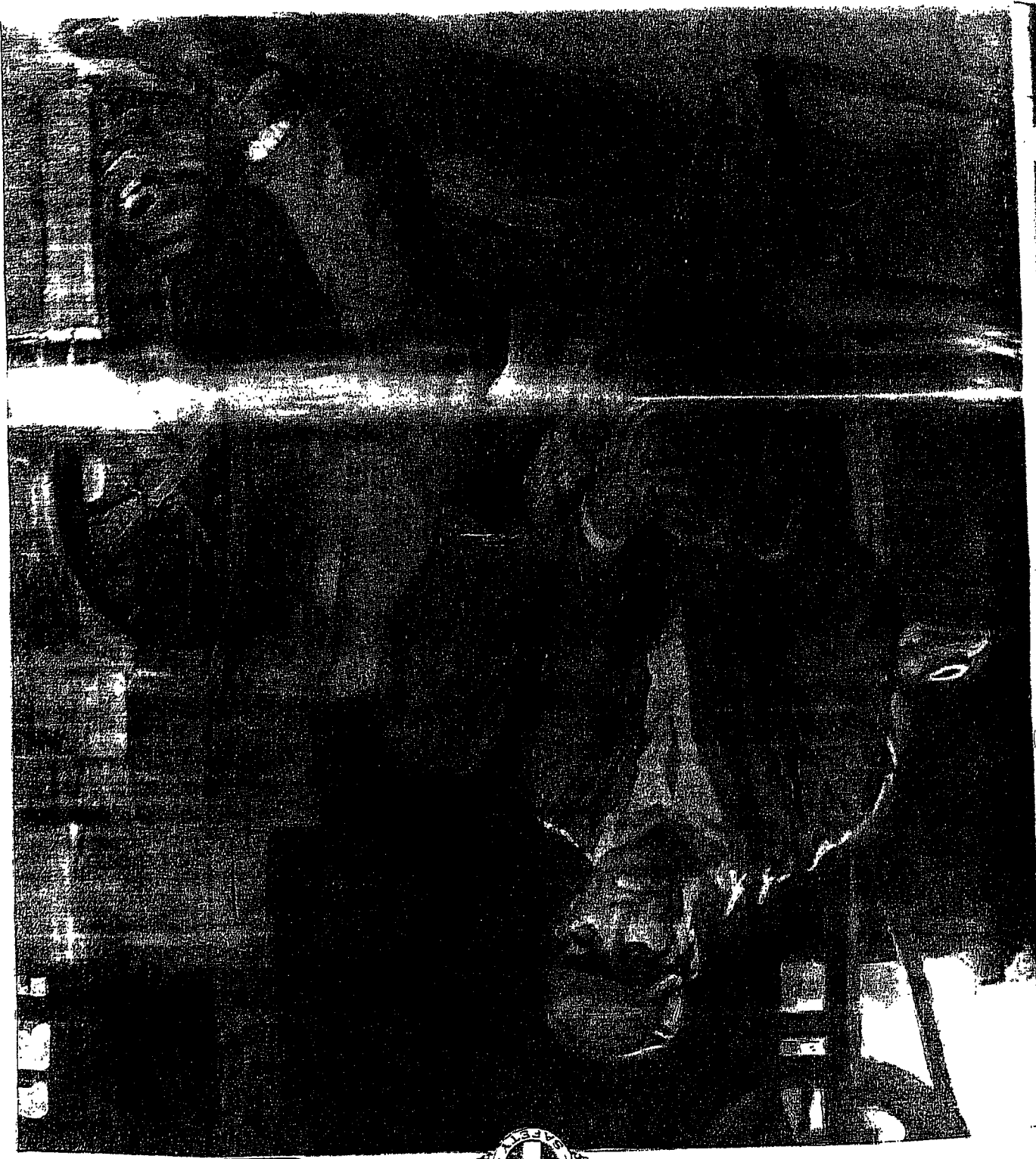


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painters and electric storage battery makers, and Dr. Hoffman's statistical studies show that in the period 1914-24 nearly 53 per cent of the deaths caused by lead poisoning were among painters. Of 920 cases of lead poisoning in New York, approximately 50 per cent were among storage battery makers. Although the statistical reports are not entirely accurate there is every reason to believe them to be more accurate at present than ever before, and comparatively they show a decrease in some forms of lead poisoning.

Importance of the Benzol Hazard

Benzol as an industrial hazard has during recent years been receiving increasing attention. The importance of benzol as an industrial hazard was the subject of a three year investigation by the National Safety Council. In this study the laboratory was again taken out into the field and the nature, extent and severity of poisoning by this substance was determined, as well as the toxic quantities of material involved. The study showed that persons who were subjected to the inhalation of over 100 parts of benzol per million parts of air might be expected to come down in time with benzol poisoning, that this poisoning could be ascertained in its earliest stages by means of the examination of the blood as indicated by a leucopenia with a decrease in the percentage of polymorphonuclear leucocytes and an increase in the percentage of lymphocytes. It was found by animal study that the higher homologues of benzene,—toluol, xylol, may be used with a great degree of impunity. The use of benzol in industry is only justified where it becomes absolutely impossible to conduct the industrial process without it and then only under the supervision of the plant physician. To the plant physician should be entrusted the complete care of the workers and his judgment based on blood studies should be the sole guiding factor in deciding whether or not the worker should continue at his appointed task.

