being revised under the supervision of the American Standards Association. The title of this code is being changed to the "American Standard Safety Code for Protection to Heads, Eyes and Respiratory Organs." A study of the code's revisions, even in its present tentative form, will be of great value in the individual's consideration of our subject; and in its final form, when published, will be of inestimable value.

Of special interest are the following requirements for respirators and gas masks, as proposed in the revised code:

Requirements for Respirators and Gas Masks

"The respirator, gas mask, with mechanical filter, or hose mask is permissible.

"The respirator shall be so designed and constructed that, when it is worn in its proper position, it will permit only air which has passed through the filter to enter the mouth or nostrils of the wearer. The material used for the body of the respirator shall be such as to combine mechanical strength and lightness of weight. The respirator shall be comfortable to wear and shall not impede free action by the wearer. The facial contact edge of the respirator body shall not irritate the skin of the wearer and shall not allow leakage of unfiltered air. If rubber is used, the rubber compound shall be free from lead and mineral sulphates. If used in work requiring goggles, the respirator when in place on the wearer shall permit the use of various types of goggles without impairing the effectiveness of either the goggles or the respirator, or the goggles may be permanently attached to the respirator. An automatic exhalation valve is optional.

"The gas mask is permissible for limited exposure. For higher concentrations and for longer exposures to any gas, a hose mask, or a hood with positive air supply may be used.

"The hose mask shall be of such design and construction as to completely protect the respiratory organs of the wearer from toxic gas and dust, and make a gas-tight fit when in its proper position on the wearer.

"Canister type gas masks shall be of such design and construction as to protect the eyes and respiratory organs of the wearer from acid and organic vapors, ammonia, carbon monoxide, dusts, smokes, and mists, either singly or in combination, where the oxygen content of the surrounding atmosphere is not less than 16 per cent. In places where only non-irritant gases, such as carbon monoxide, are present, the eyes need not be covered. Gas masks shall be of such design as to insure a gas-tight fit when in proper position on the wearer. Cartridge-type masks shall meet all requirements for the canister type except as to canister, connecting tube, and body harness."

Among the devices designed for the protection of the individual worker against dusts, by far the most important is the positive pressure respirator. In particularly dusty operations, such as sandblasting and metal grinding, where the particles may injure the face, the helmet type of respirator is prefe[illegible] whatever type of air-

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...s worn, it is essential that the apparatus be provided with an adequate air ... drawn from a pure, dust-free source. Some authorities recommend as ... as six cubic feet per minute, while others are of the opinion that respirators ... on modern principles are efficient when used with but one or two ... feet of air per minute. The source of air supply is equally important. The ... is frequently made of taking the air directly from a compressed air line ... providing the air intake to compressors with a filter capable of removing ... dust particles. Sometimes the air of the compressed air line is wet and ... and there may be a possibility of carbon monoxide poisoning due to oil being ... burned in a reciprocating piston-type compressor. The air, under these ..., is unsuited for use in the respirator and it becomes necessary to install ... rotary compressor blower, supplied from a clean source of air. This ... method is applicable particularly to plants not equipped with compressed air.

Respirators should be selected for their comfort to the wearer and for their ... efficiency. The manufacturer should be required to submit a laboratory ... of the efficiency of his device, for the purpose selected. Although respirators ... never be regarded as substitutes for local exhaust ventilation, they provide ... means of protection for workmen engaged in dusty operations carried ... occasionally or for short periods of time. The positive air pressure type of ..., unfortunately, cannot be worn by workers engaged in operations requiring ... to move about unhampered by air hose. The only available protection ... worker under these conditions is to wear a respirator with a filtering ... of fibre or tissue. Only those types which have been demonstrated to ... the necessary filtering medium to give sufficient protection against fine ... should be selected.

The importance of the use of the positive pressure respirator in dusty work ... is illustrated by the results of an analysis conducted by Dr. Leonard ... and Charles Pierce, of the Laboratory of Hygiene at Yale University, ... connection with the study of the subject of "Ventilation and Its Relation to the ... of Dust, Gases and Fumes." They found that air drawn from a cabinet ... fifty million of dust particles per cubic foot retained four and one-half ... particles per cubic foot when drawn through a respirator; two million ... were drawn through helmet and respirator; four-tenths of one million of ... particles per cubic foot were drawn through helmet with positive air pressure; ... but two-tenths of one million were drawn through a respirator and helmet ... positive air pressure. This demonstrates conclusively that a respirator alone ... limitations in effectiveness when used in heavy concentrations. The reason for ... lack of satisfaction arises from the fact that the fit of the respirator to the face ... made by soft rubber which, even though the best available, is not air tight when ... wearer is working. Where dust exists which cannot be otherwise controlled, ... protection can be obtained through the use of respirators; however, if ..., a positive pressure helmet system should be installed, since it gives ... complete protection.

Safe Protective Equipment as Related to Accident Prevention

By R. B. ROAPER

Safety Engineer, Humble Oil & Refining Company, Houston, Texas

The speaker said in part: I am convinced that a combination of education and ... equipment is essential for accident prevention work. The use of protective ... cannot prevent all accidents, nor can the training of employees prevent all accidents. No matter how proficient employees may become in the performance of a duty, they must not lose sight of the fact that certain hazards and conditions require protective equipment.

In order to determine just what equipment must be used, it is necessary to study past experience in each class of work. If it is found that men engaged in certain ... of work are prone to receive injuries to certain parts of the body, even in

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BUSINESS SESSION

September 30, 1934

The annual business meeting of the Accident Prevention Equipment Manufacturers' Section was called to order after a pleasant dinner by General Chairman Buell W. Nutt, Safety Equipment Service Company, Cleveland, who presided. Reports were heard from the General Chairman and the Chairmen of Standing Committees on activities during the past year. The report of the Nominating Committee was then called for, and new officers for the Section were nominated and elected as follows:

Chairman:—Irwin W. Millard. Secretary, Industrial Gloves Corporation, Danville, Ill.
Vice-Chairman:—George Shull. President. Safety First Supply Co., Brady Bldg., Pittsburgh, Pa.
Secretary:—William Wahlert. Pulmosan Safety Equipment Corp., 176 Johnson St., Brooklyn, N. Y.
Treasurer:—L. E. Dickson. Vice-President. Standard Safety Equipment Co., 75 East Wacker Drive, Chicago, Ill.
Executive Committee-at-Large:—
J. T. Ryan. V-Pres., Mine Safety Appliances Co., 201 N. Braddock, Pittsburgh, Pa.
F. R. Davis. President. Davis Emergency Equipment Co., 55 Van D[illegible] New York City.

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R. T. Solensten, V-Pres., Elliott Service Company, 242 W. 55th St., New York City.

B. W. Nutt, President, Safety Equipment Service Company, 1228 St. Clair Ave., NE. Cleveland, O.

ADJOURNMENT

Accident Prevention Equipment Manufacturers

Who Made Exhibits at the Twenty-Third Annual Safety Congress and Exposition, Statler and Cleveland Hotels, Cleveland, Ohio, October 1-5, 1934

American-La France & Foamite Industries, Inc., Elmira, New York
Fire protection equipment

American Optical Company, Southbridge, Massachusetts
Industrial eye protection service

Bendix Products Corporation, South Bend, Indiana
Automotive testing equipment

Robert A. Bernhard, Rochester, New York
Saf-T-top applicator bottles for antiseptics

Binney & Smith Company, New York City
Emulsified carbon black for concrete pavements

Bishinger-Koehler Manufacturing Company, Pittsburgh, Pennsylvania
Oxygen equipment products

Bradley Washfountain Company, Milwaukee, Wisconsin
Group washing equipment

Brown Shoe Company, St. Louis, Missouri
Safety Toe Shoes

R. H. Buhrke Company, Chicago, Illinois
Safety belts, straps, buckets, and tool guards

E. D. Bullard Company, San Francisco, California
Safety equipment for mines and industry

Burroughs Wellcome & Company (U. S. A.), Inc., New York City
First aid and medical equipment

Godfrey L. Cabot, Inc., Boston, Massachusetts
Emulsified carbon black for concrete pavements

Chicago Eye Shield Company, Chicago, Illinois
Head and eye protection equipment

H. Childs & Company, Inc., Pittsburgh, Pennsylvania
Safety footwear

Cunningham-Hall Aircraft Corporation, Rochester, New York
Sand blast helmet and suit

Davis Emergency Equipment Company, Inc., New York City
First aid, gas masks and safety equipment

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Eagle Signal Corporation, Moline, Illinois
Traffic signal equipment and industrial timing equipment

Elliott Service Company, New York City
Elimination of waste, promotion of efficiency and safety

Evans Products Company, Detroit, Michigan
Railroad grade crossing and barrier and traffic signals

The Gerson-Stewart Corporation, Cleveland, Ohio
Soaps, disinfectants and cleaners for planned sanitation

Harley-Davidson Motor Company, Milwaukee, Wisconsin
Special police motorcycles and equipment

Hunter Auto Equipment Company, Inc., New York City
Fleet specialties, rubber mirrors, stop and tail-lights

Hynson, Westcott & Dunning, Inc., Baltimore, Maryland
Mercurochrome and Thantis lozenges

Industrial Commission of Ohio, Columbus, Ohio
Accident record charts and graphs, educational safety literature

International Shoe Company, St. Louis, Missouri
Safety shoes

Junkin Safety Appliance Company, Louisville, Kentucky
Safety guards for punch presses

Walter Kidde & Company, Inc., New York City
Permanently piped fire systems and portable extinguishers

Lehigh Safety Shoe Company, Allentown, Pennsylvania
Safety shoes and boots

Lima Cord Sole & Heel Company, Lima, Ohio
Non-slip soles and heels for footwear

Liquid Carbonic Corporation, Chicago, Illinois
Fumigant for infestation control

Macwhyte Company, Kenosha, Wisconsin
Wire rope and braided slings

Martindale Electric Company, Cleveland, Ohio
Protective masks, safety roadway signals

Metropolitan Life Insurance Company, New York City
Insurance, industrial group, etc.

