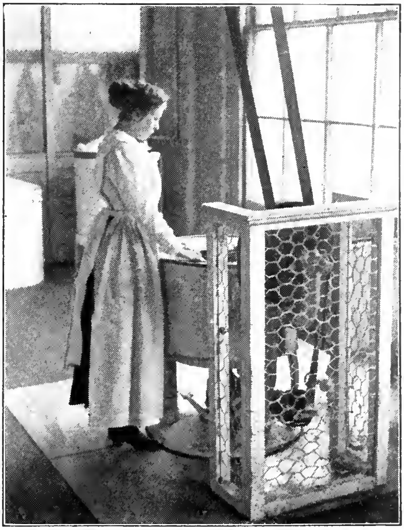
SAFETY

WILLIAM H. TOLMAN

DEVICE FOR ILLUMINATING THRESHOLDS AS ELEVATOR APPROACHES EACH FLOOR AT THE NATIONAL CASH REGISTER COMPANY

MOVABLE SCREEN TO PROTECT OTHER WORKMEN AND PASSERS-BY FROM FLYING CHIPS OF METAL. ALLGEMEINE ELEKTRICITAETS GESELLSCHAFT

HOODED CAPS AND EXHAUSTS FOR PREVENTING WORKERS FROM INHALING DUST. FRIED. BEYER, LEVERKÜSEN



GUARDS OVER BELTS IN LAUNDRY. NATIONAL CASH REGISTER COMPANY

SAFETY

METHODS FOR PREVENTING
OCCUPATIONAL AND OTHER
ACCIDENTS AND DISEASE

BY
WILLIAM H. TOLMAN, PH.D.
DIRECTOR OF
THE AMERICAN MUSEUM OF SAFETY
AND
LEONARD B. KENDALL

ILLUSTRATED

HARPER & BROTHERS PUBLISHERS
NEW YORK AND LONDON
MCMXIII

PRINTED IN THE UNITED STATES OF AMERICA
PUBLISHED JUNE, 1913

E-N

CONTENTS

Part IV

SOCIAL WELFARE

ILLUSTRATIONS

DIAGRAMS

INTRODUCTION

THIS book is the only comprehensive work on safety that has yet appeared in the English language. It is a handbook of practical information for every one interested in industry. It shows how big business can be good business, in surrounding the workers with the adequate safeguards to protect them at work and in promoting the essentials of shop hygiene. Two sentences from President Wilson's inaugural address might be applied here:

"Society must see to it that it does not itself crush or weaken or damage its own constituent parts. The first duty of law is to keep sound the society it serves."

The author has illustrated the underlying principles of the world movement for safety and industrial hygiene by means of typical examples, showing the methods through which simple and practical safeguards are being applied to further these ends. This application has resulted in lowered costs and increased production, with cumulative tendency toward greater knowledge, caution, and self-control on the part of the workers.

While the subject of accident prevention and shop hygiene has been treated in a broad way, the treatment has necessarily been limited to include only those features common to the generality.

This book proves the author's contention that 50 per cent. of industrial accidents are preventable, by examples taken from many sources, among others the prevention work in the shops and plants of the Pennsylvania Railroad Company, the Midvale Steel Works, and the United States Steel Corporation, where the reduction of serious shop accidents last year was 63 per cent., 61 per cent., and 45 per cent. respectively.

From official connection with the great International Expositions of the last decade; as delegate from the United States Government to the International Congresses of Housing, Hygiene, and Demography, Workmen's Insurance and Accident Prevention at Paris, Berlin, Rome, London, Vienna, and Milan; as corresponding member of the Imperial Technological Museum of Vienna and the Illuminating Society of London; as secretary of the American Section of the International Committee for Improved Dwellings, and Chairman of the American Section of the International Committee of Workmen's Insurance, the author has had unusual opportunities for studying these problems at original sources here and abroad. "Every life saved is a national asset" is the philosophy of the wise men in Europe. What they save America often destroys. The sanctity of life is a lesson industrial America must learn.

All unnecessary social waste is one fundamental cause for the increased cost of living, since, in addition to loss of services, it imposes an additional burden on the taxpayer in the increased expenditures of our great city departments of health, charity, education, and police. To-day, through our lack of foresight an army of producers are thrown into the ranks of another great army of consumers, and through their disablement and wage-earning incapacity, are diverting money which ought to go to dividends, profit, increased wages and salaries, into rivers of expenditure for these social and industrial dependents and defectives. Conservation of human life means a credit balance on the ledger of social efficiency.

Dusty trades, industrial poisons, and occupational diseases run the cost of needless deaths and disablement well up into nine figures. This socio-economic waste can be cut in two.

The author is thoroughly familiar with the best shops and plants in all sections of our own country, having studied actual conditions in every industrial state in the Union.

In acknowledging indebtedness it is important to mention that opportunities for utilizing the collections and archives of the American Museum of Safety and the kind co-operation of its president and heads of departments greatly facilitated the work.

In covering the general subject of industrial hygiene the suggestions and notes of Professor Rambousek, of Prague, were of great assistance. Acknowledgment is made to Director Hirschberg of the Allgemeine Elektricitaets Gesellschaft, Berlin, for facts and illustrative material. Dr. Charles A. Doremus and Mr. L. B. Marks very kindly gave the benefit of their revision of the chapters on Chemical Industries and Illumination respectively. In the section devoted to the theory and practice of fire prevention acknowledgment is made to R. H. Newbern, superintendent Insurance Department of the Pennsylvania Railroad Company, for permission to use his valuable papers, "Private Fire Brigades" and "Private Fire Departments and Fire Drills," dealing so exhaustively with these subjects.

The author is particularly indebted to C. L. Close, manager of the Safety, Relief, Sanitation, and Welfare

Bureau of the United States Steel Corporation, for his most generous co-operation in placing the latest technical and photographic material, together with statistical information contained in the archives of his department, at my disposal.

I wish also to thank Miss Adelaide Wood Guthrie for her valuable aid in the preparation of this book and in seeing it through the press.

It is believed that men of affairs, business managers, officers, the upper employees, students who are entering upon industrial careers, and that portion of the public which is interested in the industrial issues of the day, in social welfare, and in broad humanitarian considerations will find a distinctive value in the first general exposition which has been made in the English language of the vital subject of safety.

PART I.

GENERAL CONDITIONS

SAFETY

I

THE PHILOSOPHY OF SAFETY

IT is the general opinion of the engineering profession that one-half the accidents in the United States are preventable, and that a conservative estimate of the annual number of accidents which result fatally or in partial or total incapacity on the part of the worker may be placed at 500,000. Reckoning the wage-earning capacity of the average workman at $500 per annum, we have to consider a social and economic loss of $250,000,000 a year. And these figures, of course, take no account of the many high-salaried professional men and industrialists killed every year in mining, building, transportation, and other fields of industry.

The suffering involved for these injured and the sorrow and hardship inflicted upon the families of the injured or killed are obviously not to be estimated in concrete terms. The humanitarian considerations involved naturally appeal first to every sympathetic mind. If they are not dwelt upon at length in this book it is because its function is like that of the physician or surgeon, to prevent or to relieve suffering as immediately as possible rather than to give time to considerations which are based on sentiment.

Every year we spend enormous sums "conserving the national resources." We are taking care of our trees; we are taking care of our game; we are taking care of our fish; but also every year we lose many times over what we conserve in this way, simply because an army of wage-earners are allowed to become a charge on charity for no other reason than that we do not seem to consider it worth while to take care of the very foundation of the nation—the working-man and his family.

World-wide we are known as a nation of wasters. Our fires cost us more; our coal, lumber, and oil waste is more reckless than that of any other country on the face of the globe. But in this last and most vital question of all—the wasted lives of our people—we have been making ourselves ridiculous in the eyes of the world powers.