The hazards associated with the process of spray coating have also received much attention, Dr. Smyth, whose experience with this process is greater than that of any other investigator in this country, carried on the study made for the Department of Labor and Industry and the study made for the National Safety Council. There is no doubt that the use of the spray gun with lead paints and benzol containing materials may constitute a very real industrial health hazard. In the case of the application of vitreous enamels to cast iron or sheet metal, a silicosis hazard may exist unless adequate precautions are taken for the

suppression of dust. These adequate precautions must be conscientiously taken if the worker is to be protected.

In the control of the industrial poison hazard the plant physician must play a large part, as well as the hygienist and safety expert. In general, there are three lines along which we may proceed in the control of the industrial poison hazard. It seems obvious that the first of these must be such means as may be introduced for the control of the spread of the toxic material in the atmosphere of the workroom. Where the material is in the form of dust or fumes, the mechanical enclosure of the process constitutes a very satisfactory procedure. Exhaust ventilation may be introduced for the removal and collection of the toxic agent. And lastly, where it is impossible to remove the substance by means at our disposal the possibility of the protection of the worker by surrounding his nasopharynx with a mask or respirator may be worthy of consideration.

The recent studies of Dr. Smyth on spray coating have served to make valuable additions to our knowledge concerning the proper ventilation requirements in certain of these hazardous processes. Dr. Smyth's Pennsylvania studies, as well as the National Safety Council studies, indicated that in by far the majority of plants utilizing the spray coating method exhaust velocities were in use which yielded little or no protection. For the proper conduct of spray coating operations, Dr. Smyth's work indicated that the exhaust velocity should lie between 125 and 200 feet per minute. The use of enclosures and the provision of exhaust ventilation may be highly satisfactory procedures if properly designed and properly carried out. In many cases, because of the nature of the work, it is impossible to utilize such means. Masks and respirators have been advocated as offering protection to the worker under these conditions.

Respirators and Gas Masks

In considering masks and respirators, it is well to have a clear picture in one's mind of the possibility of deriving benefit from these appliances. We may divide this equipment into three groups; those appliances which are based merely on the filtration principle; those which provide filtration and absorption; and those which do not depend on either of these but provide a continuous supply of fresh air to the worker.

So far as the possibilities of the first two groups are concerned, the ordinary filtration respirator is valuable possibly only for non-poisonous but irritating dusts. In the case of

poisonous dusts these masks may accumulate such a large amount of the toxic material on their surface that they may actually represent an additional hazard due to this fact. For protection in the case of gases and vapor it becomes necessary to use an absorptive type of mask, such as those provided with a charcoal or silica gel cannister. The drawback to such devices, in addition to their size and cumbersome nature, is that in relatively short periods of time their efficiency is reduced practically to zero.

There remains to discuss but one type of respirator, namely the positive pressure respirator which usually consists of a small mouth and nose covering connected to a source of fresh air under pressure. This type of respirator is effective and, if properly designed, of a practical nature. It is the only type of respirator which the writer feels should be endorsed for continuous use in dangerous atmospheres.

The Second Line of Defense

Assuming that industry must continue to use hazardous materials, and assuming that mechanical and personal safeguards have been provided for the worker's protection, we arrive at the second real means of defence against serious poisoning, namely the systematic and regular examination of the worker, coupled with the continuous use of elite laboratory tests on the blood and other body fluids. It has been pointed out how in the case of lead and benzol we possess laboratory criteria in the form of blood tests which reveal the existence of early poisoning before serious damage has resulted.

One need hardly emphasize the point further that no worker should be employed in a trade requiring the use of lead or benzol without careful control of the blood by examinations made every two or three months. Anyone who has pursued examinations of poisoning in industry can recall numerous instances in which men have become poisoned simply because the employer failed to provide the necessary medical assistance before the disease arrived at a terminal stage. The recognition by the employer of the value of the physical examination and the repeated study of the condition of the worker at stated intervals is one of the most important steps which must be made before industrial disease shall become obsolete.

There is but one immediate and complete solution of the industrial poison problem, and that is the complete elimination of poisonous materials in industry. The committees on benzol and spray coating of the Na-

tional Safety Council, realizing this fact, concluded:

We would therefore urge that the serious attention of manufacturers now using benzol should be given to the possibility of substituting one of these, or other relatively harmless, substances wherever the conditions of a given manufacturing process make it possible to do so.