Mine Safety Appliance Company, Pittsburgh, Pennsylvania
Mine and industrial safety equipment

National Automatic Safety Signal Company, Chicago, Illinois
Safety flash signal for rear of trucks

National Safety Council, Chicago, Illinois
Poster, Library, Research and Education Divisions

The Patent Scaffolding Company, Chicago, Illinois
Ladders and scaffolds for industry and construction

Portable Lamp & Equipment Company, Pittsburgh, Pennsylvania
Electric mine lamps and safety equipment

The Positive Safety Manufacturing Company, Cleveland, Ohio
Power press safety devices

Protectoseal Company, Chicago, Illinois
Safety cans for washing, bench, storage, etc., tank fittings

Pulmosan Safety Equipment Corporation, Brooklyn, New York
Respiratory protection and general safety equipment

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Pyrene Manufacturing Company, Newark, New Jersey
Hand fire extinguishers and systems

Reece Wooden Sole Shoe Company, Inc., Columbus, Nebraska
Wooden sole safety footwear

The Safety Clothing Company, Cleveland, Ohio
Safety clothing and equipment

The Safety Equipment Service Company, Cleveland, Ohio
Goggles, safety clothing and other safety equipment

Safety First Shoe Company, Holliston, Massachusetts
Safety shoes

Safety Signal Devices, Inc., Chicago, Illinois
Safety stop-light for cars, trucks and buses

The Service Recorder Company, Cleveland, Ohio
The Servis Recorder for trucks and buses

Shepherd Safety Shoe Corporation, Chicago, Illinois
Safety shoes

The Sight Light Corporation, New York City
Instruments for measuring light in industries, etc.

Standard Safety Equipment Company, Chicago, Illinois
Dust protective equipment and general safety devices

Stonehouse Signs, Inc., Denever, Colorado
Metal accident prevention signs

The Surety Rubber Company, Carrollton, Ohio
Rubber safety equipment for linemen and industry

Weaver Manufacturing Company, Springfield, Ill.
Automotive testing equipment

West Disinfecting Company, Long Island City, New York
Disinfectants, insecticides and sanitary supplies

Willson Products, Inc., Reading, Pennsylvania
Eye, head and respiratory protective devices

Wil-X-Mfg Corporation, Brooklyn, New York
Fire extinguishers and equipment

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American Society of Safety Engineers—Engineering Section

Officers 1933-34

General Chairman—S. E. Whiting, Liberty Mutual Insurance Co., Boston, Mass.
Vice-Chairman—E. F. Blank, Jones and Laughlin Steel Corp., Pittsburgh, Pa.
Vice-Chairman—A. S. Regula, Industrial Relations Counselors, Inc., New York, N. Y.
Secretary—W. Dean Keefer, National Safety Council, Chicago, Ill.

Members at Large—

Cyril Ainsworth, American Standards Association, New York, N. Y.
C. B. Auel, Westinghouse Electric and Manufacturing Co., East Pittsburgh, Pa.
J. I. Banash, Consulting Engineer, Chicago, Ill.
E. W. Beck, United States Rubber Co., New York, N. Y.
H. R Bixler, Union Carbide and Carbon Corp., New York, N. Y. (Metropolitan Chapter).
C. B. Boutet, Wisconsin Public Service Corp., Milwaukee, Wis.
J. E. Cullinen, Bethlehem Steel Co., Bethlehem, Pa.
R. E. Donovan, Standard Oil Company of California, San Francisco, Calif.
W. M. Graff, National Bureau of Casualty & Surety Underwriters, New York, N. Y.
Harry Guilbert, Pullman Company, Chicago, Ill.
A. P. Huckestein, Pennsylvania Department of Labor and Industry, Pittsburgh, Pa. (Western Pennsylvania Chapter).
R. McA. Krown, Industrial Commission of Wisconsin, Madison, Wis.
G. A. Kuechenmeister, Dominion Forge & Stamping Co., Limited, Walkerville, Ont., Canada.
M. G. Lloyd, United States Bureau of Standards, Washington, D. C.
John P. McCann, New England Power Engineering and Service Corp., Worcester, Mass. (Boston Chapter).
W. S. Paine, Aetna Life Insurance Co., Hartford, Conn.
G. E. Sanford, General Electric Co., Schenectady, N. Y.
C. W. Smith, Standard Oil Co. (Ind.), Chicago, Ill.

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TWENTY-THIRD ANNUAL SAFETY CONGRESS
NATIONAL SAFETY COUNCIL

Automotive and Machine Shop Section

Officers 1933-34

General Chairman—M. J. McCarthy, Fisher Body Corp., Detroit, Mich.
Vice-Chairman—K. A. Callam, Detroit, Mich.
Secretary—G. E. Sanford, General Electric Co., Schenectady, N. Y.
News Letter Editor—E. C. Walker, Dodge Brothers Corp., Detroit, Mich.
Engineering Committee Chairman—W. W. Janzer, Seaman Body Corp., Milwaukee.
Health Committee Chairman—Dr. A. F. Lecklider, Fisher Body Corp., Detroit.
Membership Committee Chairman—Nils Juell, Hayes Body Corp., Grand Rapids.
Poster, Slides and Safety Kinks Committee Chairman—M. A. Kroger, Chevrolet Detroit Plants, General Motors Corp., Detroit, Mich.
Program Committee Chairman—M. A. Clark, United States Rubber Co., Detroit.
Publicity Committee Chairman—W. A. Bechill, Chrysler Corporation, Detroit.
Statistics Committee Chairman—C. W. Bishop, Lycoming Manufacturing Co., Williamsport, Pa.
Members at Large—
L. E. Averill, C. H. Dickson Co., Detroit, Mich.
Hoyt L. Fracher, Detroit Steel Products Co., Detroit, Mich.
R. F. Thalner, Buick Motor Co., Flint, Mich.
R. A. Shaw, The Murray Corporation of America, Detroit, Mich.
Carl L. Storck, Delco Products Div., General Motors Corp., Dayton, Ohio.

MONDAY AFTERNOON SESSION

October 1, 1934

The opening session of the Automotive and Machine Shop Section was called to order by General Chairman M. J. McCarthy, Fisher Body Corporation, Detroit, who presided. Chairman McCarthy introduced Mr. Charles H. Hazelton, Directing Manager, Foote-Burt Co., Cleveland, who made a brief address of welcome on be-

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Cement Section

Officers 1933-34

General Chairman—J. B. Zook, Great Lakes Portland Cement Corp., Buffalo, N. Y.
Vice-Chairman—W. W. Hamilton, Alpha Portland Cement Co., Easton, Pa.
Secretary—A. J. R. Curtis, Portland Cement Association, Chicago, Ill.
News Letter Editor—Jack Dempster, Canada Cement Co., Ltd., Port Colborne, Ontario, Canada.
Engineering Committee Chairman—Frederick B. Hunt, Nazareth Portland Cement Co., Nazareth, Pa.
Membership Committee Chairman—H. A. Renninger, Lehigh Portland Cement Co., Allentown, Pa.
Poster Committee Chairman—M. P. Greer, Marquette Cement Manufacturing Co., Cape Girardeau, Mo.
Program Committee Chairman—D. E. Coleman, Missouri Portland Cement Co., St. Louis, Mo.
Members at Large—
R. P. Forsyth, Pennsylvania-Dixie Cement Corp., Nazareth, Pa.
E. Possell, International Cement Corp., New York, N. Y.
C. E. Ralston, Pittsburgh Plate Glass Co., Pittsburgh, Pa.
F. E. Town, Manitowoc Portland Cement Co., Manitowoc, Wis.
H. Vanderwerp, Medusa Portland Cement Co., Cleveland, Ohio.

TUESDAY MORNING SESSION

October 2, 1934

The opening session of the Cement Section was called to order by General Chairman J. B. Zook, Great Lakes Portland Cement Corp., Buffalo, New York, who presided. Chairman Zook introduced Mr. Edward J. Maguire, Vice President and Treasurer, Medusa Portland Cement Co., Cleveland, who made a brief address of welcome on behalf of the City of Cleveland. The General Chairman then presented, under the heading, "Our Work—Today and Tomorrow," some brief thoughts on the future activities of the section and followed with brief reports from the chairmen of standing committees. He then called for the report of the Nominating Committee, and new officers for the section were nominated and elected as follows:

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TWENTY-THIRD ANNUAL SAFETY CONGRESS
NATIONAL SAFETY COUNCIL

Chemical Section

Officers 1933-34

General Chairman—JOHN ROACH, Deputy Commissioner of Labor, Trenton, N. J.

Vice-Chairman in Charge of Program—A. L. ARMSTRONG, Eastman Kodak Co., Rochester, N. Y.

Vice-Chairman in Charge of Engineering—G. H. MILLER, E. I. duPont de Nemours & Co., Wilmington, Del.

Secretary—RALPH O. KEEFER, Aluminum Company of America, Massena, N. Y.

News Letter Editor—JOHN MORONEY, Aluminum Company of America, Massena, N. Y.

Occupational Disease Committee Chairman—DR. LEONARD GREENBURG, Yale Medical School, New Haven, Conn.

Membership and Publicity Committee Chairman—S. D. KIRKPATRICK, Chemical and Metallurgical Engineering, New York, N. Y.

Statistics Committee Chairman—IRA V. KEPNER, Pennsylvania Salt Manufacturing Co., Menominee, Mich.

