PLAINTIFF'S EXHIBIT

(3)

Dust Hazard in Industry

Details Given of Department of Health Survey of Dusty Trades . . . Problems of Dust Control . . . Examples of Dust Collection Equipment Available

An Editorial Staff Article

INHALATION of large quantities of dust has long been recognised as a danger to health. Effects of inhaling dusts, such as are found in many industries, have been studied, particularly over the last half-century. Efforts have been made to prevent dissemination of harmful dust particles by the installation of dust collectors and other methods. Several countries, including England, U.S.A. and Australia have introduced regulations aimed at dust suppression, especially in mines and foundries.

Types of Dusts

Types of dusts encountered in industry include toxic and non-toxic dusts, explosive dusts, non-harmful nuisance dusts, and dust arising from the powdered form of products and by-products being manufactured.

Toxic dusts are produced from poisonous material, for example lead, but there are several non-toxic dusts in a finely divided state, which are also injurious to health although the material from which the dust is derived is not in itself harmful. Examples are silica and asbestos.

Dusts that are explosive when present in air in certain proportions include carbonaceous materials such as coal and grain and also many metallic dusts such as those from aluminium and titanium.

This article discusses problems arising from the presence of harmful dusts associated with many industries. It is generally assumed that the main danger to health comes from dust particles which are less than five microns in dia. (a micron (μ)=one-thousandth part of a millimetre).

This means that dangerous dust is invisible to the naked eye. It can be detected and estimated by suitable instruments, involving the use of microscopical methods of size ranging and counting. A method of studying the behavior of respirable dust has been evolved by the Inspector of Factories in England, employing intense illumination and cinematography.

Victorian Survey

A survey recently conducted by the industrial hygiene division of the Victorian Health Department, under the supervision of Dr. D. L. G. Thomas, showed that dust is a serious health hazard in several dusty trades in Victoria.

An extensive x-ray survey of 4,000 Melbourne workers disclosed 356 cases of silicosis and asbestosis, which are serious lung diseases. Many workers are being slowly incapacitated by dust without realising it. Others, complaining of shortness of breath, tiredness, or a cough, had not suspected the cause.

Workers exposed to harmful dust include miners, moulders, potters, brick and tile makers, furnace bricklayers, mineral earth operatives, masons and quarrymen, boiler makers, welders and metal polishers.

Incidence of Dust Victims

The number of known dust victims in Victoria, before the Health Department survey, was 522, including 343 miners. The investigation brought the number up to 1,100, inclusive of 565 miners.

Silicosis has long been recognised as an occupational disease in mining, but its extent in Australian industry was not realised prior to the survey.

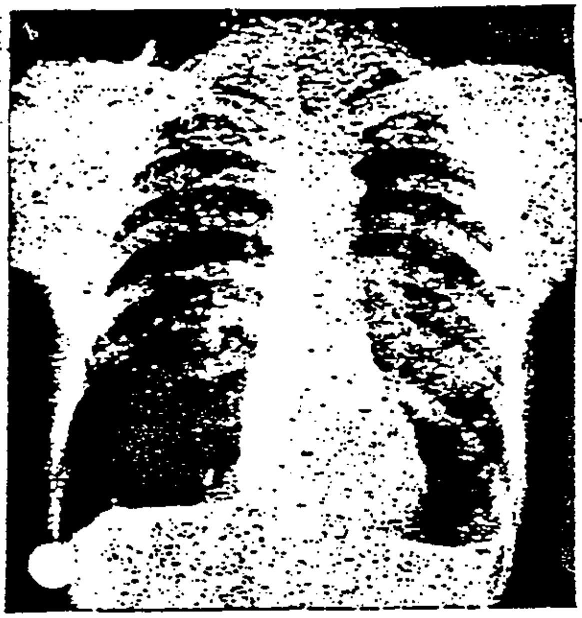
Asbestosis was diagnosed in a third of the asbestos workers tested. Of 260 x-rayed, the health of 50 was definitely impaired and 40 others showed early effects of the disease.

More than 20 workers have become ill in the past few months after inhaling vanadium dust, mainly through cleaning oil burning furnaces, although protected by masks and protective clothing.

Harmful Dusts and their Effects

Silica

Prolonged breathing of dust containing silica particles causes silicosis.



● Fig. 1 (left)—This case is a typical silicotic after 24 years in a mineral grinding works. ● Fig. 2 (right)—A proved asbestotic—confirmed by the presence of asbestosis bodies in the sputum.

