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Louis Brookman, Jr., *Business Manager*
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Representatives

New York City
E. Macdonald Bacon
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The Cement Mill Edition also contains all the material published in the corresponding Regular Edition and so provides news of the uses and merchandising of the materials whose manufacture is discussed in the Mill Edition.

The Regular Section furnishes mill operating officials and mill executives valuable points of contact with the users of the materials they produce.

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J. C. WITT, *Consulting Editor*

A. C. BAMBERGER, *Assistant Editor*

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Mechanical-Filter Types of Respirators

RESPIRATORS of the mechanical-filter type, and methods for testing them, are discussed in a report by H. H. Schrenk published by the U. S. Bureau of Mines as *Information Circular No. 7086*. The classification, testing and design of acceptable respirators in general formed the subject-matter of an article based on the same report and published on page 278 of the December (1939) issue of the *Cement Mill Edition of CONCRETE*.

Mechanical-Filter Respirators

Mechanical-filter respirators are based on the principle that particulate matter is retained when air is passed through a filter of fibrous or other suitable material. This type of respirator probably is the simplest, lightest, cheapest, and most used of all the respiratory protective devices.

Most mechanical-filter respirators consist of a filter of a fibrous or other suitable material in a holder connected directly to a half facepiece that covers the nose and mouth. The filter holders or filter elements may be divided into two groups—those in which the filter holder or filter element is attached to each side of the facepiece and those in which a single felt holder or filter element is attached to the front of the facepiece. The filter holders or filter elements are designed so that the filter may be removed readily for cleaning or replacement by a new filter.

The respirator may or may not have inhalation and exhalation valves. All but one of the approved respirators have exhalation valves and the majority have inhalation valves. The consensus of those well acquainted with the mechanical-filter respirators is that both exhalation and inhalation valves are desirable.

Mechanical-filter respirators are divided into three groups, depending on the character of particulate matter against which they are designed to protect. *Type A* is for protection against dust generated by disintegration, as in drilling and blasting. *Type B* is for protection against fumes such as are gen-

erated in lead burning; and *Type C* is to be used against mists such as are formed in electroplating and spray-painting. The discussion in this report will be confined mainly to *Type A*, or dust respirators for protection against pneumoconiosis-producing dusts such as free silica and asbestos, and nuisance dusts such as aluminum, iron ores, and flour. However, much interest has been shown in respirators for protection against lead dust and lead fume.

Tests for Direct Leakage

The general approval requirements are that the respirators must give adequate protection with reasonable comfort for a satisfactory time in any atmosphere for which they are designed. In addition to examining the respirator for design, durability, and practicability, three main tests are made to ascertain efficiency, resistance, and fit of the facepiece.

The facepiece fit of the respirator is tested by blowing air containing a high concentration of coal dust toward respirators worn by three subjects, each with a different type of face (lean, average, and full). The results of such a test, in which leaks were intentionally caused under the respirators worn by two of the men by inserting toothpicks under the facepiece, were quite unmistakable. Inasmuch as facepiece fit is one of the important requirements of mechanical-filter respirators from the standpoint of practical application, such a test as described might well be used in teaching persons to wear the respirators

properly, and to impress upon them the significance of proper fit of a facepiece. This test also indicates very quickly the inadequacy of some of the poorly designed respirators.

Resistance to Air Flow

In the gas mask, the contaminants may be removed satisfactorily for a certain time, after which efficiency drops rapidly and the mask is no longer satisfactory for protection. In the mechanical-filter respirator, however, the filter increases in efficiency as the contaminant is removed. The limiting factor is not the efficiency of the filter, but the resistance to inhalation. The service life of a suitable mechanical-filter respirator, therefore, is not based on filtering efficiency, but on resistance. The resistance to inhalation is limited to a maximum of 50 millimeters of water-column height at 85 liters per minute after the respirator has been tested and loaded with dust. The resistance to exhalation is limited to a maximum of 25 millimeters at the same rate of flow. The respirator should give satisfactory service without cleaning or changing the filter element for about 8 hours in any atmosphere that does not contain an excessively high concentration of dust. In other words, the resistance of the respirator must not increase unduly before a reasonable amount of dust is retained. The use of mechanical-filter respirators in the immediate vicinity of operations such as abrasive blasting with dry sand or rock drilling with dry-type pneumatic drills is impractical,

(Continued on page 105)

TABLE 1. - Test conditions and filtering requirements of respirators for protection against pneumoconiosis-producing or nuisance dust.

Concentration, mg/m ³	Air flow, l/m	Test period, minutes	Volume of air through respirator	No. of respirators	Approximate dust load, mg	Allowable leakage, mg
50 ± 10	32	90	2.9	3	145	3 mg. average for 3 respirators or 4 mg. for any one.
5 ± 2	32	312	10	3	50	10 mg. average for 3 respirators or 12 mg. for any one.

Safety Work Made Effective in a Heavy Industry

By LEA P. WARNER, JR.

