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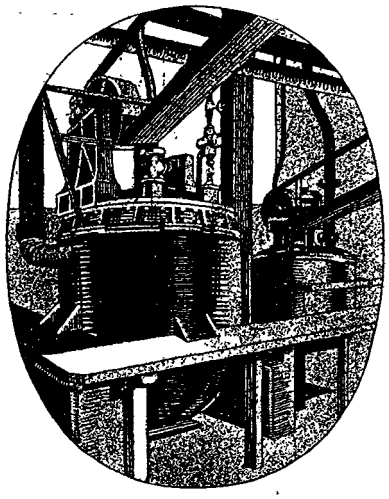

THE

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Prevention of Disease in Industry

By Donald Hunter, M.D., F.R.C.P.

At a meeting of the Institution of Chemical Engineers held on March 24, a paper with the above title was presented by Donald Hunter, M.D., F.R.C.P. The following is an abstract of Dr. Hunter's remarks.

INDUSTRIAL medicine, Dr. Hunter said, is the practice of medical supervision, preventive medicine and public health within the confines of an industry. Its aim is to safeguard the health of the employee and to minimise time lost from work because of sickness or of accidents. Though one of its functions is treatment, it is mainly an advisory and preventive service. The industrial medical officer has to co-operate with managers, workers, engineers, chemists and architects. He has to discover faults in the working environment and try to find remedies. One of his most interesting duties is to bring into the effective service of industry the discoveries of the research worker.

It was possible to summarise the main principles underlying the prevention of disease in industry under a number of headings.

Protection of the workman by law.—In this country the number of diseases notifiable under the Factory and Workshops Acts and subject to compensation under the Workmen's Compensation Acts indicates the existence of an alert and enlightened legislature. From 1878 onwards, provisions were made to control dangerous trades by so-called special rules of the Home Office. The early knowledge of industrial diseases was obtained by placing an obligation on the medical practitioner and employer to notify them to the Chief Inspector of Factories. The scope of the Workmen's Compensation Acts is wider than that of the Factory Acts, as they are intended to cover all cases of sickness of strictly occupational origin, the individual being considered and not merely the conditions under which he works. There are now some 38 scheduled diseases. New occupational risks constantly arise ; asbestosis and dioxan poisoning can be quoted as dangers recently brought under control. Sometimes great expansion will occur in one trade, as was the case with the manufacture of accumulators from 1922 to 1924.

Detection of Intoxication

Medical inspection under State support.—In this country medical examination of entrants into industry, required by law and carried out by certifying surgeons, is very limited in extent and applies only to young persons between the ages of 14 and 16; but it was undoubtedly the forerunner of the much more extensive voluntary medical examination now frequently undertaken. An increasing number of employers are realising the advantages of some kind of medical service in the factory. An additional measure of protection applied in many industries is the periodic medical examination of any workers exposed to known risks.

It is often possible in this manner to detect signs of intoxication before disability is produced.

Touching on the prevention of dust and fume, Dr. Hunter said that wherever possible exhaust ventilation through hoods must be applied at the point of origin of the dust or fume. It is in use in the manufacture of electric accumulators and of white lead, in the manipulation of silica and asbestos, and of carbon bisulphide and benzene in indiarubber works. In certain instances general as opposed to local exhaust ventilation is applied. A preventive method which has been widely applied in the mining, metallurgical, and ceramic industries, is the substitution of wet methods for the original dry screening, grinding, milling and mining processes.

Education as to the nature of the danger.—The factory physician should insist on the necessity of teaching the workman to take an interest in protecting himself. He should be taught the importance of clean habits in lead works, and should be made to understand such things as the principles of dust suppression. For example, he should know that a vacuum cleaner is used to remove dust from a workshop for his protection, and should, therefore, never be employed with the motor reversed. Cautionary placards and illustrated notices should be used in the work-rooms concerned so that the early lesions of the skin in anthrax and in chrome ulceration are familiar to all. The factory physician must never agree to a scheme where the workmen are kept ignorant of the poisonous nature of substances handled. In the War American workmen were told that trinitrotoluene might indeed explode but was otherwise harmless. This attitude was a distressing obstacle to those who tried to introduce into American plants the safeguards which had been successfully adopted in this country.