The abundance of silica in the earth's crust and the large number of people engaged in occupations involving the inhalation of dust containing free silica, make silicosis the most important of diseases classified under the general heading of pneumoconiosis.

Silica particles, once in the lung, set up a chemical action. Nodules of connective tissue are formed which eventually greatly interfere with the elasticity of the lungs. Tuberculosis and silicosis are closely associated, especially in quartz miners. X-ray is the principle means of diagnosing silicosis, although the radiological picture does not necessarily give a definite finding in all cases.

Shortness of breath is one of the most common symptoms of silicosis. The disease takes from about five twenty years to gain a grip, according to intensity of exposure.

Apart from removal from the hazard, change to an open-air life, and physiotherapy to improve lung capacity, there is no known treatment for silicosis.

Surveys made by the Division of Industrial Hygiene, Victorian Department of Health, prove that silicosis is a prevalent and serious disease in Victoria, resulting in incapacity or diminishing efficiency. Steps have been taken to eliminate siliceous dust, but much remains to be done in effectively controlling industrial hazards associated with the dusty trades.

A chest x-ray of a typical sufferer from silicosis is shown in Fig. 1, and from asbestosis in Fig. 2.

Asbestos

Asbestosis is a disease caused by the inhalation of asbestos dust (magnesium silicate). It is believed that the condition is set up by the mechanical intrusion of asbestos fibres into the substance of the lungs.

People prone to the disease are those handling asbestos in its raw state or processing it to make lagging materials; also operatives sawing and cutting any finished product containing asbestos such as brake linings, asbestos sheeting and various insulating materials. Dismantling old dry lagging is a hazardous occupation.

Once established, asbestosis constitutes a grave threat to life and health. Symptoms are shortness of breath, tightness and pain in the chest, together with loss of energy and tiredness. Some patients show marked improvement after a course of physiotherapy.

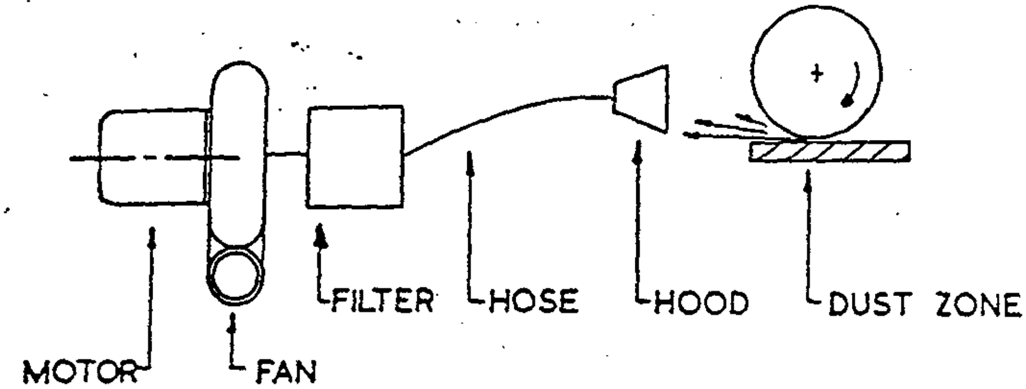
Stringent regulations aimed at controlling the hazard of asbestos dust have been framed in Victoria, and when these come into force, it is hoped that the incidence of asbestosis will steadily drop.

Vanadium

Vanadium is a new dust hazard. Vanadium remains in residual heavy oil, after more volatile fractions, such as petrol; paraffin and diesel oil have been distilled. It is a constituent of the exhausts of gas turbines using heavy residual oils. Operatives cleaning oil-fired boilers or relining combustion chambers are exposed to vanadium dust.

Symptoms of vanadium dust poisoning include irritation of the mucous membrane, digestive disturbance, nervous troubles and even blindness.

Precautions against vanadium poisoning comprise efficient ventilation and hygiene, and use of respiratory apparatus, special overalls and goggles.



● Fig. 3—Essential components for dust extraction.

Other Dusts

Talc, used in rubber factories, cotton dust, sugar cane dust, and coal dust can cause fibrositis in the lungs.

Iron dust can produce a radiological effect similar to silicosis but with little or no symptoms.

Most lead poisoning is caused by the inhalation of lead dust.

Protective Equipment

Industrial equipment available for protection against dust includes gas masks and respirators of various kinds. Filter respirators are used for protection against silica dust and toxic dusts. Distant breathing hoods are commonly used by sand blasters.

However, it is generally conceded that collection of dust at source and so preventing its dissemination is the best method of combating the dust problem.