Members at Large—

DR. ELIZABETH B. BRICKER, Lititz, Pa.
F. E. CLANCY, JR., Mathieson Alkali Works, Inc., Niagara Falls, N. Y.
F. W. DENNIS, Hooker Electrochemical Co., Niagara Falls, N. Y.
E. F. KING, Lever Brothers Co., Cambridge, Mass.
S. F. LARCHAR, Thomas A. Edison Industries, West Orange, N. J.
H. L. MINER, E. I. duPont de Nemours & Co., Wilmington, Del.
E. L. ROOT, Celluloid Corporation, Newark, N. J.
C. E. SEVRENS, Merrimac Chemical Co., Inc., Boston, Mass.
JOHN S. SHAW, Hercules Powder Co., Wilmington, Del.
R. C. STRATTON, The Travelers Insurance Co., Hartford, Conn.
PLUMMER WHEELER, American Cyanamid Co., Linden, N. J.
S. E. WHITING, Liberty Mutual Insurance Co., Boston, Mass.

MONDAY AFTERNOON SESSION

October 1, 1934

The opening session of the Chemical Section was called to order by General Chairman John Roach, Deputy Commissioner of Labor, State of New Jersey, Trenton, N. J. Chairman Roach introduced Dr. W. R. [illegible] head of the Chemical

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Co., Niagara Falls, N. Y.
facturing Co., Menominee, Mich.
idge, Mass.
& Co., Wilmington, Del.
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Inc., Boston, Mass.
mington, Del.
Co., Linden, N. J.
e Co., Boston, Mass.

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rogram was a general Round Table to the Hands and Feet of Workers . Armstrong General Supervisor mpany, Rochester, N. Y. This although interesting and of value

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TWENTY-THIRD ANNUAL SAFETY CONGRESS
NATIONAL SAFETY COUNCIL

Construction Section

Officers 1933-34

General Chairman—JOHN RUSSELL, Jr., United Engineers & Constructors, Inc., Newark, N. J.

Vice-Chairman—W. G. WHEELER, Building Trades Employers' Association, New York, N. Y.

Vice-Chairman for Engineering Projects—P. R. MANETTA, Jr., Thompson Starrett Co., New York, N. Y.

Vice-Chairman for Utility Construction—C. H. BLACK, Stone & Webster Engineering Corp., Boston, Mass.

Vice-Chairman for U. S. Engineer Department—CAPT. ELLIOTT VANDEVANTER, C. of E., Office of the Chief of Engineers, Washington, D. C.

Secretary—ROBERT MCKINLEY, General Accident Fire & Life Assurance Corp., Detroit, Mich.

News Letter Editor—EDGAR N. GOLDSTONE, (State Compensation Insurance Fund of Calif.), San Francisco, Calif.

Engineering Committee Chairman—J. C. FORESTER, The L. E. Myers Co., Chicago, Ill.

Membership Committee Chairman—NORMAN WELLINGS, Booth & Flinn, Ltd., Pittsburgh, Pa.

Poster Committee Chairman—JAMES N. DOYLE, James N. Doyle Adjustment Bureau Reg'd., Montreal, Quebec, Can.

Program Committee Chairman—R. J. ENGELUTH, C. W. Blakeslee & Sons, New Haven, Conn.

Publicity Committee Chairman—THOMAS W. WALTON, Henry W. Horst Co., Philadelphia, Pa.

Statistics Committee Chairman—W. A. SNOW, Associated General Contractors of America, Inc., Washington, D. C.

Members at Large—

W. F. AUSTIN, Detroit, Mich.

MISS E. S. GOFF, McLaury Marble Corp., New York, N. Y.

W. R. RICHARDS, Bureau of Contract Information, Inc., Washington, D. C.

GEORGE WILLIS, Builders and Manufacturers Mutual Casualty Co., Chicago, Ill.

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Marine Section

Officers 1933-34

General Chairman—FRANK H. COGAN, Railroad Marine Service, New York, N. Y.

Vice-Chairman (in Charge of Posters and Slides)—ROBERT F. HAND, Standard Shipping Co., New York, N. Y.

Vice-Chairman (in Charge of Publicity)—ARTHUR M. TODD, Consulting Marine Engineer, New York, N. Y.

Vice-Chairman (for the Pacific Coast)—A. O. WOLL, General Petroleum Corp. of Calif., Terminal Island, Calif.

Secretary—E. C. HOLDEN, JR., United States P. & I. Agency, Inc., New York, N. Y.

News Letter Editor—HENRY BLACKSTONE, United States P. & I. Agency, Inc., San Francisco, Calif.

Engineering Committee Chairman—B. C. EDWARDS, Consulting Engineer, New York, N. Y.

Membership Committee Chairman—W. E. STEWARDSON, Colombian Steamship Co., New York, N. Y.

Program Committee Chairman—J. S. HUNTER, The Atlantic Refining Co., Philadelphia, Pa.

Statistics Committee Chairman—BENJAMIN H. SELF, Travelers Insurance Co., New York, N. Y.

Stevedoring Committee Chairman—F. C. GREGORY, United States Employees' Compensation Commission, Washington, D. C.

Members at Large—

FRANK E. AMES, Lykes Bros.-Ripley Steamship Co., New Orleans, La.
W. P. BIGGS, Navy Department Safety Engineer, Washington, D. C.
C. F. BLACKTON, Erie Railroad Co., Jersey City, N. J.
A. R. BUSH, International Flare-Signal Co., New York, N. Y.
E. W. FISKE, JR., Standard-Vacuum Transportation Co., New York, N. Y.
CHARLES H. FLATHERS, Eastern Steamship Lines, Inc., Boston, Mass.
F. P. FOISTE, Shipping Federation of the State of Washington, Seattle, Wash.
J. M. GRISTER, Alabama Dry Dock & Shipbuilding Co., Mobile, Ala.
WM. GROUNDWATER, Union Oil Co. of Calif., Los Angeles, Calif.
WM. F. JONES, Gulf Refining Co., New York, N. Y.
W. P. KAIN, Marine Surveyor, New York, N. Y.
R. K. KELLY, Tide Water Oil Co., New York, N. Y.

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J. L. Luckenbach, American Bureau of Shipping, New York, N. Y.
Daniel J. Murphy, Murphy, Cook & Co., Philadelphia, Pa.
Byron O. Pickard, Pacific American Steamship Assn., San Francisco, Calif.
E. J. Robeson, Jr., Newport News Shipbuilding and Dry Dock Co., Newport News, Va.
J. K. Robison, Sinclair Navigation Co., New York, N. Y.
J. C. Rohlfs, Standard Oil Company of Calif., San Francisco, Calif.
H. L. Seward, Yale University, New Haven, Conn.
Arthur R. Savage, Peninsular & Occidental Steamship Co., Port Tampa, Fla.
A. J. Smith, Marine Office of America, New York, N. Y.
J. H. Toma, New York State Merchant Marine Academy, New York, N. Y.
Elliott Vandevanter, Capt., Office of the Chief of Engineers, Munitions Bldg., Washington, D. C.
John Wright, American Export Line, New York, N. Y.
G. D. Zeh, Associated Oil Co., San Francisco, Calif.

TUESDAY MORNING SESSION

October 2, 1934

The opening session of the Marine Section was called to order by General Chairman Frank H. Cogan, the Delaware, Lackawanna and Western Railroad Co., Hoboken, N. J., who presided. Chairman Cogan introduced Mr. Herbert C. Jackson, of the Interlake Steamship Co., Cleveland, who cordially welcomed the delegates in the name of the City of Cleveland.

Chairman Cogan then presented a brief review and preview of Marine Section activities during the past year, including the work of sectional officers and chairmen of committees. The chairman then introduced the first speaker.

The Economics of Accident Prevention in Handling Marine Cargo

By H. W. HEINRICH

Assistant Superintendent, Engineering and Inspection Division, The Travelers Insurance Co., Hartford, Conn.

The speaker said in part: According to data provided by the U. S. Department of Commerce, 342,489 tons of cargo valued at $10,910,439,000 were handled for export and import in the United States in 1932. This includes cargo handled on the rivers and lakes as well as at ocean ports. The payroll required was $188,000,000. Estimated payments for compensation and employers' liability claims and for medical and hospital services amounted to approximately $14,000,000. In addition to this, the indirect costs of accidents in stevedoring work is approximately four times as much as the direct costs, or $56,000,000.

From these data accident costs may be expressed in terms of tons and payroll, as follows:

Total cost per ton, 20c. Total cost per $100 of payroll, $37.

Part of total cost per ton not covered by insurance, 16c. Part of total cost per $100 of payroll not covered by insurance, $29.60.

It is fair to compare accident costs with other so-called overhead costs in handling cargo in order that a true picture of its relative importance may be had. Stevedoring operators in the Port of [illegible]ork provide the following estimates: Overhead costs, .068; labor costs, .68; [illegible], .90; [illegible], .13; accidents, .20.

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Some men's minds, of course, are more sluggish than others in absorbing ideas of this nature; but safety can be visualized and is being visualized every day in almost every shop, plant, dock, ship and quarry in the country. It is being "sold" to the workmen through the medium of posters as certainly as by verbal instruction and every other means, such as the Safety Instruction Cards obtainable through the National Safety Council. It must be borne in mind, however, that the posters should not be allowed to become common-place.

Report of the Nominating Committee

At this point Chairman Cogan called for the report of the Nominating Committee, and new officers for the Section for the ensuing year were nominated and elected as follows:

General Chairman—E. W. Fiske, Jr., Scony Vacuum Co., Inc., New York, N. Y.

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

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

Vice-Chairman (for the Pacific Coast)—A. O. Wulf, General Petroleum Corp. of Calif., Terminal Island, Calif.

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

News Letter Editor—Henry Blackstone, United States P. & I. Agency, Inc., San Francisco, Calif.

Engineering Committee Chairman—H. C. Edwards, Consulting Engineer, New York, N. Y.

Membership Committee Chairman—E. C. Holden, Jr., United State P. & I. Agency, New York, N. Y.

Program Committee Chairman—Frank E. Ames, Lykes Bros.-Ripley Steamship Co., New Orleans, La.

Statistics Committee Chairman—Benjamin H. Selt, Travelers Insurance Company, New York, N. Y.