As a contrast we may turn to the statement of Dr. Zacher, director of the German Imperial Bureau of Statistics.

> One billion marks in wage-earning efficiency annually we conserve for Germany through our sanatoria, museums of safety, convalescent homes, and other forms of social insurance, by which we safeguard the lives and limbs of our workmen and prevent the causes and effects of diseases which would lessen their economic efficiency.

Evidence certainly shows that it would pay us to adopt those safeguards, which, for instance, allow Germany to conserve annually almost exactly what we throw away.

From an economic standpoint the matter of taking care of the thousands of negligence cases which come to our courts every year for adjustment provides food for thought.

The late presiding justice of the Appellate Division in the First Department, Van Brunt, about ten years ago, stated that two-thirds of the time of the courts was taken up in the consideration of negligence cases. To-day that percentage has certainly increased, because the laws have made it much easier for injured workmen to recover against their employers. Also the bar at large, especially throughout the state outside of New York, are more inclined to bring suits for negligence, while there are many specialists actively engaged in this line of litigation.

The annual cost to the taxpayers of New York City alone to-day is several million dollars. An immense sum every year the city of New York must charge to accidents, though not one penny of this is spent with any idea of gaining relief for the victims of the accidents. The average compensation payment is $400, of which the plaintiff's lawyer usually gets one-half.

The cost of maintaining New York's judicial department is only a partial view of the situation resulting from lack of caution and insufficient conservation of our human resources.

The judgments which are entered each year against persons and corporations whom the courts hold responsible for accidents, total into an incredibly large sum, but again this is only one phase of the situation; it takes no account of human suffering.

Nobody knows how great a sum was spent in 1912 for defense in negligence suits. The question naturally presents itself: Where did it go? Generally speaking, our system of accident liability is about as commercially wasteful as could be devised. Besides being unfair, it is unbusinesslike. It requires the employer to defend and try to defeat, or at least to limit, exorbitant demands made in negligence suits; and it almost inevitably entails the injured worker getting less and the employer paying more than he should, while the expense of all the inevitable litigation falls in taxes on the general public. This may be minimized where a system of "workmen's compensation" is substituted for "employers' liability," but until that is accomplished and during the change from one system to another the burden upon the taxpayers will continue.

Japan in the Russo-Japanese war, by careful preparation and organization and the application of practical sanitary measures through a fully equipped and empowered medical department, reduced the mortality in her forces by more than 80 per cent.

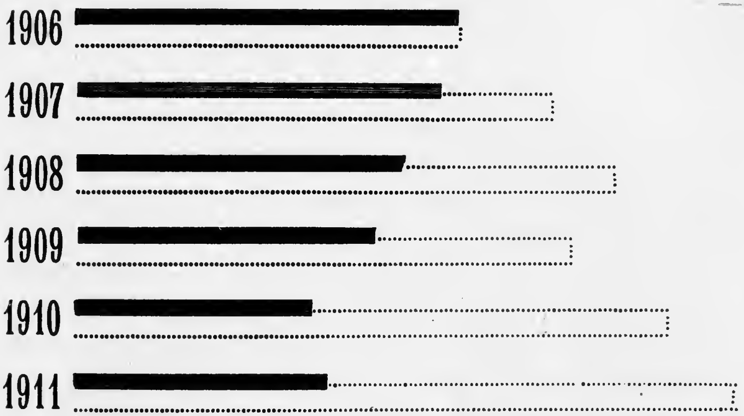
So in the struggles and contests of business it is perfectly possible for our industrialists to reduce materially their accident and sick list, and some of them have been notably successful in doing so. In 1911, for instance, the Pennsylvania Railroad reduced the serious accidents to their 33,000 shop men 63 per cent. over the previous year.

Considering that every wage-earning life is an economic asset of the country at large, to say nothing of the human suffering, it becomes apparent that whenever a life is lost or a person taken from the rank of workers there must be a corresponding increase in cost of maintenance for the remainder of the population. Thus, the manufacturer who finds that he has lost money in the compensation of injured workmen, in the reduction of operating time, and in the loss of certain salable output, charges it to the cost of production; and it is the consumer who pays the bill.

In this economic waste may be found one basic cause for the increased cost of living, for every year an army of producers are incapacitated and reduced to the rank of consumers, imposing an ever-increasing burden upon

UNITED STATES STEEL CORPORATION

CHART SHOWING COMPARATIVE STATEMENT OF ACCIDENTS AND RELIEF—1906 TO 1911, INCLUSIVE



Heavy line shows reduction in serious and fatal accidents, using 1906 as a basis.

Dotted line shows increase in total casualty expenses per employee, using 1906 as a basis (not including amount spent for safety).

The slight increase of serious and fatal accidents in 1911 over 1910 is due to a change in classification of accidents, established January 1, 1911, resulting in more accidents being classed as serious than formerly were so classed.

The fatal accidents in 1911 were 27.27 per cent less than in 1910.

society in general, to say nothing of that upon the city departments of health, charity, and police.

In 1910 Germany compensated 5,704,429 cases of sickness, equivalent to 113,459,544 days of incapacity for work. Through her economic forethought in recognizing that the non-impairment of the efficiency and productivity of her wage-earners is her greatest civic and social asset Germany has cut in half her accident and sick cases.

The population of the United States is about one-third greater than that of Germany. In our country there has been no concerted effort to reduce accidents and sickness, but on the basis of Germany's statistics we can reasonably assume that the days lost to our workmen through sickness and incapacity for work would be twice that of Germany, or 226,919,088. Reckoning $1.50 as an average day's wage, the annual loss in wage-earning efficiency may thus be conservatively estimated at $300,000,000.

With the need for safety and caution in the fields of labor, and hygiene made a part of the education of our children, the next generation of citizens should be able to turn this stream of wastefulness into channels of increased dividends, salaries, and wages. A barrier against the rising tide of this wastefulness in our national life, is the consciousness that gives the worker a feeling of proper protection. Safety relieves the tension, prevents accidents, maintains health, and is an economy for the employer, for, in addition to removing cause for damage suits or the loss of skilled employees, the output of the plant is increased.

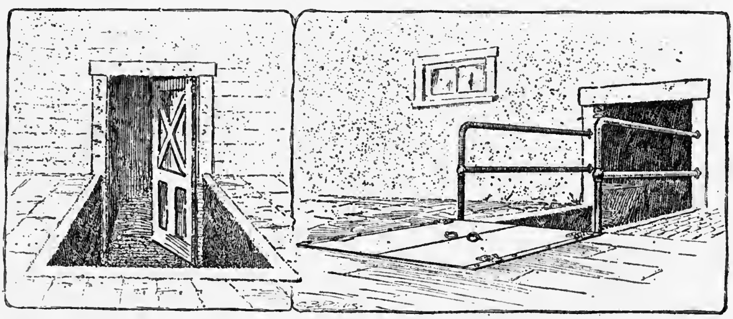
A large number of industrialists have been quick to see this, but there are still many whose outlook is yet not capable of grasping anything beyond the first, comparatively trivial, expense entailed by proper precautions for safety.

In short, one of the most important phases of our future development is the work of creating an inexpensive, efficient hand-rail at the top of our industrial precipice to take the place of the unreliable and expensive ambulance at the bottom.

A recent case brought to light how one manufacturer, even after the inspector's report had been received, left a floor pit uncovered. Shortly afterward a workman fell into it and received $15,000 damages. Literally, a wooden hand-rail at the top of this precipice would have cost \$5—the ambulance cost \$15,000.