Importance of Cleanliness

Cleanliness of work places.—In some dangerous trades constant vigilance by a staff of good foremen is necessary. In the manufacture of trinitrotoluene, absorption through the skin cannot be prevented unless benches, tools, floors and walls are kept spotlessly clean. Where it is impracticable to use a wet process, as for example in the manufacture of litharge, the foremen must see that no dust is raised in shovelling.

Bodily cleanliness.—Cloakrooms, washing rooms, mess rooms, baths, nailbrushes, towels and soap must be provided by the employers and used in their time. Where absorption is known to occur through the skin, as in the use of aniline, nitrobenzene, and trinitrotoluene, appropriate protective clothing must be worn. If direct contact with the poison cannot be avoided every means must be adopted to protect the skin. The surface which is necessarily exposed may be covered with a bland ointment, dusted with powder or washed frequently. There is a risk in too much washing of the skin, and care must be taken in such cases to use the least irritating cleansers, to avoid scrubbing and to replace the lost oils of the skin by inunction with an animal fat.

General hygiene.—There are certain principles which apply to all trades but are of greater importance in the dangerous trades because to neglect them may increase the susceptibility of the worker to the poisons concerned. Measures must be taken to prevent long hours of work, the employment of boys and girls, undue heat from furnaces and steam from tanks, and the use of underground workshops and bad lighting and ventilation. During the War it was realised that hygienic surroundings, good ventilation and lighting, facilities for obtaining food at a reasonable cost, and opportunity for rest and recreation were not only good for the worker but to the advantage of the employer. The benefits derived from such improvements

have served to stimulate the provision of further facilities for workers to enjoy a healthy life. Except in the special rooms set aside for the purpose, smoking, eating, and drinking must be forbidden in certain works, for example, lead works. Otherwise a man might carry a compound of lead on his fingers to his cigarette and perhaps inhale a dangerous amount.

The simplest method of preventing an industrial disease is to prohibit the use of the toxic substance which causes it. The possibility of such prohibition depends on the finding of an innocuous substance competent to replace the noxious one. A low solubility glaze has been produced which protects the potter from the dust of white lead, and in a similar way paint technologists have protected the painter of metals by the invention of a non-setting red lead. The use of plastic rubber, that is rubber in which litharge has been incorporated in a mother batch to the extent of 90 per cent., will abolish the production of lead dust in certain processes in the rubber industry. Extraction with sulphuric acid or oxidation will reduce or completely remove the carcinogenic activity of a mineral oil such as that used in cotton mule spinning. Substitutes must be found for toxic solvents.

Reduction of Manual Operations

Wherever possible mechanical means should be substituted for hand carriage. Examples of this are seen in the use of cranes, rails, hoists, travelling belts, covered conveyers and hoppers, and automatic packing machinery. The abolition of hand filling of shells, the substitution of shot-blasting for sand-blasting and of stainless steel for chromium plating, and the use of a closed-in film steam evaporator in the manufacture of silver nitrate are further examples. An outstanding contribution to the reduction of the risk of lead poisoning was the invention of the wet pulping method in the manufacture of white lead. Glass workers' cataract has been minimised by the invention of the glass bottle-making machine.

Knowledge as to portals of entry.—Where it is known by what route—respiratory, alimentary or cutaneous—a poison is absorbed the physician can, in consultation with the employer, indicate on what principles the methods of protection should be based. In the majority of industries absorption through the respiratory tract is of overwhelming importance. Except very rarely, lead poisoning is not due to eating with unwashed hands. In a few industries absorption through the skin takes place, for example, in the handling of aniline, nitrobenzene, trinitrotoluene, nicotine and lead tetra-ethyl.

In certain dangerous processes it must be forbidden for men to stay for long periods at any one job. In lead smelting and in processes involving exposure to carbon bisulphide, nitro-benzene, and trinitrotoluene, short shifts must be enforced.

Employment of women and of all persons under 18 in certain lead trades must be forbidden. In gas works and on blast furnaces, where there is a danger of carbon monoxide poisoning, it is better to employ middle-aged men, who are partially protected by their lesser physical activity and slower respiration. The selection and employment of immune persons only is an ideal the attainment of which must wait on better knowledge.