Stevedoring Committee Chairman—F. C. Gregory, Waterfront Employers Union, San Francisco, Calif.

Members at Large—

W. P. Biggs, Navy Department Safety Engineer, Washington, D. C.
C. F. Blackton, Erie Railroad Co., Jersey City, N. J.
Frank H. Cogan, The Delaware, Lackawanna and Western Railroad Co., Hoboken, N. J.
F. P. Foisie, Shipping Federation of the State of Washington, Seattle, Wash.
J. M. Griser, Alabama Dry Dock & Shipbuilding Co., Mobile, Ala.
Wm. Groundwater, Union Oil Co. of Calif., Los Angeles, Calif.
Henry J. Heidorn, Standard Shipping Company, New York, N. Y.
Willard F. Jones, Gulf Refining Co., New York, N. Y.
W. P. Kain, Marine Surveyor, New York, N. Y.
T. F. Kavanagh, Grace Lines, Inc., New York, N. Y.
R. K. Kelly, Tide Water Oil Co., New York, N. Y.
Stewart Lee, Jr., New York Shipbuilding Co., Camden, N. J.
J. L. Luckenbach, American Bureau of Shipping, New York, N. Y.
Daniel J. Murphy, Murphy, Cook & Co., Philadelphia, Pa.
Carl E. Petersen, Newport News S. B. & D. D. Company, Newport News, Va.
Byron O. Pickard, Pacific American Steamship Assn., San Francisco, Calif.
H. W. Proom, Black Diamond Lines, New York, N. Y.
J. K. Robison, Sinclair Navigation Co., New York, N. Y.
J. C. Rohlfs, Standard Oil Company of Calif., San Francisco, Calif.
Arthur R. Savage, Peninsular & Occidental Steamship Co., Port Tampa, Fla.
H. L. Seward, Yale University, New Haven, Conn.
A. J. Smith, Marine Office of America, New York, N. Y.
J. H. Tomb, Capt. USN Ret., New York State Merchant Marine Academy, New York, N. Y.
E. Storm Trosdal, Jr., South Atlantic S. S. Line, Savanna

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Metals Section

Officers 1933-34

General Chairman—E. F. Blank, Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Vice-Chairman—J. A. Voss, Republic Steel Corporation, Youngstown, Ohio.
Vice-Chairman—H. W. Dana, Bethlehem Steel Company, Johnstown, Pa.
Secretary and News Letter Editor—A. Berquist, The Youngstown Sheet and Tube Company, East Chicago, Ind.
Engineering Committee Chairman—J. E. Cullinen, Bethlehem Steel Company, Bethelehem, Pa.
Health Committee Chairman—Dr. R. C. Engel, The Corrigan, McKinney Steel Company, Cleveland, Ohio.
Membership Committee Chairman—R. A. Chaffin, Continental Steel Corp., Kokomo, Ind.
Poster Committee Chairman—W. D. Speight, Keystone Steel & Wire Co., Peoria, Ill.
Program Committee Chairman—C. M. Allen, The American Rolling Mill Co., Middletown, Ohio.
Publicity Committee Chairman—A. M. Lytle, The Newton Steel Company, Newton Falls, O.
Statistics Committee Chairman—C. E. Ralston, Pittsburgh Plate Glass Co., Pittsburgh, Pa.
Slides and Safety Kinks Committee Chairman—J. A. Oertel, Carnegie Steel Company, Pittsburgh, Pa.
Foundry Committee Chairman—F. G. Bennett, The Buckeye Steel Castings Company, Columbus, Ohio.
Railway Car Builders Committee Chairman—P. J. Brand, Pullman Car & Manufacturing Corporation, Pullman, Chicago, Ill.
Members at Large—
L. S. Adam, Hubbard Steel Foundry, East Chicago, Ind.
J. A. Coltrin, National Radiator Corporation, Johnstown, Pa.
H. M. Crocker, Inland Steel Company, East Chicago, Ind.
G. A. Davis, Illinois Steel Company, Chicago, Ill.
John P. Em, Illinois Steel Company, Joliet, Ill.
E. A. Ellis, Wheeling Steel Corp., Wheeling, W. Va.
W. T. Filmer, The Youngstown Sheet and Tube Co., Youngs[illegible] Ohio.
A. C. Gibson, Spang, Chalfant & Company, Inc., Pittsburgh.

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CHARLES W. HANKO, Pittsburgh Steel Co., Monessen, Pa.
O. F. HARVEY, American Car and Foundry Co., New York, N. Y.
S. E. HAWKES, MacWhyte Company, Kenosha, Wis.
HARVEY G. HENSEL, The Youngstown Sheet and Tube Company, Chicago, Ill.
W. J. IRELAND, Kohler Co., Kohler, Wis.
W. A. JARVIS, The Chase Companies, Waterbury, Conn.
F. A. LAUERMAN, Republic Steel Corporation, South Chicago, Ill.
T. H. MCKENNEY, Illinois Steel Company, South Chicago, Ill.
D. V. MEDALIE, Interlake Iron Corp., Chicago, Ill.
W. E. MEGRAW, H. H. Robertson Company, Pittsburgh, Pa.
ROBERT L. SCHMITT, Louisville Car Wheel and Railway Supply Company, Louisville, Ky.
J. K. STAFFORD, Mississippi Valley Structural Steel Co., Decatur, Ill.

MONDAY AFTERNOON SESSION

October 1, 1934

The opening session of the Metals Section was called to order by General Chairman E. F. Blank, Jones & Laughlin Steel Corporation, Pittsburgh, Pa., who presided. Chairman Blank introduced Mr. Donald B. Gillies, President, Corrigan, McKinney Steel Co., Cleveland, who made a brief address of welcome on behalf of the Convention City.

General Chairman Blank then presented a brief "Resumé of the Year's Activities" of the Metals Section, giving in some detail the activities of officers and chairman of standing committees, whose work for the Section was highly valued. Chairman Blank then introduced the first speaker.

Practical Safety from an Operating Standpoint

By G. D. TRANTER

General Superintendent, Middletown Division, The American Rolling Mill Co., Middletown, Ohio

The speaker said in part: If we seek the solution of the accident problem by the same methods used for operating control, we will more quickly improve the plant safety record. For example, safety rules must be regarded in the same manner as operating rules and practice. Some years ago, safety gates had been installed in the rear of open hearth furnaces for the protection of men working on tap holes and runners in a certain plant. The safety appliance was not accepted wholeheartedly by the furnace men until a helper fell off the backstanding and was fatally injured. But after this accident, the gates were always in place.

Here is another case. A gas maker was seriously injured during the burn-out of a gas producer. Investigation of the accident disclosed that the man had previously received a number of minor injuries while working on this particular job. It further developed that he was unsuited to this type of work because of age and previous training. If this man's foreman had considered these minor injuries in the light of a danger signal and transferred the man to a less hazardous job, this accident would have been prevented.

Discipline in accident prevention as well as in operation should be resorted to only when other means fail. Men usually respond willingly to proper inspiration and leadership. In case of a violation of safety [illegible] a word from the superintendent to the person who committed the act goes a long way. In going about

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Mining Section

Officers 1933-34

General Chairman—P. M. Arthur, American Zinc Company of Tennessee, Mascot, Tenn.

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It is also to be realized that a safety program or method that is suitable for one company or location may not be desirable for another company. For example in our two New York state mines, which have the same regulations regarding safety hats, shoes, goggles, etc., and where the primary rule is also enforced that each and every man is responsible for his own safety and for the safety of his fellow worker, great emphasis is placed on housekeeping or cleanliness about the mines and mills. Each department of the two divisions has a metal sign, ruled in three columns: one being for the month of the year, while the other two are for the housekeeping rating and lost-time accidents. If the conditions are good, a gold star is placed on the sign; if only fair a green star is awarded, while for poor cleanliness a red star is given. A gold star counts ten, a green five, and no score is given for red. These scores are posted monthly on the bulletin board, and the basis of comparison between the two mines is thereby made possible. If a score is not perfect, or at a reasonably high figure, the department which is negligent receives considerable adverse publicity. If there are no lost-time accidents, a gold star is placed in the accident column.

The results of our New York safety program are reflected by the achievement of operating 162,912 man-hours with only one lost-time accident (which incapacitated a worker for two days), and this record resulted in the 1932 award of the "Sentinels of Safety Trophy."

THURSDAY MORNING SESSION

October 4, 1934

The Dust Problem in Mining Operations

By D. E. CUMMINGS

Assistant Director, The Saranac Laboratory for the Study of Tuberculosis, Michigamme, Michigan

The speaker said in part: Refuge can no longer be taken under the shelter of ignorance that the prolonged inhalation of dust may lead to serious disease, for the medical, technical and lay press is filled with accounts describing the dangers associated with breathing certain dusty atmospheres. What, then, should be the proper course to pursue in meeting this problem and dealing with it in a satisfactory manner?

Both industrial and laboratory studies prove that only certain dusts are dangerous when inhaled, and that quartz or other forms of pure crystalline silica are most dangerous, constituting a specific tissue poison. Where men are exposed to a sufficient quantity of very fine pure crystalline silica dust only, a true hazard always exists. The dusts of silica in combination with other elements generally give rise to pulmonary reactions which differ in many respects from those caused by pure silica, and which vary rather widely among themselves in their harmfulness. As a class, and with the notable exception of asbestos, silicates are less dangerous than pure crystalline silica. Not only are certain dusts apparently incapable of producing a specific harmful reaction when inhaled by themselves, but when associated with silica favorably modify the usual response to this dangerous dust. The effective size range of particles causing disease is now regarded as three microns and smaller, while the qualities of hardness and sharpness are no longer regarded as of significance. The term pneumonokoniosis is intended to describe the changes arising out of the prolonged inhalation of any dust, harmful or otherwise, and does not necessarily imply the presence of disability, nor a predisposition to pulmonary infections. The term silicosis refers specifically to the disease which results from the prolonged inhalation of harmful silica dust, and is characterized by a [illegible] nodular fibrosis in the lungs and pulmonary lymph nodes, and increased su[illegible] to pulmonary infections. Pure silicosis should be regarded as a geniun[illegible]

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tional condition, but it should also be understood that uncomplicated silicosis is seldom disabling to any significant degree. Disability usually results from pulmonary infections, generally tuberculous, which the silicotic contracts or reactivates more readily, and handles less successfully than the normal person.