Europe, generally speaking, has removed that constant feeling of dread which hung over every workman and made him realize it was only his daily earning capacity which kept himself and his family from starvation. Each wage-earner has been made of more worth to himself, to his employer, and to his community.

In direct contrast is the position of the American workman. His only possession is his daily labor; and he knows it. The grim specter Want stands forever



DANGER IN THE UNGUARDED OPENING; SAFETY ON ACCOUNT OF IRON RAILING

nudging his elbow, while he is made to gamble his all against death or injury. And the result is that he is working at a tension which inevitably exacts its toll in lowered operating efficiency.

In all the talk of "efficiency" which is flooding the country experts overlook the human element. Efficiency which concerns itself merely with speeding up the man, so as to approximate the precision of the machine, requiring one motion where he made two before, will more and more tend to make the man of not much more value than the cog on the wheel. This attitude toward efficiency cannot fail to devitalize and de-energize the man, making him less valuable to himself and to his employer. Overstrain and overspeeding can be shown to raise many undesirable conditions among employees. Chief of these is the creation of a desire for stimulants, which inevitably leads to impaired health, less usefulness to the employer, and tendency toward a corrupting influence on fellow-workers. True efficiency must rest on accident prevention, improved hygiene, and mutuality.

Any efficiency movement which is not based on the sense of security due to a thorough system of accident prevention, the maintenance of health through sanitary conditions of work, and mutuality, or those reciprocal relations of good-will which must obtain between capital and labor, or any industrial system which ignores these fundamentals is foredoomed to failure.

Some one has said that the principal progress of the present century will be in making the policy of "prevention" take the place of "compensation"—namely, the prevention of disease by sanitation, the prevention of unrest and extreme poverty by advances in social science, and of industrial accidents by the elimination of unnecessary hazards in the field of labor.

This is a time of intense competition. Organizations advance or hold their own only through the most rigid conservation of their energies and resources, the most active co-operation between employer and employee, and the wisest guidance of their executives.

Waste in any form is a drag. It gnaws steadily into the credit side of the ledger. Loss of life, injury, or even the temporary illness of an employee is waste—dollars lost not merely from the minor viewpoint of the pay-roll, but from the much more important side of co-operation and public opinion.

It is certain that the general efficiency of any business is at a higher standard when the employees feel that their lives, their health, and their interests are matters of importance to the management than when this feeling is absent. As to public opinion, it must be remembered that in this day the good opinion of the general public represents a tangible asset—something which may be measured and placed on a dollars-and-cents basis, as when it is sought through the advertising pages of periodicals and paid for in sums ranging from a few hundred up to one million dollars cash annually. And this good opinion, so hard to gain, is easily lost.

In seeking illustrations of national movements for lessening industrial accidents the field of selection is practically limited to Germany. If now our industrialists are wise they can avail themselves of the principles of paternal and aristocratic efficient direction by setting forth again and again in simple language to the millions of democracy the clean-cut issues of wage-earning conservation.

Every German employer—and to-day there are upward of 725,000 individuals and corporations—must belong to the trade association of the business in which he is engaged. His accident premium is the sum he pays his trade association to insure his workmen's safety, and is based on the amount of his pay-roll and the risk of his business. All occupations are divided into danger classes, the premium on each class being fixed by means of a "danger tariff" based on twenty-six years of experience of the respective trades.

Every German employer knows only too well how searchingly any accident will be investigated; how almost the first question asked will be "Was there a proper safeguard provided?" And how, if blame attaches to him, he will be heavily fined for the compensation payment which his associates in the same trade must make for his carelessness.

It is impossible to estimate the number of casualties which have been prevented by the many small and comparatively simple safety arrangements. The durability of these devices soon recoups the employer for any initial expense; but, what is of far more worth, his accident premium grows constantly less on account of the lowered risk.

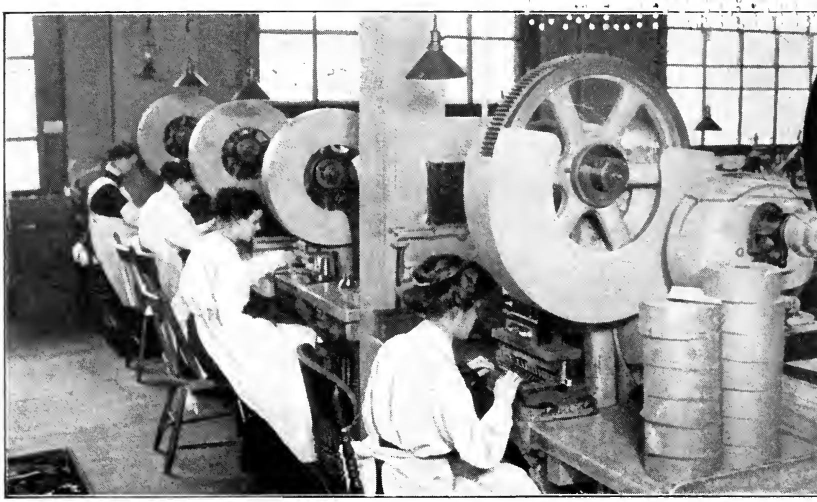
However, in Germany, almost to the same degree as in America, the unwillingness of workmen to use safety devices is encountered. But when the expense of any accident falls on the employers through their respective associations they see to it that their workmen use the safety devices provided whether they want to or not.

France and Italy both yield helpful suggestions in the organization in each country of associations of employers for the prevention of accidents. Their objects are:

First, a prevention of accidents in the use of machines, in physical or chemical operations, and in the various shops where structural work is done.

Secondly, to seek the most effective means of tabulating the experience of members and placing it, for instant reference, at the disposal of others; such as the periodical inspection of factories and workshops, communicating efficient methods of protecting workmen, indicating the best rules for their regulation, and by publications explaining the law and its operation on industrial matters.

Thirdly, to recompense, by prizes or other awards, those who, by the invention of appliances, processes, or by the practical application of any device in their own factory, have contributed to the lessening of accidents or the best sanitation of their plants.



GEARS ON SMALL PUNCH-PRESSES WELL GUARDED AT THE NATIONAL CASH REGISTER COMPANY

INDIVIDUAL EXHAUSTS FOR POWDERY SUBSTANCES AT THE SIEMENS-SCHUCKERT WORKS

The chief advantages of membership in these associations are oftentimes the means of reducing one-half the industrial accidents, promoting the security of workers and tranquillity for the proprietor, the creation in favor of the employer of presumptive evidence that his caution and foresight will tend to a more favorable consideration of any accident case when brought into court, also progressive lowering of accident-insurance premiums resulting from the lessened risk of accidents. Pamphlets on special trades have passed through several editions. Frequently issued circulars inform members of the text of new laws, with observations and conclusions of the legal committee on the law in question. The associations also furnish to members posters for use in workrooms regarding the use of dangerous machinery, with precautionary measures.

Attending with the marked success in the advancement of the science of the industry are the furtherance of reciprocal relations, an increased respect and good-will between the two great wings of the industrial army, capital and labor.

In pointing out the excellent results of the close co-operation between capital and labor Dr. Kaufmann, president of the Imperial Insurance, in his speech in 1909, on the occasion of the twenty-fifth anniversary of workmen's insurance in Germany, said:

> Our German employers have proved worthy of our trust. They have willingly borne the burden of accident insurance; and, what is far more important, have given time and personal attention to this cause, in spite of the overwhelming demands of a tremendous commercial expansion, rightly judging that not money alone, but a broad humanitarian interest must be the basis of such a work.
>
> The result has been of incalculable benefit to the employee, in stimulating the employer to found benevolent institutions and to establish measures for the protection and advancement of employees.