It would be idle to suppose that our knowledge of industrial diseases is a finished chapter. Many diseases of occupational origin remain unknown for years, notable instances being asbestosis and Weil's disease. Clearly there must be others still eluding our search. Recently fluorosis of bones, a new horror of industrial medicine, was unearthed. Is this condition widespread among cryolite crushers elsewhere than in Denmark? Do bath enamellers suffer from it? What, if any, will be the ultimate consequences to bone and bone marrow of the deposition of calcium fluoride in the skeleton? Is the high incidence of malignant disease of the nasal sinuses in workers in nickel related to substances used in their work and is there also a high incidence of lung carcinoma among them? Will the chemist find a suitable substitute for nitrate of mercury in the felting of fur? Will the bacteriologist succeed in producing effective inoculation against Weil's disease? These and many other problems await solution. We are on the right path but we have a long way to go.

Discussion

THE PRESIDENT, referring to silicosis in the Rand mines, said that whereas at the beginning of the century it had caused great loss of life, he had the authority of Dr. Irvine, a well-known pathologist there, to say that since certain measures were adopted some 13 years ago there had been no fresh cases of silicosis on the Rand. Notwithstanding that fact, compensation to those who were formerly employed in the mines and in whom the disease had developed to a certain stage, would be payable to the extent of a million pounds per annum for the next 10 or 12 years. The measures taken were that all drilling in the mines was being done wet instead of dry; blasting was done when the workmen were out of the mines; an immense volume of air was passed through the mine workings in order to clear out the dust; and no one was employed in the industry unless he passed a very severe medical test and unless his family medical history was satisfactory.

DR. G. ROCHE LYNCH, discussing lead in tissues and bone, said that anything up to 150 parts per million had been found in people who were normal in the sense that, so far as could be ascertained from their medical histories, they had never been in contact with lead in industry. He had never found, in the bones of people who had died of lead poisoning, proportions so high as the highest found in normal cases.

MR. C. S. ROBINSON commented on the vastly increased responsibilities thrown upon those managing chemical works and the like during the last 25 years. Most of the works of his firm had had a medical service for some years, and they regarded the dental service as an extremely important part of the general medical service. There seemed to be still a strong feeling on the part of the workers against medical examination, presumably by reason of a feeling that the relatively unfit would be denied employment. They had still to be educated to the view that the medical examination of all workers entering industry was to their benefit.

MR. W. H. CADMAN referred to the dermatitis which had been common among paraffin shed workers in connection with petroleum refining, and said the precautionary measures were regular medical inspection, baths (in connection with which a great deal of attention had been paid to the use of non-irritating soap, and the rubbing of prophylactic ointment on exposed places before the men commenced work, the ointment being made up of olive oil and lanoline), and the removal of the susceptible men to other duties, temporarily in slight cases, or permanently in more severe cases. Special precautions were necessary in the handling of ethyl spirit by reason of the toxicity of ethyl compounds. Only selected men were employed in the distribution of it, and they were regularly medically examined. The blending apparatus was kept out of doors, in open sheds, and in the course of blending neither ethyl nor ethyl spirit came into contact with the blenders' skin. Under rigorously hygienic conditions, it should be considered that no major reason could be offered against the use of tetra-ethyl lead until a replacement

product was found which, to the same anti-detonant qualities, added the advantage of less toxicity. Mr. Cadman added that efforts were being made, with considerable success, to find a substitute. "Poly" dope was coming into the picture; the polymerisation of the refinery gases, the higher hydrocarbons, such as propane, butane, and so forth, into motor spirit, which had very high anti-knock properties, was being developed, and the day was not far distant when every refinery throughout the world would have a polymerisation plant as part of its normal refinery equipment, to convert what were hitherto more or less useless gases into very suitable substitutes for tetra-ethyl lead.

Prevention of Disease

MR. W. CARROTT referred to a hygienic and cheap respirator, which had been developed by the lead industry, and which was effective and easy to wear. It consisted of a plain piece of muslin tied across the face with tapes, there being inside the muslin a piece of gauze-covered cotton wool, $\frac{3}{8}$ in. to $\frac{1}{2}$ in. thick, which acted as a perfect filter. The gauze was thrown away and replaced by another every time a man took his respirator off, so that it was hygienic and did not become a receptacle for germs or dusts.