Industrial Relations Manager, Warner Company
Philadelphia, Pa

SO that you may better understand the background of our safety program, a brief description of its organization set-up is in order. We produce and process sand and gravel and limestone and are engaged in the wholesaling and retailing of these commodities. We also operate and maintain our own central-mix concrete plants and delivery trucks and a river transportation fleet consisting of barges, tugboats and dredges.

The Organization

The main office of the company is in Philadelphia and most of the plants are located within a 30-mile radius. The plants and yards vary from 10 to 200 employees for a total company personnel of around 900. Our company is too small to operate separate departments for safety, personnel, medical, employee publications and workmen's compensation, so we have combined all of these functions under the guidance of the industrial relations department.

This combined arrangement has been a vital force in our ability to create close harmony and co-operation in accident prevention work, and we are able to apply more carefully the humanitarian concept of accidents to their costs. We are self-insurers for workmen's compensation and have accordingly set up our own system of physical examination, general medical procedure, accident reporting and cost analysis forms.

Cost Is Moderate

Our total workmen's compensation costs, medical, physical examinations, X-ray examinations and department salaries amounted to 1 per cent of the total company payroll during 1938. For six months of 1939 the total cost was 0.9 per cent of the payroll.

Monthly safety meetings are held at most of our locations to discuss hazard-

ous conditions and the previous month accidents. There are several methods of procedure for conducting these meetings. In one division, for instance, our marine superintendent acts as permanent chairman, and the general superintendent, regardless of seemingly more pressing duties, sits in with the safety committee. This group is made up of three plant and accident inspectors, who serve a term of three months, and one safety observer appointed from each department. The latter serve for a term of one month and wear badges indicating their authority to warn fellow workers of unsafe working methods, etc. In another division, two permanent safety committees of foremen and sub-foremen operate in competition with each other. In all company meetings, minutes are kept and a copy filed with the main office.

All Accidents Investigated

All accidents are investigated and a signed report sent to me by the accident inspection committee. On lost-time or disabling injuries, a more thorough investigation is made, pictures are often snapped and immediate action taken to remedy the cause. In some cases we can only render first aid to the situation until a final correction can be made at a later date.

Supplementing our plant safety work the industrial relations department publishes several house organs. One, the *Foremen's Bulletin*, issued bi-monthly, goes to all men directly responsible for departmental safety. On alternate months the *Safety News & Views*, also a mimeographed publication, goes to all employees. It is designed to encourage safety in the home, on the highway and playgrounds. We also have a printed publication, the *Warner-American News*, in which we commend group records or individual achievements.

Summary

Summarizing the main highlights which we in the Warner Company feel

will result in effective safety work in a heavy industry, we note the following:

1. In a decentralized industry there should be centralized control of all safety work, combined where possible with the department designated to handle personnel or industrial relations.

2. The men must be interested in and the management serious about preventing accidents.

3. An active safety program should be carried out with the men participating.

4. Thorough plant inspections and accident inspections should be made, and something done immediately to remedy the hazard or condition.

5. Keep complete records of accidents, costs and general medical routine such as the physical examinations. Do everything to help a man improve his health, and *don't* give examinations for the purpose of weeding out employees.

6. Put the whole program on a friendly basis.

FILTER RESPIRATORS

(Continued from page 104)

due to the rapid increase in resistance to breathing caused by excessive amounts of dusts retained by the filter.

Filtering-Efficiency Test

The filtering-efficiency test consists mainly of testing three or more respirators on a mechanical testing apparatus against a high concentration of dust whose properties are similar to those for which the respirator is to be approved. The test atmosphere is pulled through the respirator at the rate of 32 liters per minute. The concentration of dust in the chamber and the amount of dust that leaks through the respirator is collected by electric precipitation, and weighed on an analytical balance.

Table 1 gives the detailed requirements of the filtering efficiency test for pneumoconiosis-producing or nuisance dusts. The filtering-efficiency tests are based on the so-called safe or permissible limits. From data available, 1 milligram of silica dust per cubic meter, or approximately 8 million particles per cubic foot, is considered safe to breathe. Therefore, if the air passing through the respirator does not contain more than this amount, it is considered safe. In other words, the permissibility of the respirator is based primarily on the amount of leakage and not on the relation between leakage and amount retained.

(The next article—the final one in this series of three—will cover the sampling and determination of dusts.—Editor.)

Presented before the Cement and Quarry Section of the National Safety Council at the 28th Annual Safety Congress, held in Atlantic City, N. J.

Procedures in the PREVENTION OF DUST

IN a paper headed *Some Data on Dust in Industrial Work*, by D. Harrington, chief of the health and safety branch of the U. S. Bureau of Mines, Washington, D. C., and published by the Bureau as *Information Circular I. C. 7072*, interesting information is given on procedures in the prevention of dust.