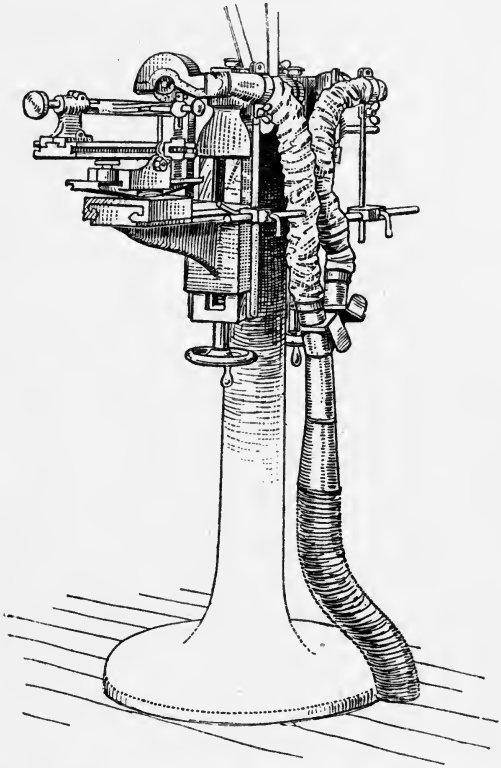
It is always the greatest blessing of a good deed that it opens up a vista of future opportunities.

In this connection I wish to repeat what I have said on many former occasions—to emphasize the political importance of this industrial association. A common meeting-ground and a common work in the trade association have brought employers together, promoting mutual understanding and abolishing prejudices. If the employers from north, east, south, and west are now working together for the common weal, it is the trade association we have to thank for this great German industrial unity.

Our industrialists strive constantly for higher speed, for increased efficiency in the machine, the tool. The whole wealth of our inventive genius has been lavished without stint on perfecting the mechanical side of labor, with little or no thought of its humanitarian aspect. It can be shown, however, that no country long stands in the front ranks of civilization which does not take as much care of the worker as of the machine itself.

In 1893 Holland felt that the time had come to show her employers how they could prevent accidents to workers. A dwelling-house was rented and filled with actual devices, models and photographs, showing how to protect the dangerous parts of machines and processes. To-day the wisdom of that industrial prevision has flowered into the establishment of a new and beautiful building in the city of Amsterdam. It stands diagonally opposite the famous Rjyks Museum.

The same thing occurred in Berlin when, in 1903, a few citizens held a small exhibit of safety devices to arouse public interest. This was the second great advance in the German ideals of social evolution which began under Bismarck. It succeeded so well that the government soon took over all obligations for its enlargement and permanent maintenance. At the present time this museum stands the finest of its kind in the



METAL GUARD FOR CUTTER; EXHAUST FOR GRINDING DUST

world. Yet Germany, seeing the incalculable benefits that were being constantly derived from this source, has established a second museum in Munich, a third is under way in Dresden, and to-day the problem in Germany is solved.

The only agency for safety definitely patronized by our government is the Labor Department, but this department, of necessity, operates within a limited sphere and with limited means, entirely disproportioned to the needs of the situation.

The whole scheme of safety must be developed by disinterested bodies of citizens who spend their own time and money freely to establish such institutions as the American Museum of Safety. The municipal government supports museums of art and museums of natural history, and for no other reason than that of self-protection it should help to support a museum of safety.

It now remains for us to discuss the second sphere of human conservation—namely, health. It is not enough to protect the worker's life and limbs through the prevention of mechanical accidents. His health must be maintained so that he can do his full share in swelling the output.

The hygienic elevation of the masses comes within the scope of federal, state, and city aid, but these directing forces of political and social life are almost powerless to control the sanitary habits of individuals. Education by demonstration and persuasion is the work of a museum of safety or other form of associated effort among industrialists.

Industrial hygiene now occupies the same plane of social welfare as general hygiene. Workmen suffering from occupational ailments are also, through lowered vitality, rendered more susceptible to infectious diseases by which the general health of an entire community is sometimes imperiled.

The principles of industrial hygiene are the same as those of hygiene in general. The ventilation, heating, lighting, dust removal, and water-supply in foundry, mill, and workshop should receive the same care and consideration as in the most sanitary dwelling.

Impure water may not always produce typhoid, but almost invariably does produce stomach and bowel disorders. Typhoid at once removes the man from the pay-roll, and another takes his place; indisposition of a day or two, half a day, or even an hour with no one taking the place of the absentee means smaller output from the same pay-roll.

As an illustration of attention to details in securing the continuous services of its workmen the National Tube Company of the United States Steel Corporation may be cited. At an expense of several thousand dollars they installed a refrigerating plant so that the drinking-water throughout the rolling-mills and other parts of the plant might be maintained at an even temperature the year round. While it proved a good investment at all times, its benefit was most pronounced in the summer, when the water kept a "spring" temperature of about 48 degrees. Last summer hardly a man was absent from work on account of stomach or bowel troubles.

There is, of course, always a direct connection between disease and impure water. A Philadelphia employer installed a sterilizing apparatus for water at a cost of \$1,500. He states that each year it has saved him \$2,000. Previous to its installation the average daily absence was sixteen, which afterward was reduced to only two. In computing the saving the quicker release of money tied up in process of manufacture, rental of floor space, charges to tools, and increased output were reckoned.

There is an increasing number of industrialists who are realizing the importance of information for promoting improved hygiene along economic lines, but there is still a larger number of works' managers who are ignorant of what hygiene engineering would accomplish for them in their own field.

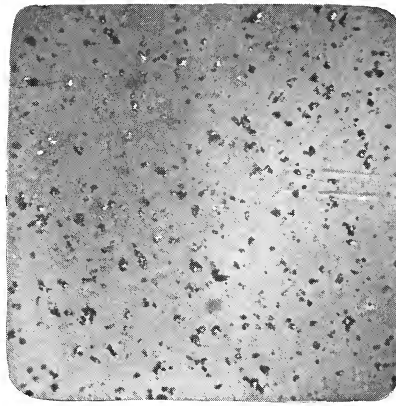
Unsanitary workrooms have an economic bearing on the output of a plant. Sanitary conditions mean that the employer has the continuous service which results in the fullest co-operation. The small outlay for accident prevention and better health conditions is always very quickly made up by the lessened charges for accident compensation and payments for sick benefits. The larger industries have their own laboratories for testing the noxious qualities of substances and for new investigations. But for the thousands of smaller plants an organization like a museum of safety is a necessity, for only from such a source may this specialized knowledge be secured.

In industry there are certain occupational diseases and dangers not met with in other callings and professions; among these may be mentioned the dangers to health due to industrial poisons, such as lead, antimony, mercury, phosphorus, etc., and to the animal, vegetable, fiber, mineral, and metal dusts encountered in the various trades.

Occupational diseases have been recognized for a long while, but scientific research as to their causes and effects is a recent activity. The fund of knowledge so far acquired has been the basis for much legislation. Social hygiene in its newer development is constantly evoking new facts, thanks to the diffusion of technical knowledge and the rise of new industries.

Concrete illustration of this is offered in the improved sanitation of wood-working shops by means of systems for exhausting the dust arising from machines. This is comparatively new. The Germans having recently

SPECIMEN OF SANDSTONE FROM WORKMAN'S GOGGLES



MAGNIFIED SPECIMEN OF SANDSTONE

TRAVELING EXHIBIT OF THE GERMAN WOODWORKERS' UNION SHOWING OCCUPATIONAL DISEASES DUE TO DUSTS

discovered that certain obscure diseases among wood-workers are due to the noxious qualities of some wood dusts, the dangers have been recognized and the way paved for their elimination. This means also that the inquiry must be pushed back to a study of the environment in which the workman lives—in other words, that which is connoted by the term Social Hygiene.