Silica Dust a Very Old Hazard

The third type of hazard which concerns the industrial worker is that of silicosis or fibrosis of the lung produced by silica dust. Thackrah said that the affections of the lung and air tube induced by industry are the most urgent of maladies which result from our employments. Over 100 years ago he pointed out that the fork grinders of Sheffield who used the dry grinding stone suffered higher mortality than the table knife grinders who worked on wet stones. Reference may be made to studies conducted in an ax factory in Connecticut where the death rate from tuberculosis for a period of 20 years was 1,900 per 100,000 among grinders and polishers and but 160 for the other employees of the same factory. The studies conducted by the Bureau of Labor, and later by the U. S. Public Health Service at Barre, Vermont; by the U. S. Public Health Service at Joplin, Missouri; at Hagerstown, Maryland, in the cement industry; and in certain coal mining districts of the United States, make it quite clear that all types of dust, when present in fairly large quantities, have a real effect in increasing susceptibility to acute respiratory diseases, such as pneumonia and bronchitis.

Under certain circumstances these dusts, and particularly when they are high in free silica content, predispose to a peculiar type of fibrosis which is readily followed by tuberculosis. During the course of his studies in connection with the Pennsylvania Department of Labor and Industry on spray coating, Dr. Smyth became cognizant of the importance of the problem of silicosis brought about by vitreous enameling process, now widely coming into use. It is interesting to note that the National Safety Council study on spray coating disclosed the fact that of the nine workers who were employed for a period of more than three years, two yielded a picture interpreted by the expert who read the plates as being silicosis, and the third as probable silicosis. Three years is a relatively short time in which to develop silicosis, and judged by this, one is justified in assuming that the silicosis hazard in this industry is a real one.

It is impossible here to discuss every one of the problems which play such an important role in the proper conduct of the industrial establishment; but

the problem of ventilation is so important that it cannot be dismissed without some detailed discussion. The interesting and valuable studies of Brundage of the U. S. Public Health Service on "Sickness Among Industrial Employees" indicate that respiratory diseases accounted for 47 per cent of our cases of sickness reported during the five year period in an experience of 130,000 industrial workers. There is little doubt that from the standpoint of the industrial employer respiratory diseases place a very serious burden upon industry. Ventilation studies conducted by the New York Commission on Ventilation some years ago and again repeated last year by the New York Commission on Ventilation and by the writer individually at New Haven, Connecticut, indicate that improper ventilation may be largely responsible for this high incidence of respiratory disease.

From these New York City studies conducted during two successive winters among approximately 5,000 school children it appears that in rooms with an average temperature of 68.5° and mechanical ventilation the amount of absence due to respiratory disease was 18 per cent greater than in ordinary window ventilated rooms kept at an average temperature of 66.5°. There is much evidence to show that an environment not maintained at the proper temperature may, in addition to producing respiratory diseases, also hamper the worker so much that production may be materially reduced. The English tin plate studies have often been cited in an effort to bring out this point. Of late, however, there have been added studies made in the coal mining industry in Great Britain which corroborate these earlier findings. Of all industrial health problems, that of the maintenance of proper atmospheric conditions in the workroom is a most important one, and one which should receive the very careful attention of employers and plant physicians.

Medicine Has Proved Useful

The physician was first employed in industry probably primarily for the purpose of providing first aid in order that compensable accidents might be reduced, and the cost of insurance accordingly made smaller. After the medical department had become a portion of the plant organization for a short time, it demonstrated its field of usefulness and proved of great value in taking care of noncompensable injuries and illnesses. And finally, in the case of those enlightened employers, the medical department soon proved its worth in providing facilities for the routine examination of applicants

at their tasks in the factory. Concerning this very important point, Dr. Mock in his book on Industrial Medicine and Surgery estimates that in 10 major industries at a cost of \$250,000 somewhat over 11,000 applicants were rejected on the basis of physical examinations. Based on the conservative estimation of \$35 as representing the cost of hiring and training a new worker and assuming that these 11,000 workers would soon have been forced to drop out of their positions, the total saving involved would be in the neighborhood of \$400,000.

How Far Should the Physician Go?

One is often confronted with the question as to how far the industrial organization is justified in carrying this work. I believe that there should exist in every organization, a reasonably adequate system of health protection and supervision for the employees of the plant. It would seem as if this conclusion must be forced on one after very little thought. The millowner does not consider operating his mill without hands to take care of machine breakages. The cement mill without a rather complete machine shop would be practically useless. The industrial organization proceeding about its business without the aid of the physician to keep adequate control over the health of the worker is not availing itself of modern means which make for efficiency and economy.

The effects of industry on the health of the worker have long been underestimated. At the present time, for example, we are provided with Boards of Health, both City and State, whose duty it is to safeguard our health, really from each other. We seem to have failed in a measure to recognize the fact that brought together as we are in modern industry for periods of eight to twelve hours a day has brought about certain problems due to this new mode of life. The plant physician and the plant hospital may in the broadest sense serve as a health department for this small city during the workday.

The control of industrial disease does not depend on the factory physician alone. It often happens that early industrial disease goes unrecognized by the family practitioner. It is true that the manifestations of industrial disease may be varied, but it is only at such time as the private practitioner can diagnose industrial diseases that these will be traced back to the industry which contributes them and so help in correction of the conditions. In this way will the private practitioner be fulfilling his duty to the patient and the community to the best of his ability.