Every effort should be made to prevent silicotics from contracting infections which will later prove disabling, and to protect those who have pulmonary infections from being dangerously exposed to harmful dusts. In order to determine which workmen in a hazardous industry have silicosis or pulmonary infections, all employees should have a thorough physical examination including the taking of a complete occupational history and satisfactory stereoscopic roentgenograms of the chest.

Since the rate at which silicosis develops depends upon individual susceptibility and the degree of exposure, it follows that these factors should be determined as accurately as possible. Individual susceptibility to a dust hazard can be estimated fairly accurately from a single examination, and can be defined quite exactly by repeating these examinations at regular intervals. The degree of exposure for each individual should be evaluated by determining the length of service, and the concentration, size distribution, and composition of the dust suspended in each working place during each operation. The method generally used to enumerate dust particles is that accepted as standard practice by the U. S. P. H. S. with the addition of dark field illumination as suggested by Fehnel and Cummings. Size distribution studies can be made by any of the several satisfactory techniques. The composition of the dust can be studied by the usual quantitative analysis, supplemented by petrographic and rational chemical analysis to determine the amounts of free and combined silica and the other minerals.

A medical and technical survey should be supplemented by an analysis of the mortality records in and about the locality under study, and by the information obtained from carefully performed post-mortem examinations on employees who have been exposed in the industry and who have died from any cause. If these procedures for recognizing and defining a hazard are carried out under the supervision of an organization competent to deal with the many complex and confusing aspects of the problem, the investigation will be worth while regardless of the conditions which are discovered. Where the findings of such a study fail to disclose a significant hazard, both the employer and employees will gain the protection which this knowledge affords; and if a health hazard is discovered, the original investigation will serve as a guide to the program which should be inaugurated to overcome the dangers disclosed.

The most severe dust hazards in mines or in plants can be reduced as successfully as were accidents by the Safety First program, and the chief requisite to success lies in establishing adequate control procedures. The physical condition of all the employees must be determined at regular intervals, and well interpreted roentgenograms provide a most satisfactory control procedure. Men applying for work should not be hired until they have passed a thorough physical examination including chest roentgenograms. Reliable records should be established to show the exact time, place and duration of employment for each person working in hazardous positions. Policies of employment should be worked out for each mine or plant based upon an accurate knowledge of the physical condition of each employee, so that all of the workmen may be protected from contracting occupational disabilities. Occupations should be selected which are compatible with the physical condition of the employee. Care should be taken to protect the silicotic from infection, or the case of infection from harmful exposure to silica, or the normal individual from contracting either silicosis or pulmonary infections.

Engineers should be especially trained to recognise and deal with dust hazards in mines or plants, and it should become accepted practice, where a hazard exists, to maintain a constant check on the amount of dust present in the working atmosphere. The method of dust counting accepted as standard by the U. S. P. H. S. should be adopted by all industries having a hazard, not only to determine the amount of dust in the air but more particularly to maintain a control over the effectiveness of the procedures adopted to reduce the dust [illegible] records should be kept which will disclose the amount of dust present in each [illegible] place, and the prevent[illegible] measures which are in use.

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Shortly after the inauguration of a program designed to control a known dust hazard, it will become evident that marked improvements can be effected without incurring an impractical expenditure. Personnel problems will arise, due to the reluctance of labor to accept new procedures, and in the end, these problems must be dealt with by educating workmen to recognize the necessity for introducing methods to control dust hazards. The question of what men should be told regarding their physical examinations should follow the practice adopted by any reputable physician in dealing with individual cases. As industry becomes more familiar with this problem, it will discover the serious need for further research.

Since silicosis is a true occupational disease, disability resulting from or attributable to it should be compensable in the same manner as other injuries sustained as the result of employment. Only the intelligent cooperation of industry will bring about the formulation of reasonable occupational disease legislation and its fair administration.

Silicosis from the Operators' Standpoint

By G. C. BATEMAN

Secretary, Ontario Mining Association, Toronto, Ont., Canada

The speaker said in part: It is important to know what causes silicosis, but unless a knowledge of the cause leads to a cure, it is not nearly as important from the operators' viewpoint as the knowledge of how to reduce the incidence. With all the research work that has been going on throughout the world for many years, we still do not know the cause and we still have no cure, but we have learned a lot about how to reduce the incidence.

The silicosis provisions of the Ontario Mines Act and the Compensation Act were passed in 1926. These provided for the examination of all men employed in positions in mines where they were exposed to silica dust, for all such workers to be the holders of medical certificates certifying as to freedom from tuberculosis of the respiratory organs, and also for compensation to men affected by silicosis.

This legislation was introduced as a result of a survey in Northern Ontario mining camps which indicated that silicosis had made alarming progress among the miners. There being no reason at that time to question the results of this survey, the operators agreed to do all that was asked of them and cooperated fully with the Government in the steps considered necessary to meet the situation.

When this legislation was first introduced in Ontario, we were advised that men with a moderate degree of silicosis, while not physically disabled, were better out of the industry and that they should be paid a lump sum which would assist them in rehabilitating themselves in some other occupation.

We were further advised that if we took active steps to clean up the situation then existing, pension the more serious cases and remove men in the early stages of silicosis from underground, the situation would be well in hand, the first expense would be the heaviest, and that from then our liability would be practically limited to the anteprimary cases as they developed.

When the 1926 Amendments were approved by the mines it was our understanding that men in the anteprimary stage had suffered no impairment of working capacity and that the $500 payment was a compassionate allowance for rehabilitation and not for disability. We further understood that with the payment of $500 to these men our responsibility in respect to them would be practically ended. It developed, however, that the legal position was different. The Compensation Board cannot make an award except for disability and where disability has once been established the claimant can come back for review on evidence of further disability. It is generally accepted that silicosis predisposes a man to tuberculosis. It followed, therefore, that with secondary silicosis as defined in the Act, if any anteprimary silicotic at any future time and from any cause whatsoever developed tuberculosis, his condition was considered to be the result of his original disability and he was entitled to total disability compensation at the average [illegible] per case.

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When, therefore, an award of $500 was made the Compensation Board immediately set up a prospective reserve for progression of an additional $11,500, with the result that we had an estimated liability to the end of 1932 of several million dollars, most of which was outstanding.

With the passage of time it also became apparent that the removal of the men from underground employment in the early stages of silicosis did not have the results anticipated. The payment of a lump sum award did not in most cases serve the end expected. As a general rule this money was expended for other things and the men made little effort to rehabilitate themselves. A certain number of men classified as silicotic continued in their undereground employment and we found practically no difference in the rate of progression in those who continued as compared with those who were taken out of the mines. Some of this may have been due to the altered economic status, but even if the economic status had remained the same, we were forced to the conclusion that there was little if any benefit to the men by removing them from underground work, unless of course, there was evidence of an onset of tuberculosis.

It should, of course, be understood that during this time active efforts were made by the mines to improve ventilation and to allay dust. Without this the above statement would not hold true. Steps were also taken by the mines to provide that men in the early stages of silicosis were placed where the conditions underground were most favorable.

Our experience also indicated that the early stages of silicosis do not necessarily mean an impairment of working capacity. This is all the more important on account of the difficulty of diagnosing silicosis in its early staces, as there is no sharp line of demarcation between the pre-anteprimary and the anteprimary, or between anteprimary and primary stages, and as a matter of fact, we believe that there is a great deal more uncertainty in the diagnosis of silicosis than the medical men are willing to admit. The determination is largely a matter of personal judgment and therefore subject to error.

A great deal of what may be read into an X-ray film depends upon the technique in taking the film. Certain other diseases and chest conditions will also give in the film an appearance simulating that of silicosis and we believe it is safe to say that without a definite knowledge of occupational history the diagnosis of silicosis in its earlier stages would be practically impossible.

In view of these conditions, it was felt that the industry was carrying an unfair burden and in 1933 the Act was amended. The anteprimary and primary classifications were deleted, compensation was made payable only for disability, which means actual impairment of working capacity, men with a moderate degree of silicosis were allowed to continue underground work and the industry was relieved from unlimited liability in respect to progression by providing that the claimant must make and establish his claim for disability within two years of leaving the employment at which he was exposed to dust, to entitle him to compensation.

As I said before, silicosis is essentially an employer's problem. It is in many places an important item in his cost of production and to a considerable degree it is a controllable item of expense. If the employer simply leaves the matter in the hands of the doctors, he will have no one to blame but himself over what it costs him. The opinion of the ordinary practitioner and even of the roentgenologist and expert chest and lung man may be of little value. Only the opinion of those doctors who have had special training in the diagnosis of silicosis from both clinical and X-ray examinations should be accepted, and even those opinions cannot be accepted in all cases.

We do not say this with any intention of criticizing the members of the medical profession, but where the matter is so important and costly to industry, where so little is actually known about the disease, and where there is still an element of uncertainty in the diagnosis of silicosis in its earlier stages, too much care cannot be exercised, and the closest scrutiny by industry which has to pay the bills is most necessary. The best results can only be obtained by the employers and the doctors working together, but the employer must consider it as one of his particular problems.

I have also stated that in the absence of any [illegible] much more important

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to know how to reduce the incidence than to know the cause. We believe the chief preventive measures are as follows:

1. Improvement in fundamental working conditions in the matter of ventilation and allaying dust.

2. A rigid initial examination to keep out of the industry those men whose physical condition would indicate a type most susceptible to silicosis and tuberculosis.