The prevention of occupational diseases is not merely a social duty, the duty of every man toward his brother man. Economic consideration and the world's competitive struggle make it imperative that the health and strength of our wage-earners be maintained at the highest point of efficiency for the maximum period. Those familiar with the subject of industrial hygiene recognize the value of healthy, skilled workers. The means used to promote the health of workers, therefore, are worth many times over what they cost the employer in money, time, and thought.

For example, work in foundries and their various branches is generally of a complex nature, and because of this condition vary in different shops and localities.

Of first importance in depriving the management of continuous service at high efficiency are pulmonary and bronchial troubles, tuberculosis in its various forms, diphtheria, hernia, rheumatism, heart and kidney troubles. Then follow burns, bruises, sprains, and internal injuries. Cause for the ailments first mentioned are poorly lighted, ventilated, and heated shops, unsanitary lockers, washing facilities, and water-closets, besides lack of room for drying and changing clothing. Injuries in the second category are generally due to insufficient space, lack of inspection of mechanical devices, and improper footwear in the case of men handling molten metal.

Recently the doctor of the National Cash Register Company, examining a suffering employee, remarked:

"It's a bad case of blood-poisoning, but for the life of me I do not see how it could have happened. This machinist had nothing the matter with him except a slight cut on the hand when I first saw him; but now it looks as though his arm must be amputated."

In some way the chemist of the company learned of the case. "I wonder if the oil had anything to do with it?" he thought, though of course bacteria in oil used on machinery seemed impossible. What was his surprise upon analysis to find the oil swarming with bacteria. As the oil in this plant is used over and over again, it had gradually become infected through impurities that had gathered. It was found also that some of the men had thoughtlessly expectorated into the cans. As a result of this investigation all the oil is now subjected to a degree of heat sufficient to kill any dangerous bacteria, and a known amount of sickness every year is thus eliminated.

In a recent study made by the American Museum of Safety of shop conditions affecting 4,760 molders enrolled in 22 labor-unions, the following conditions were disclosed:

VENTILATION: 56 shops well ventilated, 33 fairly well, 57 poorly.
LIGHTING: 61 shops well lighted, 21 fairly well, 62 poorly.
HEATING: 63 shops well heated, 23 fairly, 58 poorly.
WASHING FACILITIES: 35 shops with sanitary facilities, 3 fair, 107 without sanitary facilities.
LOCKERS: 26 shops with sanitary lockers, 3 fair, 116 shops without sanitary lockers.
TOILETS: 51 shops with sanitary toilets, 3 fair toilets, 76 shops without sanitary toilets.
INSPECTION OF MACHINERY: 61 shops regularly inspected, 59 not regularly inspected.
FLOORS WHEN CASTING: 83 shops with clean floors, 19 fair, 42 bad.

The same facts expressed diagrammatically show:

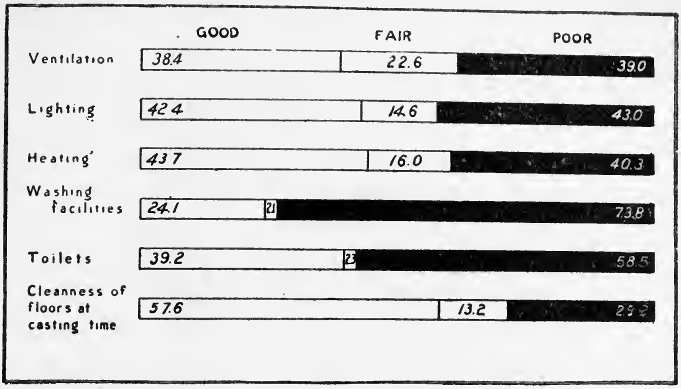


CHART SHOWING GOOD AND BAD WORKING CONDITIONS IN MOLDING SHOPS

Again, in a certain town in New York State the foundries employ some 1,500 men. Only two of these shops are of modern construction, and even in these very much more could be done for the improvement of sanitary conditions. The other shops are low, dark, poorly ventilated, and overcrowded; they are provided with poor hoisting and lifting facilities, very poor toilets, and no washing accommodations. Owing to the excessive strain of rolling and lifting heavy implements, together with the above-mentioned unsanitary conditions, the men are discontented and take no interest in their work. They violate all rules of sanitary decency, bring liquor into the plant, which they drink during working-hours, and abuse and torment their foremen. As a result the output of plants such as these is needlessly restricted.

The foremen are thoroughly aware of these facts, but feel themselves powerless, and so remain indifferent, well knowing that any action which they may take may bring about labor troubles, the responsibility for which they will not assume. These firms not only lose the advantages of the full capacity of their shops, but also considerable loss in trade.

The men, on the other hand, feel that if no one thinks it worth while to give them better working conditions their management will put up with whatever attitude they care to take, or they will get a job elsewhere.

As one workman of the better sort remarked: "Gee! I don't know how long I can stand the work in this shop. There's the biggest gang here of booze-fighters on earth, and you've got to move with the gang or they'll get you!"

In many shops where the piece-work system prevails the men make fairly high wages with a nine-hour day. But the speed required combined with the constant strain and exertion so weakens and exhausts the men mentally and physically that they seek renewed strength or relaxation in alcohol.

From earliest times the soul of man has been striving for expression: the Pyramids, the Parthenon, the Forum, Shakespeare, Wagner, and Morse stand for the outward manifestation of this striving. To-day the sanctity of human life is being materialized in the stone and brick of safety museums, life-saving stations, laboratories for conservation of life and limb, proving grounds for industrialists of the country at large. In these museums every known device which has been proven commercially useful is laid before the public, so that no employer may be subjected to the enormous expense of experimenting with human life to find practical appliances suited to his needs. In this manner identity of interest in the three parties concerned is preserved — namely, the employer, the employee, and the government representing the entire community.

The civilized world now finds itself on the threshold of a great transition, a change which will have its effect upon all fields of labor, from the lighting of a lamp to the running of an express-train, a change from the inadequate and costly compensation to the cheaper and more humane prevention.

If now the United States would escape the reproach of being the only nation that fails to recognize the tremendous question involved in the needless sacrifice of life we must stop and think. No one section, no one group, no one combination of interests can remove the stigma. The awakening must be national.

II

NEGLECTED FACTORS

THAT it is possible for employers to overcome the antagonism of labor-unions was demonstrated by the Carnegie Steel Company, who once were savagely accused of failing to provide safety devices for their operatives. "I'll tell you what I'll do," said the company's superintendent to the representative of the union, "you appoint a committee, and I'll have everything in our plant thrown open to them, if they will come and see for themselves what we are doing to protect our men from accidents." His offer was accepted, and as a result of the inspection the union gave the company a clean bill for accident prevention and apologized for their previous attacks, which they admitted were not based on a knowledge of facts. This policy of "getting together" on disputed questions often promotes better understanding between employers and employees.

Another method is for the employer to present to his employees, through illustrated lectures, the principles of accident prevention and health helps, so that the workers may realize the importance of individual caution, personal hygiene, and self-control.

In 1911 an educational campaign of this very nature was inaugurated by Charles Kirchhoff, chairman of the Iron and Steel Section of the American Museum of Safety. Each lecture was richly illustrated by lantern slides showing safety devices in use in the best iron and steel practice. These conferences were held under the auspices of such companies as the Pennsylvania Steel Company; Wheeling Steel and Iron Company; Whitaker-Glessner Company; La Belle Iron Works; American Bridge Company, Pencoyd; Youngstown Sheet and Tube Company; Republic Iron and Steel Company; Youngstown Steel Company; Cambria Steel Company; Jones and Laughlin Steel Company; Lackawanna Steel Company; National Tube Company; Pennsylvania Railroad.