In machine shops, dust collection may be made either by general room ventilation or by hoods adjacent to the work bench or by collection at source. A comparison of the rate of fall of spherical particles of different sizes shows the inefficiency of the first two methods.

A particle of 0.5 micron size has a terminal velocity of .001 cm. per sec. in still air while a particle of 10 micron size increases the rate to 0.3 cm. per sec., and the rate of a 20 micron particle rises to 1.2 cm. per sec.

Therefore, small harmful particles dispersed in normal air currents encountered in factories or foundries, may well remain in suspension for very long periods, with harmful results to operators.

If these particles are collected at source, such a condition cannot occur.

Dust Extraction Fundamentals

Dust extraction equipment can be resolved into the series connected components shown in Fig. 3. They are—

Hood to suck in dust laden air;
Hose to suck away dust laden air;
Filter to clean dust laden air;
Fan to induce air movement;
Motor to drive the fan.

● Fig. 4 — Surface type grinder with Dustuctor LVHV cowl.

Alternatively, the vacuum source to induce air movement may be an air-driven eductor, as used in the Dustuctor system, described later.

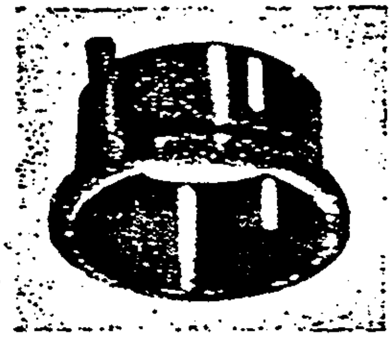
Factors influencing the choice of dust extraction elements include—

Hood. Location as near to zone of dust generation as working space permits. Shaped to "catch" heavier particles at some point on natural trajectories. To capture finely dispersed particles, air entering the hood must sweep past the dust zone at a speed sufficient to deflect them in and lower the concentration of contaminant to a pathologically safe level.

'e. Length chosen to comply with space ements. Inside diameter such that flow pro- an air velocity more than sufficient to trans- ust collected at the hood, to the filter. Hose withstand dust abrasion of inside surface, which l be smooth to minimise friction losses.

er. There are five main types of filters: 1. a (gravity, baffles, cyclones); 2. Mechanical ns, bags, etc.); 3. Viscous; 4. Washers; 5. rostatic.

oice of filter is influenced by the nature and nt of generated dust.



● Fig. 5—Cowl of the Dustuctor L.V. H.V. surface grinder.

Dustuctor System

Dust collection methods include the Dustuctor tem, made in England, and distributed in Australia Holman Bros. (Aust.) Pty. Ltd.

In the Dustuctor system, dust from power tools entrained in a high velocity air stream virtually at e point of generation, by means of specially signed cowls, sleeves or extraction rings.

● Fig. 6—Dustuctor fettling chisel sleeve, showing hoses leading to dust collection unit.

The system employs a low volume high velocity air stream. Instead of using a large flow of air vaguely, suction is concentrated at selected points, resulting in a substantial economy of air.

After entraining dust in the air stream, it is necessary to filter and separate it from the air stream by means of suitable collectors.

Dust collection units are mainly small portable or semi-portable units comprising a high efficiency cyclone or cyclones followed by a high grade cloth filter. The cyclones are responsible for collecting and depositing into a container over 95 p.c. of the dust and form a primary separation unit ensuring minimum dust passing to the cloth filter. This filter is of a specially chosen material giving little back pressure, while cleaning and replacement are easily effected.

The vacuum source may be either a built-in air-driven eductor or separately electrically driven fan or vacuum pump.

Efficiency

These collectors are all capable of filtering the dust laden air to a high degree of efficiency.

The standard demanded by Mining Health Authorities in England requires that not more than 300 particles per c.c. of air, of size range 0.5 to 5 micron be dispersed to the atmosphere after filtration. The filter units used in the Dustuctor system meet this requirement.

Applications

Successful applications of the Dustuctor system to portable power tools include surface grinders as used on castings, radial grinders, portable abrasive wheels, and swing frame grinders (see Figs. 4 and 5).

Fettling Chisel Sleeve

The Dustuctor fettling chisel sleeve, which is made of rubber, offers a simple and effective means of collecting fine and dangerous dust created at the edge of a fettling chisel, used in foundries for cleaning and de-scaling castings, or similar operations.

The dust is drawn up through two ducts in the sleeve, either side of the cutting edge of the chisel and led away through a light ¾ in. plastic hose for safe disposal.

These ducts should be kept about 1 in. from the cutting edge and the rubber may be cut back as the chisel shortens during its working life.