3. Control of tuberculosis not only among employees, but also among those with whom they come in contact.

It goes without saying that if silicosis is caused by the inhalation of dust, the removal of dust will remove the cause. This means ventilation and lots of it, and where possible the wetting down of dusty places. In mining operations the chief source of dust is believed to be from blasting, therefore the time interval before men return to a blasted face is important.

Ventilation and water will remove the visible dust from the air, but it is not the visible dust that causes the damage. It is the dust that ranges between one-half and five microns that is dangerous and is also difficult to remove, and the quantity in the air can only be determined by some method of sampling.

We would consider it a mistake to have either the type of sampling apparatus or the permissible dust count defined by law. This may be all right on the Rand in South Africa where conditions are more or less standard, but it is not advisable in the United States or Canada, where conditions vary so greatly. For one thing, we do not know what constitutes harmful dust and there is no standard practice for the treatment of dust sample slides. The untreated slide of a sample taken near a carbide lamp in an otherwise dust-free atmosphere, would show an apparent very high dust count. Dust sampling, however, should be a part of the regular routine, using the type of apparatus best suited to the particular conditions, and this will show whether the atmosphere is good, fair or poor.

Next to ventilation and the laying of dust, the most important measure is to carefully select the type of men to be allowed to work in the industry. This requires a rigid initial examination which should include a complete physical examination and X-ray. By this means men with the type of chest which would indicate their susceptibility to tuberculosis and silicosis can be eliminated. The complete physical examination should also have a beneficial effect on the accident rate.

Uncomplicated silicosis is not a big problem, but silicosis and tuberculosis combined represent a very real problem. The measures for the control of tuberculosis are well known. Particular care should be taken that men with tuberculosis be withdrawn from the industry and given proper care and treatment. Places where the employees live should also be supervised to see that they are not exposed to tubercular contacts.

Some Aspects of the Silicosis Problem

By DR. H. H. MOORE and DR. M. J. KELLY

Medical Staff, Hollinger Consolidated Gold Mines, Ltd., Timmins, Ontario, Canada

The speaker said in part: In 1928 the Ontario Mining Act was amended to provide physical examination on employment and yearly thereafter, or twice yearly if indicated, of all underground men. To be employed the workman must hold an official certificate good for twelve months, stating that he is free from disease of the respiratory organs. This certificate must be renewed at each annual examination. In the meantime, an amendment to the Workmen's Compensation Act provided for the appointment of medical officers working under the supervision of the Compensation Board to conduct these examinations. Cases of silicosis arising at these examinations are submitted to the Workmen's Compensation Board if the total exposure to silica of five years in Ontario mines is verified. In addition to this routine with silicotics, there is a close check kept on the possible underlying progress in the fibrosis in any case and if necessary steps are taken to remove the case from harmful contact with silica.

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The act in its present form was passed in 1933 and served to clear the situation which had become involved by the tie-up of large sums of money in reserve funds against possible future claims by men adjudged silicotic previously, but who had since been lost sight of or who were carrying on at work showing a minimum or no disability.

From the workman's point of view, the new act is a great step forward, as it allows a man to continue at his usual duties underground as long as he is able to work without any serious degree of discomfort. Previously, a workman was advised to quit underground work when a certain stage of fibrosis had been reached, regardless of his ability to carry on, and sacrificed his rights to compensation if he continued to work.

In the X-ray examination of the chests of the 2007 men employed at the Hollinger mines during 1933, determinations are graded as follows: *Normal* is a chest showing little or no fibrosis, where the condition of the lung is better than the average for the age. *M. F.* or "More Fibrosis" is a chest which is normally found in the average adult at the age of the miner under consideration. *M. F. P.*, "More Fibrosis Plus" is a chest showing slightly more fibrosis than normal for the particular age. *M. F. P. P.* or "More Fibrosis Plus Plus" is a chest showing considerably more fibrosis than normal and is a pre-silicotic stage. Silicotics are that group which show a great deal of fibrosis and taking into consideration the mining history and consequent exposure to silica, are thus termed. Admittedly, disability may or may not be present. This last group ranges from the early silicotics with a minimum of disability to the late complicated or secondary cases with marked disability and tuberculosis. It must be added that a large number of men at the commencement of employment at the Hollinger, and without previous mining experience or contact with silica, show chests of M. F. P. rating. Following are the results of this examination:

Normal	33	1.4%
M. F.	930	40.8%
M. F. P.	932	41.4%
M. F. P. P.	98	4.3%
Silicotics	24	1.1%

Average contact with silica of men working and M. F. P. P. ..... 12 years.
Silicotic ..... 15 years.

Next is an analysis of the changes in chest rating in 1933.

Normal	to	M. F.	11
Normal	to	M. F. P.	3
M. F.	to	M. F. P.	207
M. F. P.	to	M. F. P. P.	9
M. F. P. P.	to	T. B.	1
M. F. P. P.	to	A. P.	
A. P.	to	P.	231
M. F.	to	Normal	11
M. F. P.	to	M. F.	231
M. F. P. P.	to	M. F.	1
M. F. P. P.	to	M. F. P.	20
T. B. ?	to	M. F.	1
T. B. ?	to	M. F. P.	1
A. P.	to	M. F. P. P.	1
P.	to	A. P.	266 Total 497

These figures cover approximately 500 men in whom there was some change in chest rating during the year, and the direction of the change. The remaining 1500 men show no change from the previous year. It will be observed that 231 men showed an increase in fibrosis rating, while 266 show chests which are improved. The explanation given for the group [illegible] shows improvement is, in the first place, that some concurrent bronchial [illegible] respiratory infection had complicated the picture at the previous annual [illegible] and so caused a m[illegible]

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advanced rating to be given. The second explanation is that constant improvement in radiological technic is making diagnosis more accurate.

It would seem, therefore, that on the whole the situation is showing considerable improvement from this viewpoint. During 1933 no case progressed from the pre-silicotic to the silicotic stage. In the years up to 1933, 120 men had been rated silicotic and the total cost to the Hollinger involved a sum of $915,950, which figure includes the progressive and contingent funds set aside to cover future costs and possible future claims.

Two objects have been kept in mind during the many years of study of the dust problem at the Hollinger Mine.

1. The collection of complete data regarding the nature of air breathed by workmen in different occupations, its chemical composition, temperature, humidity, dust content and rate of flow.

2. Working tests of all practical methods of improving the condition of such air.

In searching to adapt a method for the determination of air dustiness, it was realized that no instrument has been devised which would measure the dust content of the air with scientific precision. Furthermore, it was felt that the principal object of making determinations was to ascertain if the dust count of the air was undesirably high, and if such a condition was found, to devise a method of reducing it. Hence, for practical purposes, the instrument which possesses a high efficiency in the range of desirable concentrations and gives a quick indication of dangerous quantities of dust is most desirable. The circular Konimeter, invented by Sir Robert Kotze and introduced to the Miners' Phthisis Prevention Committee of South Africa in 1916, has therefore been used in the Porcupine District for the past eight years.

A summary of our investigations along this line may be given as follows:

1. About 900 of the underground force are engaged in work which will produce dangerous dust if measures of control are not applied.

2. Of this number a little over 400 are engaged in shoveling broken ore into cars and the average dust exposure does not exceed 300 particles if the muck piles are kept thoroughly wet and blasting carefully restricted.

3. The remaining 500 men are engaged in drilling and blasting operations and are subjected to severe potential hazard. Men engaged in stopes who do not have to return to the working faces have an average exposure of about 1200 particles, while using the ordinary type drills. It is felt that the use of the "dustless" type of drifter will reduce the concentration of dust to somewhere near 300 particles.

4. The men engaged in development drifts are exposed to the same concentrations of dust, namely, 1200 particles. Where possible, two development drifts are worked simultaneously by the one crew, so that the men do not have to go back through the dense dust after blasting the cut. There are only a few exceptions to this rule and when necessary to go back to load the remaining holes, the men are provided with the special respirator.

5. The high dust concentrations in the vicinity of stopers we hope to deal with by the use of compressed air masks. Also the practice of driving adjacent raises simultaneously has reduced the hazard after blasting.

With the constant improvement and maintenance of general health conditions kept always to the fore as most desirable and necessary in aiding in the solution of the silicosis problem, the men at the Hollinger Mine are cared for under a contract medical system. The facilities and service at mine, office and hospital are most complete and efficient and in combination with the annual or semi-annual check made by the medical staff of the Compensation Board health of the workers is under constant supervision.

Men who report with such conditions as non-tuberculous or non-silicotic chest trouble, with focal infection in teeth, tonsils, sinuses, etc., are singled out and treated and observed and where necessary changes in occupation are made or rest and vacation periods advised.

At the mine, constant improvements have been made and at present the following is the routine. A worker coming on shift removes all his outside clothing, usually wet, and racks them on a set of [illegible] attached to a chain and wet clothes are pulled up to a height of [illegible] 20 feet and [illegible]

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atmosphere for 14 to 15 hours, during which they are thoroughly dried. After undressing the miner passes through a series of shower baths of temperatures varying from hot to cold. After drying he proceeds to his locker where he has placed his street clothes before the beginning of the shift.

With a view to reducing the infection of silicotics with tuberculosis, a clinic has been established in Timmins. An experienced public health nurse is employed full time and it is her duty to visit all tuberculosis suspects and patients, all contacts with these cases and contacts with silicotics to arrange for their examination and supervision and if necessary for treatment. Weekly clinics are held at which such patients are examined clinically, radiologically and by bacteriological and biological tests.

Since January of 1933, approximately 30 dangerous cases of tuberculosis have been removed from the district to a sanitarium and many more less severe cases placed on bed rest at home or on restricted activity. It is felt that by removing these cases from contact with silicotics, that within a comparatively short time tuberculosis will be moderately well controlled and since tuberculous infection is necessary to precipitate secondary silicosis, this movement, it will be appreciated, is an excellent one.