The audiences ranged from 300 to 2,900 men, in most cases no one under the grade of foreman being present. The lectures have been helpful in showing the management successful safety practice in other plants, while the foremen have been impressed with the simple, practical character of the safeguards and the necessity for greater caution on their own part. All this information is bound to come indirectly to the attention of the various labor organizations, and cannot fail to prove effective.

A contrast to the indifference of American labor organizations, as admitted by some of their leaders, to questions of safety so vitally connected with their own well being is offered by the action of the German Wood Workers' Union, who fine their members for failing to make use of those safeguards which the employer furnishes. In a recent manifesto this German labor-union appealed to its employers, in the name of the members of its craft who have been crippled and maimed by machines, for an increase of inspectors, so that a thorough inspection of all establishments can be made yearly; the employment of inspectors from the rank and file of the workers; better protection for wood-working machines, and strict enforcement of safety provisions; together with heavy and frequent fines for those who break the safety rules.

From the department of factory inspection the union demanded that lectures on safety devices with practical descriptions be given the workmen, and that each inspector should take with him an experienced machine operator familiar with actual conditions. The union did not stop there, but carried its appeal to the lawmakers, asking for an increase of thorough and frequent inspection of all plants; a maximum day for wood-workers of ten hours, with a reduction of hours within a certain period to eight hours, no women workers, or the employment of youths and apprentices under seventeen years of age, on machine work; police power for factory inspectors; courses of instruction on accident prevention and the use of safeguards for the workers.

In a recent trip of inspection from coast to coast, covering fifteen of the largest universities in this country, there was found only one tool in one shop that was protected. No university or school was found that made any provision for safety devices for the dangerous parts of machines and processes, where the students were fitting themselves for technical positions, in which they would be responsible for the safety of workmen under them.

A large standing army is not altogether, as sometimes depicted, an unmixed evil; army service provides that nearly all the adult population sooner or later receives thorough training in discipline and obedience. Consequently, when the Continental workman comes to a "Do." or "Don't" sign in shop or factory his impulse is to obey that order.

Edward Cadbury, in his description of the industrial organization which has justly made this English firm of the Cadburys so well known and successful, lays down as fundamental:

> The supreme principle has been the belief that business efficiency and the welfare of the employees are but different sides of the same problem. Character is an economic asset; and business efficiency depends not merely on the physical condition of employees, but on their general attitude and feeling toward the employer. The test of any scheme of factory organization is the extent to which it creates and and fosters the atmosphere and spirit of co-operation and good-will, without in any sense lessening the loyalty of the worker to his own class and its organizations.

On entering a new place of work it takes some little time for the new-comer to become familiar with conditions and requirements. To that end books of rules and regulations are helpful. Quoting from the introduction to the rule-book of a very successful business in the West:

> The important part of any rule is the spirit of it. This is gained by understanding the wisdom and necessity of the rule, and not by mere obedience because it is a rule. No rule seems hard when you see that it is wise—worked out from experience and made necessary by existing conditions.
>
> The object of a rule is not to abridge the rights of any one, but to point out the path which experience has taught is the wise one to follow. The traveler making his way over unaccustomed roads is grateful for the guide-posts which tell him the way to his destination; he never complains when the sign at the crossing tells him to go the uphill way, for he is glad the sign is there, and obeys cheerfully because he knows he is on the right road.
>
> The aim of these rules is to give to our employees the benefit of long experience, to save them retracing unguided steps, to enable them to grow in the knowledge of sound business principles, and to become a credit to themselves and the house.
>
> Keep close to the Rule-book; follow out the spirit as well as the letter of its advice.

It is often said that even if safety devices are provided workmen will not make use of them. This is true of the man who is not thoughtful of his employer, his fellow-workmen, and his family, and is a characteristic attitude of ignorance and bravado. It is therefore necessary to fix the responsibility, through compulsion, in the use of safety devices. The foreman is generally the responsible head for the workers immediately under him, for he sees that new workmen are instructed in the use of machines to which they are assigned.

As he holds the strategic point in the warfare against accidents, the foreman should be held accountable. A large plant recognizes the wisdom of this procedure and holds the foreman responsible for accidents to his men, whether they are working directly under him or the sub-foreman.

Whenever a man is put at work on a new job where there are special dangers, he should be thoroughly instructed by his foreman and "broken in" by a man familiar with that work.

No man should be put to work on any job until the foreman has inspected everything and satisfied himself that the place is normally safe. If a man violates instructions or takes chances that make him liable to injury, his services should be dispensed with.

A foreman needs to use judgment at all times in placing men on work; heavy, slow men should not be placed on jobs where light, quick men are required; and slow-thinking, unintelligent men should not be put at work on machinery or in places where presence of mind is required, for by so doing the probability of accidents is, of course, increased many times.

It is not good policy to employ a man to whom no one else on the force can talk. Wherever possible, only men of similar nationality should be intrusted with the operation of machines. If an accident does occur, the foreman should at once make a thorough investigation and furnish a report which may prevent its recurrence.

It is always a good plan to watch out for men who are hurt frequently. It is hard to discharge them, but this is better than running the constant risk that their clumsiness will endanger their fellows.

One successful firm constantly reminds the foremen that the management will always take into consideration their interest in the work of protection against injury in its annual review of their work. This often provides the necessary stimulus.

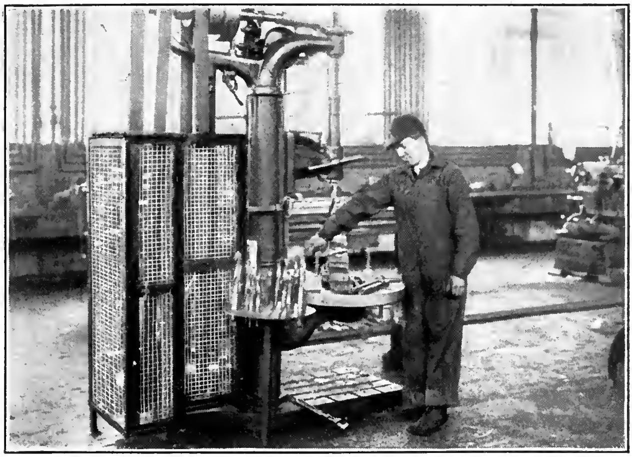
Considering that the whole subject is one in which education will produce better results than compulsion, illustrated lectures, together with "reason - why" talks and leaflets, may be used to advantage in stimulating co-operation from foremen and others along the lines of safety. Some large concerns have adopted a compulsion policy of "discharge the foreman" for failing to compel workmen to use the safeguards provided. While both of these methods have their advantages, it must be remembered that, whatever the policy adopted, much of the opposition encountered in various directions may be counted upon as the opposition received by all innovations. As time goes on it will be looked upon as a matter of course that the use of safety devices and precautionary hygienic measures should be enforced.

While the rule-book of every company fills an important place in an effort to create *esprit de corps*, at the best its appeal cannot help becoming mechanical, resulting in the loss of much of its force. Taking this viewpoint, that the standard rule-book is all right for a foundation, but that there must be created a superstructure of loyalty, sobriety, honesty, and determination on the part of the individual to advance, the Efficiency Suggestion Company, of New York City, has found a successful means of co-operating with the industrialist in this important point, by issuing what might be called guide-posts on the road to a successful career for workers in many different fields.

Perhaps this plan requires a word of explanation. Briefly, the pill of instruction is sugar-coated. Illustrated lectures have been found by employers to be an effective means of stimulating those qualities which they desire to evoke in the employee; but this new plan goes a step farther and presents the often unwillingly received but valuable message carried by a lecture in such form as to attract and arrest the attention upon only one point at a time. This is accomplished by a series of fiction and semi-fiction leaflets, written and illustrated from the view-point of the worker, and which, in the majority of cases, can be counted upon to kindle the enthusiasm necessary to profit by the message which the management wishes to convey.