On the principle that difficulties which arose in works should be published, so that others might avoid them, Mr. Carrott mentioned an occasion on which dust from a refining pot, containing metallic oxides, was watered down in compliance with the Factory Acts, and arseniuretted hydrogen was produced, which had affected two men. Probably at that time nobody had suspected the presence of arsenic in the material, and even if they had they would probably not have thought that it would decompose and produce arseniuretted hydrogen by reason of the water used. Means had been provided to overcome the trouble, of course.

Finally, Mr. Carrott emphasised that although some industrialists regarded factory inspectors as people who should be kept off the premises as much as possible, his own experience had been that it was best to ask the advice of an inspector if trouble occurred.

MR. E. EVANS JONES said he had watched the disappearance of one or two of the diseases which had been common in the oil refining industry in earlier days. One of those was the troublesome dermatitis known as paraffin plux among operators in the paraffin sheds, and the only cure for it was personal cleanliness. In modern refineries in this country bathing facilities were splendid. Palm oil and lanoline was being used, and the men changed their underclothes and top clothes frequently.

He had found, when dealing with certain oils, that it was difficult to remove carcinogeneity (as indicated by specific refraction) by treatment with sulphuric acid, and solvent extraction (as indicated by specific refraction) appeared to be a more efficient method of removing carcinogeneity. He asked whether there were statistics indicating whether cancer had been reduced in cotton spinning.

MR. ALLAN J. HOLDEN pointed out that chemical manufacturers were generally aware of the toxic properties of their products, and they took reasonable precautions, but considerable difficulties sometimes arose from the attitude of the users. The main trouble arose with the small user rather than the large user. Sometimes small users would not take precautions with regard to solvents, for instance, and the problem of imposing regulations concerning their use had been considered seriously. The manufacturers were trying to educate users, therefore, by drawing up a pamphlet of simple precautions for users of chemical solvents, which precautions the Home Office Inspectors would try to impress upon users.

With regard to the education of chemists in the making, he said the Association of British Chemical Manufacturers had a set of model safety rules for use in chemical works, drawn up in conjunction with the Factory Department of the Home Office; there was also a set of safety circulars and a safety summary, which collected monthly and quarterly items of interest from the technical point of view in connection with chemical processes, accidents, &c. They were available to chemical teaching establishments on special terms.

Over and over again in the past accidents had occurred because people had plunged into new processes without a knowledge of the properties of the materials they used, and without making any attempt to find out. He urged that those who were adopting new processes and using new materials should make some attempt to consult the literature, or, perhaps better still, to consult men such as Dr. Hunter or Dr. Collier of Birmingham, to find out what was known about those materials. If that course had been adopted, dioxan poisoning would probably not have arisen.

Books on Industrial Toxicology

DR. HUNTER, replying to the discussion, said there were some medical books containing extensive bibliographies, which might be of considerable help to those in industry who were safeguarding health. One of the best books on industrial toxicology was written by Prof. Alice Hamilton, of Harvard University, published by Messrs. MacMillan. Sir Thomas Legge had written a book on "Industrial Maladies," but it had not a very big bibliography. Dr. Hunter added that some of his own lectures on the subject had been reprinted under the title "Occupational Diseases," which contained a very extensive bibliography.

Replying to the President, he said the effects of picric acid were local; picric acid did not attack the tissues of the body and had not caused toxic jaundice.

In reply to Dr. Roche Lynch, he said that the creosote which had been referred to as having given rise to cancer in a man who was continually using it was coal tar creosote and not wood creosote.