ADJOURNMENT

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TWENTY-THIRD ANNUAL SAFETY CONGRESS
NATIONAL SAFETY COUNCIL

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WEDNESDAY MORNING SESSION

October 3, 1934

The opening session of the Quarry Section was called to order by John Campbell, Director, Bureau of Inspection, Pennsylvania Department of Labor and Industry, Harrisburg, Pa., who presided. This was scheduled to be a joint session with the Cement Section. Chairman Campbell introduced P. A. Mori, Works Manager, Cleveland Quarries Company, Amherst, Ohio, who made a brief address of welcome to the delegates on the part of the city of Cleveland.

In lieu of the annual report of the general chairman Otho M. Graves, who was unable to be present, a letter he was read from him expressing his regrets. Chairman Campbell then introduced the first speaker.

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The Dust Hazards in Industry

By DR. R. R. SAYERS

Medical Officer in Charge, Office of Industrial Hygiene and Sanitation, United States Public Health Service, Washington, D. C.

The speaker said in part: Realizing the importance of the dust problem in industry, the United States Public Health Service in cooperation with the Bureau of Mines began its first study of the health of workers in dusty trades in 1914, in the mines of Joplin, Missouri; and later, in 1923, the Public Health Service inaugurated a series of dust studies. These later studies were all conducted in the same manner in order to permit as detailed a comparison as possible between the different investigations.

Briefly, these methods of study may be divided as follows: (1) examination to determine the general physical condition of the workers under observation; (2) special physical examination to determine the prevalence of specific diseases of the respiratory system and the lung pathology resulting from exposure to the particular dust hazard; (3) record of the nature and severity of the disabling illnesses; (4) analysis and detailed study of the occupational environment; (5) occupational mortality statistics relating to the specific dust; and (6) autopsies.

The first six intensive investigations carried out by the Service dealt with the health of workers exposed to dusts in a cement plant, granite cutting industry, anthracite and bituminous coal mining, silverware manufacturing plant, cotton cloth manufacturing, and in municipal street sweeping. Brief studies were later conducted in certain slate, granite, marble and talc quarries, while more recently a rather extensive study of the health of anthracite coal miners was completed.

These six dust studies showed that the workers in the granite cutting plants who were exposed to the highest dust concentrations were found to suffer from an excess of pulmonary tuberculosis after 15 years or more of exposure and developed silicosis from 2 to 10 years. In the group exposed to a lesser amount of dust, silicosis developed only after prolonged exposure, with no excess of tuberculosis. It was found that a close relationship existed between the degree of dust exposure and the extent and severity of the pulmonary damage. Anthracite coal miners suffered from dyspnoea and other signs of pneumoconiosis and experienced a high rate of respiratory sickness; in addition, an excessive mortality from influenza-pneumonia and possibly tuberculosis was found. Bituminous coal miners experienced a generalized fibrosis of the lungs and an excess mortality from influenza and pneumonia. Cement workers showed some signs of early pneumoconiosis with an excess of diseases of the upper respiratory tract. On the other hand, workers in the cotton cloth and silverware manufacturing plants and municipal street sweepers were negative for respiratory conditions and other illnesses when compared with the general industrial population.

Rock Drilling. For five years, the United States Bureau of Mines studied lead and zinc miners in the Tri-State District, Oklahoma. The ore here is high in free silica. Of the 7,722 men examined, a group of 1,647, or 21.3 per cent, was definitely diagnosed as having silicosis, not including those diagnosed as having tuberculosis. All the men diagnosed as having first-stage silicosis had worked an average of 13 years, but those men starting in the mines after 40 years of age worked an average of only 8 years.

The work of rock drilling in subway and tunnel construction in New York City is in some respects similar to that of some of the activities in the hard rock mines, at least in so far as the manner in which dust is evolved, the type of dust and the resultant hazard. Recently the result of a study of rock drillers, blasters and excavators was reported by the New York Tuberculosis and Health Association. An examination of 208 rock drillers, blasters and excavators showed that 118, or 57 per cent of the men had silicosis in various stages of progression. The exposure of most of these men (75 per cent) had been for 20 years or more.

Sandblasting. No study of the health of sandblasters has been reported in the United States; however, a study of the dust exposure of sandblasters recently completed by the United States Public Health Service in cooperation with the

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National Safety Council. This investigation indicated that, judged by the nature of the dust and degree of the exposure, a real hazard exists in this occupation. This study also brought out the fact that it is possible to conduct sandblasting with safety, provided properly designed and well maintained equipment is used.

Diatomaceous Silica Workers. Most of the data on silicosis have been gathered from studies made both in industry and experimentally on dusts containing free silica in the form of quartz. Such studies have been made in the granite industry, pottery trades, hard rock drilling, etc. There are other free silica minerals in existence that are not crystalline in nature but of an amorphous composition. In Santa Barbara County, California, there exists the largest and purest diatomaceous silica deposit in the world. This substance consists of about 85 per cent free silica. Recently an examination was made of 108 workers selected among those employed less than 1 year, 1 to 2 years, 2 to 5 years, and more than 5 years. All of the workers were Mexican laborers and the examinations consisted of x-ray determinations, social and medical histories, and clinical examinations of the chests. Dust determinations were also made but these were not reported. The outstanding feature revealed by the examination was the splendid physical condition of the men. Eighty-four per cent of the workers were reported in excellent physical condition. It was found that 60 men showed signs of early pneumoconiosis; 15 were in the moderately advanced stage and 6 in the advanced stage. This latter finding was among workers with a history of exposure of more than 5 years.

Dust Hazard in the Granite Quarry Industry. It is a common belief that granite quarrying is not so dangerous an industry as granite cutting in enclosed sheds; quarry work is done outdoors and hence may not be attended with very much dust exposure. However, certain quarry operations require the use of pneumatic tools, which are usually associated with the formation of considerable quantities of dust. It was thought that a study made in a representative granite quarry might cast some light on our problem. Accordingly, a study of a clinico-radiographic nature of 63 quarriers was made and occupational dust exposures were also obtained. The dust determinations show that nearly 38 per cent of the workers (drillers) were exposed to many times the amount of dust considered safe at the present time. Drillers were the only persons showing pathologic lung changes. Half of these workers with an exposure of 5 to 19 years had silicosis, and 4 of the 5 men with more than 20 years of such trade life showed this condition. This study suggests that quarry drillers may experience as high a death rate from pulmonary tuberculosis as do pneumatic-tool workers in granite cutting sheds.

Effect of Inhaled Marble Dust. The pulmonary fibrotic changes due to the inhalation of marble dust appear to be slight in comparison with those caused by stone dust containing a high percentage of silica in the form of quartz. A recent study made by us among marble workers showed that although marble dust, when inhaled in concentrations averaging about 25 million particles per cubic foot of air, produced a mild bilateral, linear fibrosis in a certain number of the 80 men examined, no serious lung changes were noted and there was no disability due to the dust, even after many years of exposure (more than 40 years in some cases). The marble dust under consideration consisted of 98 per cent calcite and 2 per cent dolomite, with no silica present.

Dust Hazard in Abrasive Industry. Artificial abrasives are widely used in industry and for this reason the effect of the inhalation of dusts produced in the manufacture or preparation of these products is of great importance. In 1925, 1929 and again in 1931, Dr. Clark of the Norton Company at Worcester, Mass., made investigations of workers exposed to aluminium oxide and silicon carbide dust produced in the manufacture of grinding wheels, which showed that during a period of 13 years there were proportionately twice as many cases of pulmonary tuberculosis among those working in the abrasive dust departments as in departments where no abrasive dust occurred. In 1931, Kessler, of New Jersey, reported the occurrence of over 100 cases of alleged silicosis in the abrasive powder industry, in which the dust consisted of 99 per cent free silica.

Exposure to Silicate Dust. It has been the belief that the inhalation of dusts composed of silicates (combined silica), in comparison with silica (free silica in the form of quartz), was innocuous. Of rece[illegible] many investigators have become cognizant of the hazards of silicate du[illegible]xposure. Asbestosis, a fibrosis

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of the lungs caused by the inhalation of asbestos dust, has already been described both in its clinical and roentgenographic manifestations by investigators in other countries, but to date no studies have been reported in the United States. Cement dust, which contains about 22 per cent combined silica, has been studied, and the effects of the inhalation by workers has been discussed here. In March, 1933, Dreessen, of the United States Public Health Service, reported the results of a study conducted among tremolite talc and slate workers. The slate dust to which these workers were exposed consisted mainly of silicates, there being less than 3 per cent of quartz in the dust. The talc was a hydrous calcium-magnesium silicate, being 45 per cent talc and 45 per cent tremolite, with no quartz present. The results of the study seemed to indicate a relationship between the amount of dust inhaled and the effect of this dust on the lungs of workers.

Statistical Studies. Recently, Lanza and Vane estimated that there are over 500,000 workers engaged in the mining, quarrying and manufacturing industries in this country in which an exposure to silica dust to a harmful degree is entailed. Their analysis of mortality experience of twelve life insurance companies for the period 1913-1926 showed that the actual mortality from respiratory tuberculosis among the silica exposed persons was about three times that of a non-silica dust group. If one considers their data for certain occupations in metal mines and granite and sandstone quarries, occupations known to be exposed to high concentrations of hazardous dusts, then the comparison is more striking, since the actual deaths among these workers was found to be ten times that of the expected deaths. More detailed statistics on occupational mortality as reported by the Registrar-General of England and Wales (1921-1923), and summarized by Britten, show the high rate of 1,886 per 100,000 for tin and copper miners, while the rate for "all occupied and retired males" was only 150. Other occupations with silica exposure showed an excess.

From the evidence just presented concerning the injurious effects produced by the inhalation of certain dusts, it is apparent that a knowledge of the properties of a given dust which determine its capacity to produce pulmonary pathology is essential. Numerous investigations of the industrial dust problem indicate that these properties are the chemical and mineralogical composition of the dust, its concentration in the industrial atmosphere, and its particle size.