"In the United States skilled mechanics, all-round workmen, are getting scarcer every day," observed the general manager of a large plant, "and we are at our wit's end to recruit a supply sufficient for our growing needs." The prudent employer still scraps his inefficient machines, but has stopped scrapping his labor. He realizes that there is a limit to the worker's power, varying according to the nature of the work, constitution, personal habits, frame of mind of the individual, and conditions under which the work is performed.

Even in the non-hazardous occupations, if the body and brain are forced to work beyond their natural capacity, if the work is too severe or kept up too long at a time,



SAFEGUARDED DRILL-PRESS IN ONE OF THE OLIVER IRON MINING COMPANY'S SHOPS

THE NATIONAL CASH REGISTER COMPANY CONSERVES THE HEALTH OF ITS WORKERS

making it impossible to get the required amount of rest and recuperation, the vitality becomes weakened, and sickness and disability result just as surely as in those occupations which are considered dangerous to the workers on account of dusts, poisons, and accidents.

Every machine will sooner or later break down if kept constantly at work or pushed constantly to the limits of its energy. In the same way good business management opposes overworking the human machine to physical and mental exhaustion.

Tired muscles and brain can be forced to keep on working after the normal fatigue-point has been reached; but in doing so the toxins in the blood are many times increased, with an always corresponding increase in the risk of seriously injuring the nervous system. This point will always be found to have a direct bearing on the number of accidents or the quality of the output per worker. The normal fatigue-point, as has already been shown, differs with the occupation, the constitution, and the personal habits of the worker.

Reasonable work hours; a proper amount of good fresh air, controlled through a system by which poisonous dust or gases may be drawn off; good lighting, avoiding the fatigue due to eye strain and the resultant danger of accidents; pure drinking-water; where possible, the providing of seats for employees, especially women; a lunch period long enough to allow the workers to relax and to eat the midday meal in comfort — all of these measures applied in the workshop will reduce a large part of the fatigue and weariness now felt by many workers, the importance of which the new industrialism has only just realized.

The practice of allowing a brief recess in the middle of the afternoon, when most workers experience what is called "three-o'clock fatigue," is now being adopted by a few far-sighted employers who realize that the health and vitality of their workers is a large fundamental in the success of the business.

Fuller working efficiency may be expected when the management realizes that every worker does not start with the same physical equipment. Those with weak nervous systems, who become exhausted very quickly, need a greater amount of care, rest, and recuperation from their efforts than those endowed with greater nervous endurance. It pays to make allowance for these characteristics in the assignment of tasks.

In certain occupations a strained position while at work adds to the natural fatigue. Cramped muscles and constriction of the chest result in shallow breathing, which, taken in connection with poor circulation of the blood and other unhealthy conditions, makes some workers more liable to tuberculosis of the lungs—in other words, lessens their efficiency to the employer.

A serious neglected factor is failure on the part of the management to recognize the craving of workmen for the temporary stimulus of alcohol. This may be due to the poorly prepared foods in the homes from which they come, so that a stomachic craving exists, which is temporarily alleviated by alcohol; it may also be due to unsanitary shop conditions, and highly wrought tension due to the pressure and speed of modern industry. The wise capitalist of to-day recognizes excessive alcoholism as a big risk in his business, and that the more he can cut down the consumption of alcohol the less will be his accident rate and the greater the health of his personnel. Where there are large numbers of workers the establishment of a canteen in the working-place has safety value. For example, in 1908 the Allgemeine Elektricitaets Gesellschaft opened a canteen in their factory for the sale of non-intoxicants under the most scientific methods of making palatable and healthful drinks. Coffee, seltzer, lemonade, syrups, and beer were dispensed. The drinks are sold from different stations about the plant, but to avoid confusion in distribution they are brought from a central station. The cost is 2½ cents per bottle. In January, 1909, 5,924 workmen bought 108,130 liters of beer and 37,950 liters of tea, coffee, and soft drinks. Three years later 10,349 workers bought 155,900 liters of alcoholic and 200,785 liters of non-alcoholic beverages, while during the month of September, 1912, 11,982 workers purchased 154,450 liters of alcoholic and 335,604 liters of non-alcoholic drinks. The accidents decreased proportionately.

Alcoholism strikes at the workman in his professional capacity; it renders him less active and skilful and adds to the possibility of accident.

Machinery of to-day exacts from the workman his continual attention, a watchfulness, keen and sure, an ability that calls into play all his faculties. It is necessary that he should enter upon his work with a clear mind and a mastery of himself that he can never have if addicted to the use of strong liquors. It is therefore to the interest of both the chief of the industry and the workman to fight with all possible means against this redoubtable enemy, alcohol. The chief reasons for industrial sobriety are to prevent accidents, to assure a higher grade of work and stricter economy.

The saloon's attraction for the ignorant workman, fatigued by his day's labor, is perhaps the most powerful. He is little prepared to care for intellectual pleasures, and if he were they frequently cost him more than he can afford. The saloon seems to offer him a great deal for a small amount of money, giving him some moments of comfort, happiness, and even gaiety.

The mention of Russia does not perhaps evoke a mental picture of a country striving to lessen the consumption of alcohol, yet such is the case.

Temperance committees form a large part of the great reform undertaken by Russia for lessening the abuse of drink. A monopoly of alcohol regulated the sale of intoxicating liquors, but, while frequently eliminating the old saloon, it suppressed at the same time the only place for social intercourse that existed in a village. It was necessary then to fill this gap by the creation of a series of institutions which would provide instruction and pleasure for the people, at the same time diverting their thoughts from the saloon. Temperance committees, therefore, watch over the sale of alcoholic liquors in order that they may conform to regulations for the health and morality of the population; instruct the people in a knowledge of the dangers from excess in the use of spirituous liquors; furnish opportunities for social pleasures away from saloons by the building of social centers, floating restaurants, tea-houses, and lecture-halls; organize popular festivals and lectures; and establish houses of retreat for drunkards. These committees also lend their assistance to private societies of the same nature, and have, by lessening the use of alcohol, contributed much to the safety and health of the public.

III

THE WORKING-PLACE

CONSIDERING that the great majority of wage-earners spend at least one-third of every twenty-four hours in factory, mill, or shop, the working-place is of prime importance, not only from the viewpoint of the employee, but also from that of the employer.

In many instances conditions are so far from tending to help the worker attain fullest efficiency that not much can be done except in the way of minor improvements. Other cases there are, however, where, by a comparatively small expenditure, changes can easily be effected that will return the cost of the alteration many fold. In the thousands of new industries which are constantly springing up there is, of course, no reason why proper working conditions may not be considered from the very start.

Final orders for the building of any structure where it is intended that a number of people shall carry on their work should never be given until all plans have been gone over carefully by some one competent of judging conditions where they apply to accident prevention, hygiene in its many forms, and the possibility of securing the fullest efficiency from every employee.

This chapter will concern itself with presenting the fundamentals of safety in its widest interpretation in so far as they relate to any place where work is being done.

Detailed features of this subject will appear in Part IV concerning special trades and occupations.