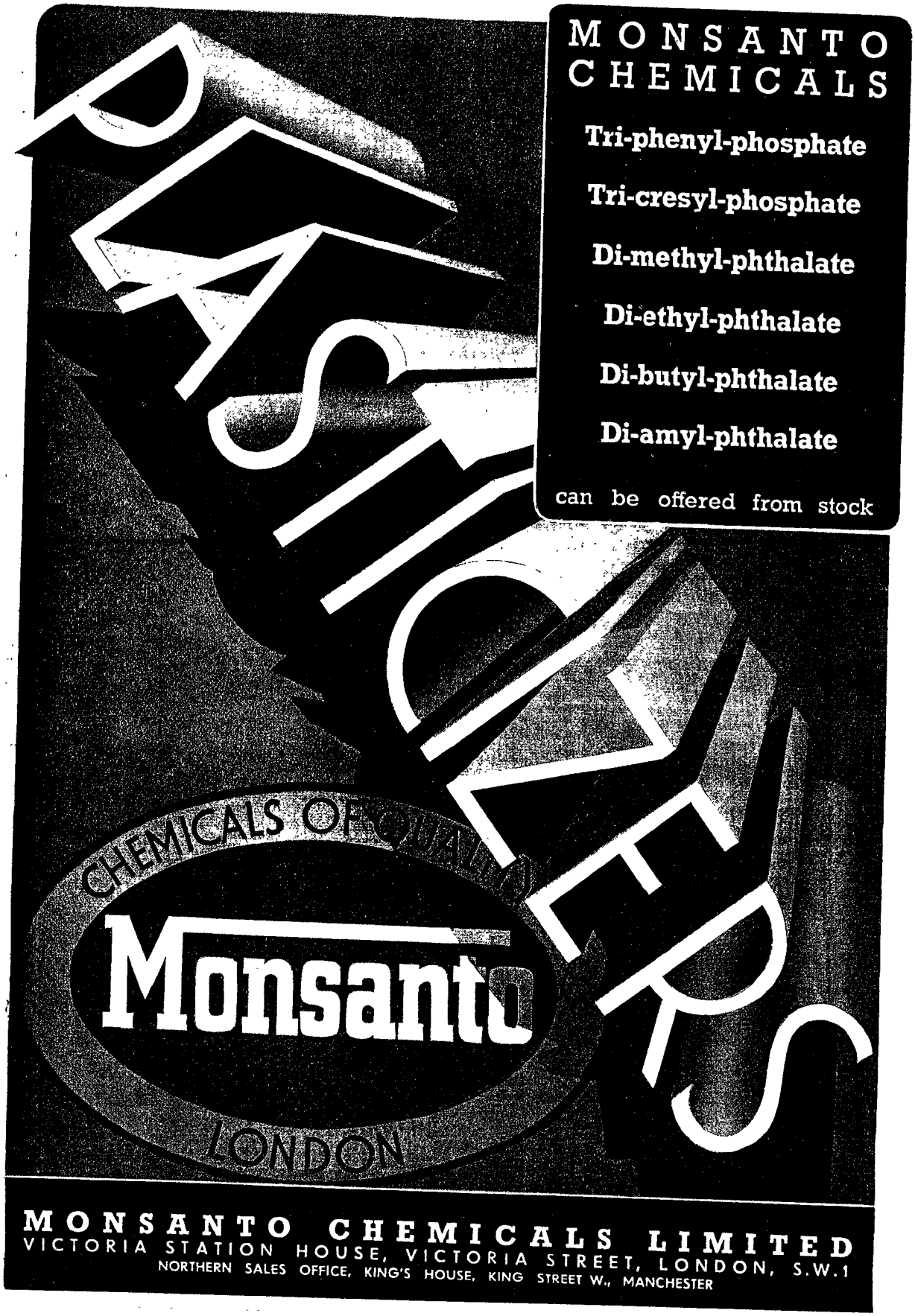
Whilst he had referred in print to the marvellous work of the Home Office Inspectors, it was unfortunate that, as Civil Servants, their lips were sealed; it was absurd. They ought to go to medical schools and meetings, and say what they knew; they were full of knowledge of the subject.

With regard to dusts, he said that the cleaning of carding machines in the cotton industry resulted in asthma. Bone meal grinding could not cause silicosis, but it might cause asthma. One could not but regard silicates and silica as absolutely deadly as compared with calcium rocks and organic dusts from animals and plants.

So far doctors could not select men who would be non-susceptible to lead poisoning, &c., but they felt that research would at some time enable them to do so; the ability to do that would be a great boon. Wrist drop was due to lead being inhaled and getting into the blood stream.

The trouble with cancer was that there was latent period of 10, 12, 15 or perhaps 20 or 25 years, and carcinogenic substances might not have obvious effect until such a period had elapsed. He counselled the greatest care in their use.

Finally, Dr. Hunter emphasised the necessity for publishing facts with regard to industrial diseases and the steps that might be taken to avoid them.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