In an earlier portion of this discussion evidence was presented which indicates that a close relation existed between morbidity and mortality rates from various respiratory diseases and the exposure to certain dusts in industry. In the study of the dust hazard in the granite cutting industry, it was definitely proved that there is a direct relation between the magnitude of the dust exposure and sickness and death resulting from tuberculosis. It is quite evident, as a result of these studies, that the remedy of the dust evil lies in the effective removal or suppression of the dust to concentration considered safe. However, no set rules may be established for the mechanical protection to be instituted in an attempt to control industrial dust. Specific conditions encountered in a plant will determine the type of protection to be employed.

The protection of workers against certain dusts known to be toxic may at times be accomplished by the substitution of a non-toxic material for the toxic one. One example of such a procedure is the possible use of a metallic or other type of artificial abrasive for sand in the sandblasting process in those operations in which it is not essential to use sand, a substance high in quartz content. Again, the mechanical enclosure of the dust-creating process also serves to protect the worker. An excellent illustration of this type of protection is afforded by the modern sandblast barrel used in the cleaning of small objects. Sometimes it is possible to protect the worker by the substitution of wet for dry processes, as wet drilling instead of dry. In one instance, in the granite cutting study previously mentioned, an operator using a diamond point tool worked the stone wet; the resulting dust amounted to 22 million particles per cubic foot. The same operator was then requested to work the stone dry; as a result, the amount of dust reached the high figure of 45 million particles per cubic foot. In the weaving of asbestos cloth it has been possible to reduce the amount [illegible] in the air by wet weaving to one-fourth of the amount present when the pr[illegible] conducted by dry methods. Another ex[illegible] this procedure in allaying [illegible] use of [illegible]

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in lever and jack-hammer drilling in hard rock, although the new type of Kelly dust trap is now finding much favor for this kind of work.

The Kelly trap consists of a metal chamber designed to enclose the drill steel at the rock surface. No attempt is made to secure a mechanical seal with the rock or between the trap and the drill steel. The dust is removed by an air stream and is carried into an exhaust system connected to the trap. Escape of dust particles through openings between the uneven rock surfaces and the trap is prevented by the air seal produced by the inflowing air. Tests made on this trap under actual working conditions show that the dust concentration at the worker's breathing zone may be kept down to less than 10 million particles per cubic foot with a 60 cubic foot per minute rate of air flow through the hood. This trap is a step forward in the program of dust removal; however, in underground work, such as in mines and subways, there is still the need to solve the problem of compact dust disposal equipment.

In certain cases, such as in the sandblasting of large castings in sandblast rooms, the practical safeguard to the worker is to provide him with a mask or helmet of the positive air pressure type. In the sandblast investigation previously mentioned, it was found that when from 5 to 6 cubic feet of practically dust-free air per minute are supplied to the helmet, the worker receives ideal protection. However, one must always bear in mind that the ultimate criterion of protection should be the dust determination of the air within the helmet during blasting and not the quantity of the air supply itself.

In most dusty processes, however, the most effective means of dust elimination are by the use of properly designed exhaust ventilation systems. Since in many instances it is difficult, costly, and at times an unnecessary procedure to remove all the dust in the vicinity of a worker, we need first to determine the minimum amount of a certain dust which the worker can apparently tolerate with impunity. Such information can be made available by the type of studies carried out by the Public Health Service. For example, in the granite study already referred to, it dust at the breathing level of about 10 million particles per cubic foot (35 per cent free silica).

Studies of dust removal devices used in granite cutting plants at the time this work was conducted showed that a linear velocity of 1,500 feet per minute as measured by an anemometer at the face of the dust-removal hood, would keep the dust at the breathing level to an amount less than 10 million particles per cubic foot.

A word should be said concerning personal respiratory protection against dusts. It has already been shown that in the use of positive pressure respiratory devices in sandblasting, it is important to have a well-designed device supplied with about 6 cubic feet of dust-free air per minute to give full protection to the worker. With reference to respirators of the filter type, there is still much to be accomplished in the design of an efficient and comfortable mask for continuous use. Of great value are standard methods for the testing of the efficiency of respiratory protection devices. Drinker advocates testing a device against the particular dust which the respirator is to encounter, these tests to be made both in the laboratory and under actual industrial conditions. He further suggested that some impartial agency should conduct such tests and certify the devices for industrial use, the work being done on a cost basis. The U. S. Bureau of Mines has prepared such a schedule for testing and approving respirators.

I wish to stress the importance of good housekeeping in the effort to combat the dust hazard. Good housekeeping should not only imply the removal of accumulated dust about a workroom but should also embrace efficient maintenance of dust removal devices and respiratory protective equipment. Systematic inspection of all dust suppression equipment should be an axiomatic principle in every dusty industry rather than the casual attention which it now receives in many instances.

Report of the Nominating Committee

The chairman called for the report of the Nominating Com[illegible] this point, and new officers for the [illegible] to serve during the ensuing y[illegible] nominated and elected as follows:

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General Chairman—William H. Baker, J. E. Baker Co., York, Pa.
Vice-Chairman—William E. Hilliard, New Haven Trap Rock Co., New Haven, Conn.
Policy Committee Chairman—H. F. Potter, The General Crushed Stone Co., Easton, Pa.
Publicity Committee Chairman—J. R. Boyd, National Crushed Stone Assn., Washington, D. C.
Statistics Committee Chairman—W. W. Adams, U. S. Bureau of Mines, Washington, D. C.
Members at Large—
V. P. Ahern, National Sand and Gravel Assn., Washington, D. C.
Norman G. Hough, The National Lime Assn., Washington, D. C.
O. M. Graves, The General Crushed Stone Co., Easton, Pa.
A. L. Worthen, The Connecticut Quarries Co., Inc., New Haven, Conn.

The Foreman's Duties and Responsibilities in Preventing Accidents

By GLENN GARDINER

Forstmann Woolen Company, Passaic, New Jersey

The speaker said in part: On my first job in the clay pit of a brick works, I witnessed a disastrous cave-in which so injured one of my fellow workers that he was totally disabled for life. The accident was so plainly the fault of the foreman in charge that he was discharged for his carelessness. That accident made an indelible impression upon my mind, and let me understand as nothing else could what the responsibility of the foreman is in accident prevention.

The foreman who is responsible for getting out the work is also responsible for the control of those conditions immediately surrounding the worker on his job. He has an unexcelled opportunity to observe his workers and their habits. If he is a competent foreman, he can detect those working habits which may result in accidents. He should come to know his workers so well that he will understand when worries and outside problems are taxing their minds and powers of concentration. He may not be in a position always to do much about the outside problems, but he can, at least, govern conditions on the job.

The foreman is the one who is most likely to set up conditions on the job which cause job anxieties for the worker. He can do much to ease the worker's mind by keeping him informed about conditions which affect his job and the steadiness of employment. He can help to reduce the fatigue his men experience and in so doing directly influence accidents which are related to fatigue.

Every intelligent foreman realizes the importance of the safety functions, and that safety should be put upon the same plane of importance as the other duties his job includes.

If the worker is indifferent to safety, it is usually merely a reflection of the foreman's attitude. On the other hand, if the foreman will stand for nothing but safe working habits, the worker will proceed very rapidly to develop safe working habits. Of course, I recognize that certain workers have an attitude of recklessness and bravado about them which makes them slightly contemptuous of the dangers of the job. But it is up to the foreman to puncture this attitude and bring such workers down to earth.

A recent study of a company employing 6,600 workers indicated that 48 out of the 6,600 had had 10 per cent of all the lost-time accidents for the entire organization. The accident frequency among these 48 men was fifty times as great as that of the average for all workers.

The record also indicated that those men having the largest number of minor accidents were also the same men having the largest number of lost-time accidents. Thus minor accidents are of real significance to the observing foreman because they point out to him the men who will most probably have the lost-time accidents.

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...hen called for and it was pre-
Department of Insurance and
...lmington, N. C.
...merican Railway Association in
...nd, Ohio, October 2 to 4, 1934,
...nded to:
The Equitable Life Assurance
...ilroad employee casualty statis-

...of Safety, Interstate Commerce
... Conditions and Practices In-
Bureau of Safety,' also for his
cooperation of the Bureau of
...ion on the American Railways;
...ne, General Safety Supervisor,
...s of the Section during his term

...ful and energetic services during

Northern Pacific Railway, for
...the Program Committee, thereby
...h Annual Convention;
...n such a commendable cause as

... their contribution to the well

... be spread upon the records of
...n all of those recognized herein."
...ly accepted, and passed by the

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...ers on election of officers for the
...was presented by H. S. Corbin,
...oad, as follows:
...fety, Pennsylvania Railroad.
Attorney, Central Railroad Com-

...tendent of Safety, Missouri Pa-

...ice President, Erie Railroad; and
...entral Lines.
...ndent of Safety, Chicago, Rock

...endent of Safety and Sanitation,

...y Superintendent System, Atchi-
H. Blakemore Superintendent of
...mph, Supervisor of Safety and
... C. Murphy Superintendent of
J. C. Yocum, Manager, Safety
Omaha Railway

TWENTY-THIRD ANNUAL SAFETY CONGRESS
NATIONAL SAFETY COUNCIL

Textile Section

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Statistics Committee Chairman—J. T. TROLINGER, American Bemberg Corp., and American Glanzstoff Corp., Elizabethton, Tenn.
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WALTER HUMPHREYS, National Association of Wool Manufacturers, Boston, Mass.

TUESDAY MORNING SESSION

October 2, 1934

The opening session of the Textile Section was called to order by Acting Chairman E. E. Place, American Mutual Liability Insurance Co., Boston, Mass., who presided. Chairman Place introduced George Richman, Secretary, Richman Brothers Company, Cleveland, Ohio, who made a brief welcoming address to the delegates on behalf of the Convention City.

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