Respirators—Their Limitation

Discussing the subject of respirators, the author of the paper points out what operating cement men well know—namely, that the respirators of various types now available for use in excessively dusty atmospheres are cumbersome and inhibit freedom of movement, making them undesirable for constant wear throughout a working shift, though they can be worn readily for several minutes at a time. They give adequate protection to wearers against inhalation of dust into the respiratory system, but essentially no protection against poisonous or asphyxiating gases. Dust respirators should be regarded as useful for emergency purposes only, and then for relatively short periods. Adequate dust protection for workers should be of a more fundamental nature: that is, the quantity of dust should be reduced at its source.

Good Housekeeping

What might be designated good housekeeping has a definite place in dust-prevention activities. Dusty materials should be stored in dust-tight containers or bins. Dusty processes, including the handling of dusty material, should be conducted, as far as feasible, in dust-tight compartments or structures the tightness of which should be maintained. Ledges or surfaces on which dust may lodge and accumulate, to be easily thrown into the air by some shock or movement, should be changed, as far as feasible, to prevent opportunity for such accumulation; if this can not be done, such surfaces should be cleaned periodically by the vacuum process, by washing down, or by sweeping (the latter is a relatively poor method and should be used if possible only when a minimum number of other workers is present). Floors should be kept as dust free as practicable. The

use of water or washing methods is recommended where they can be used. Air for the use of workers certainly should not come from dusty sources.

Physical Examination

One of the most important features in connection with prevention of harm to the health from dust is the physical examination; unfortunately, this is clouded by so much controversy that its effectiveness is largely nullified, though it should be one of the principal cogs in the machinery operating to minimize harm to the health from dust in industry. Without doubt, every person employed in an industry where considerable dust may be present in the air should have a rigid physical examination by a competent doctor before employment. If the examination reveals respiratory trouble, especially if tuberculosis is involved, the person should not be employed. Moreover, at intervals not exceeding twelve months

(possibly six months) every person in an industry wherein much dust is present in the air should have a rigid physical examination. If disease is shown to be developing, the victim should be transferred to non-dusty employment, if such is available. Handling physical examinations in a manner fair to the worker as well as to the employer is a problem that should be worked out; and up to date this has not been done adequately.

Employer's Responsibility

Prevention of dust disease is chiefly an employer's responsibility. He should not hesitate to shoulder it, with a view not only to safeguarding the health of persons under his supervision, but also relieving his company from the heavy financial burden likely to be assessed by compensation or legal authorities should any considerable number of employees become afflicted with dust diseases. When one realizes how little is known about the cause or cure, or even the alleviation, of this disease, it seems sensible to do anything practicable to reduce the amount of dust in the air of working places. This does not mean that the employee should not help himself, as it is manifestly as much to the employee's interest to avoid dust or any other occupational disease as to avoid having accidents.

Mechanical Engineers Hold Sixtieth Annual Meeting

HOLDING its 60th annual meeting in the Bellevue-Stratford Hotel in Philadelphia from December 4 to 8, the American Society of Mechanical Engineers completed another decade in the long period of its existence.

The technical sessions, starting on Monday evening, December 4, were divided in a number of separate groups, five of which held meetings on this first evening. These included one group on work standardization, one on machine-shop practice, one on aeronautics, another on elasticity, and a fifth that heard a symposium on fuels.

Tuesday morning's session was similarly divided into six groups, and so on throughout the meeting.

Tuesday afternoon saw further discussion of fuels, and it was during this session that several of the papers presented were of definite interest to cement manufacturers. One of these, on *Characteristics of Cloth Filters on Coal-Dust*

Air Mixtures, was presented by A. R. Mumford, A. A. Markson, and Thomas Ravese. These writers dealt mainly with the installation, operation and maintenance of cloth filters for handling vented air from pulverized-coal mills. Another presentation was the paper offered by Philip H. Hardie, on *Equitable Limits of Dust Emission from Stacks*. He discussed the subject principally from the standpoint of large plants, and he gave consideration to the factors which should influence limits on dust emission.

The annual dinner was held on Wednesday evening, December 6, and the after-dinner period was taken up with the conferring of honors and awards for 1939, presentation of 50-year membership buttons, with the president's reception, and with dancing. Thursday evening was taken up with college reunions, an event that practically closed the sessions, except for the Council meeting on Friday morning.

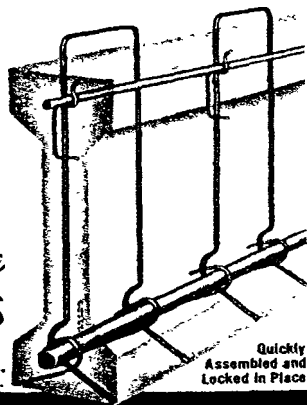
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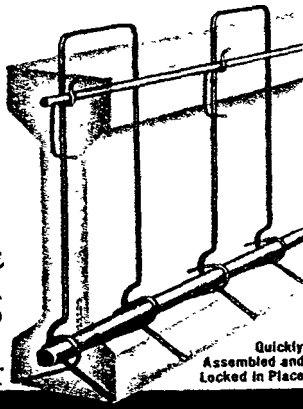
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