The sleeve is firmly positioned by an annular ring ground in the octagonal chisel which coincides with a ring in the sleeve itself. The sleeve is convenient to use and its shock absorbing qualities are a comfort to the operator.

A vacuum of 5 in. of mercury is required at which depression the sleeve passes a volume of 6.5 cu.ft of air per minute.

The sleeve, which is illustrated in Fig. 6, is designed for use with dust collection units described above.

Hollow Chisels

In another method of dust control for fettling chisels, used experimentally in England, local exhaust ventilation is applied through a hollow chisel, and the dust extracted through the pneumatic hammer. Exhaust air can be provided by an eductor or rotary exhauster.

This method is similar to a successful dust-control system in mines, in which dust is extracted through a hollow drill and taken away through the pneumatic hammer itself.

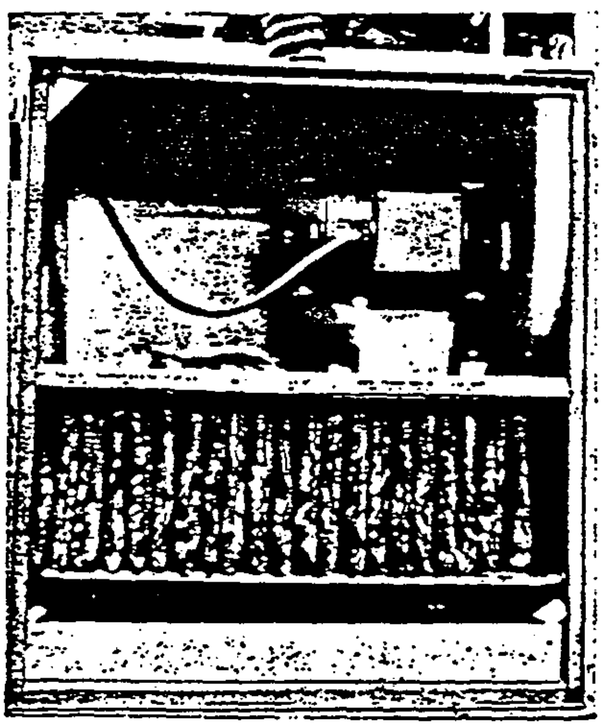
A hollow chisel has been used for fettling rough castings and cinematograph films show that the dust was brought under control.

"Power" Dust Extractor

The "Power" dust extractor, an internal view of which is shown in Fig. 7, is manufactured by Pauer & Co. Pty. Ltd., North Melbourne, Victoria, and was designed for use with stationary surface grinders and similar applications.

Under the action of a centrifugal exhaust fan, powered by a ½ h.p. 2,900 r.p.m. totally enclosed motor, dust is drawn from the point of generation by means of a specially designed hood. Dust-laden air is conveyed through special rubber suction hose, 2¼ in. inside dia., to the top of the unit and drawn

● Fig. 7—Internal view of Power dust extractor showing rubber suction hose, exhaust fan, and filter bags.



downward in the rear compartment. The air is then drawn upward, this change of direction removing all but the finest particles of dust.

The fine dust is arrested on the outside of 21 filter bags, suspended from a frame in the front compartment, and providing a total filter surface of approx. 265 sq. ft. The filter bags may be agitated by means of a lever on the side of the unit, thus allowing dust to fall into a tray for removal.

The "Power" dust extractor system has been applied successfully in the manufacturer's own machine shop not only to surface grinders, but to lathes and milling machines when used for machining cast iron. Hoods, specially designed to suit the individual machines, are used for dust collection at source.

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Daily News Sheet

Under the bright colored banner of "Today's A.P.M. News", Melbourne mill manager, Mr. Hugh Rogers, is producing a daily news page which is proving extremely popular at the mill.

The page contains up to six short paragraphs about mill and company activities.

The headed sheet on which it is fordigraphed is in a different bright color for each day of the week, so that it will not be confused with other notices and to make it easy to see.

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Ten Ways of Saving Office Space

1. Microfilm storage records.
2. Use five-drawer filing cabinets.
3. Use functional equipment.
4. Standardise size of offices.
5. Provide standard aisle space.
6. Arrange office to suit the work flow.
7. Use movable partitions.
8. Reduce the number of partitions between departments.
9. Provide centralised reception space.
10. Provide a centralised company library.

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THE GOAL

"The primary goal of any industry must be to make a better and better product for more and more people at a lower and lower cost, and still retain a fair profit."—Mr. Walter W. Killough, president, Melbourne Division, Australian Institute of Management.