In one large plant where thousands are at work and where men come from many nations seeking a job, a sign in six different languages stares them in the face to drive home the idea of safety at the very outset of their effort to secure employment:

To Men Seeking Employment

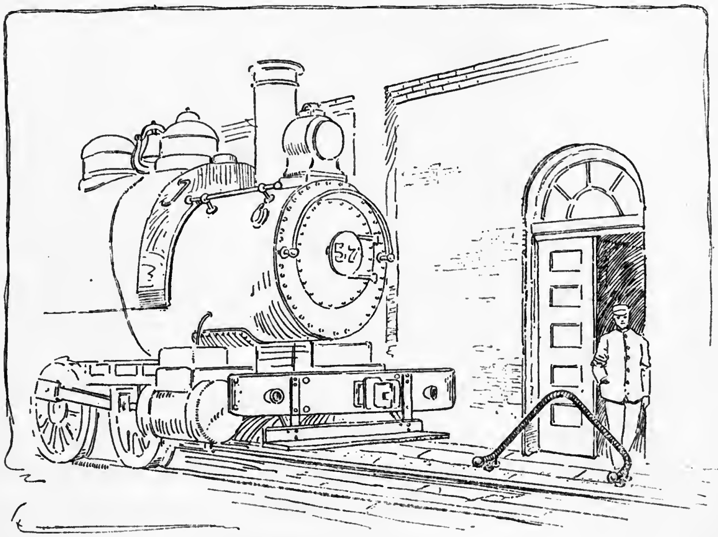
Unless you are willing to be careful to avoid injury to yourself and fellow-workmen, do not ask for employment. We do not want careless men in our employ.

Lest any one forget this obligation of personal caution illuminated signs are placed over the entrance-gateways. By day the letters show white, and at night they are brought out by incandescent lamps. As these signs are painted on a portable sash, they can be moved from one gate to another, so that the same warnings and cautions are never displayed longer than one week. Each sign is shown in six different languages.

While the management strives to make every provision for safety, there is always the possibility that some essential feature may be overlooked. This point is covered by securing chance thoughts from the rank and file of the industrial army. Suggestion boxes are placed at the entrance-gates, with invitations to employees to report at once any defect in the grounds; machinery; manner in which work is being carried on; carelessness of other employees, either in their own or other departments; in fact, anything that in their opinion is dangerous and might result in injury of any kind.

In order that each workman may feel that what he reports is a privileged communication, he is asked to get in touch directly with the superintendent of the department where the fault exists. The objects accomplished in this way are: first, protection for employees; second, co-operation of the best sort; third, prevention of damage to the company's property.

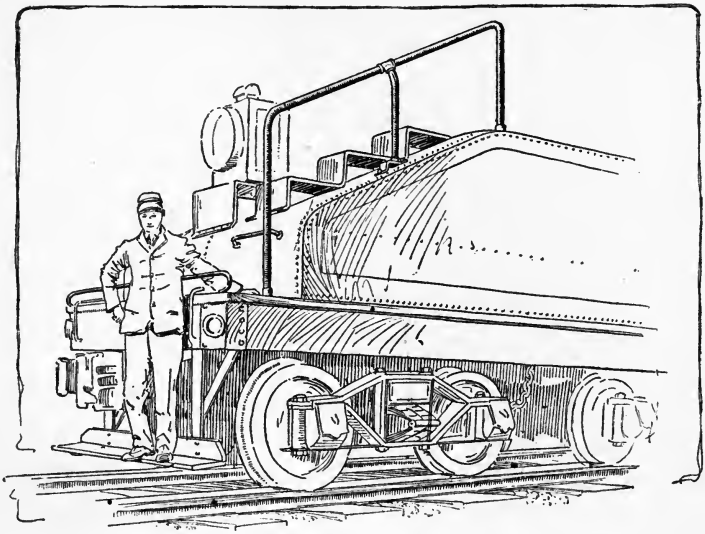
In many yards, where every inch of space is at a premium, traction rails are set to the narrowest possible clearances. Where shop exits give on yards through which trains are passing constantly, warning signs, some-



A REMINDER FOR PERSONAL SAFETY

times painted on the glass of the doors, enforce the need of caution. Sometimes reminders take the form of an iron bar in the shape of an inverted V, which prevents even the most careless from walking in front of an approaching train.

In studying an up-to-date plant the investigation notes viaducts for crossing tracks, so that the men are



SIDE-RAILS AND STEPS FOR THE SWITCHING ENGINE

forced to avoid the constant peril of shifting cars and passing trains. Where viaducts are impossible, tunnels are provided.

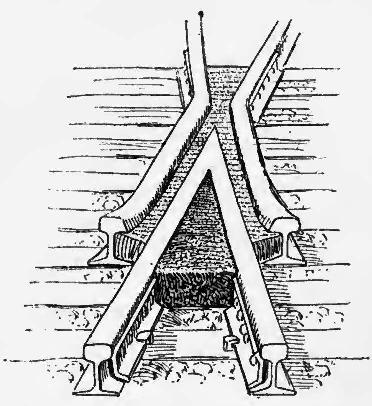
When it is necessary to have tracks crossing the approaches to a yard, and the wooden fence would prevent the engineers from seeing any one coming toward the track, this fence should be replaced by one of wire, which is just as effective, cheaper, and safer. Of course, there should be safety-gates indicated with a red lantern at night wherever the road crosses the track.

Wherever there are vent pipes in the yard, they should be carried to a height sufficient to allow the steam to escape, without any possibility that the engineer's vision may be obscured by vapor. Only too many serious accidents have occurred through neglect of this seemingly trivial point.

Frequently trainmen on the footboard of the switch-engines, desiring to get into the cab or to remove the tank cap when taking water, will climb over the tank rather than get off the engine. Modern practice provides steps and railings over the slope of the tank.

Men are caught in the frog of a switch more frequently than is supposed. Fatalities resulting from this kind of an accident can easily be prevented by means of pieces of skelp-iron fastened securely, making it impossible for any one to get a foot caught in a frog or between the rails.

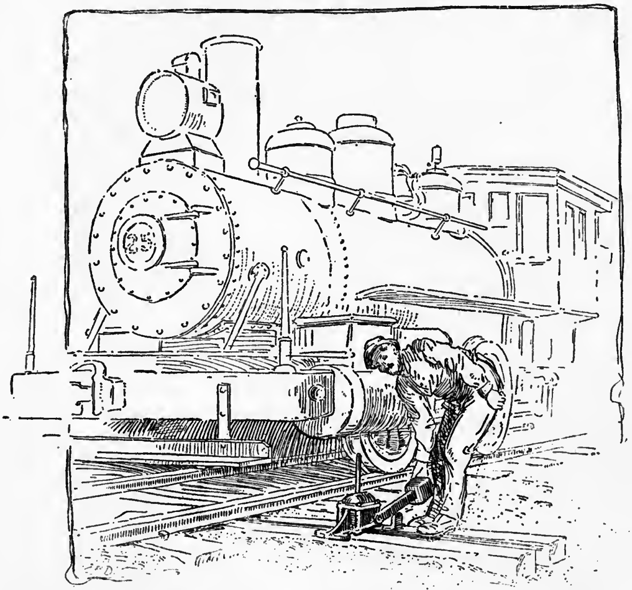
While the practice of making a flying switch is generally prohibited, many men do so. With the old type of switch-throw operating at right angles to the track, the man's body is brought into dangerous proximity to the engine or car; with the switch-throw parallel to the track, as is the case in the yards of the modern plant, the man is not compelled to get in close to the rail, and so remains outside the danger zone.



A SAFETY DEVICE FOR THE FROG OF THE SWITCH

To protect men working on or near cars undergoing repairs, loading or unloading, and also to indicate unsafe tracks, it is well to have signals clamped to the rail. To prevent any one other than the authorized person placing it in position it is padlocked. The lantern shows a light at night, while by day the target disk shows a circle painted red with an outer ring of white.

Sometimes in transferring a load to or from a flat-car by means of hoisting-chain the drag of the load will cause the car to move forward or tilt. Men standing by are liable to have their toes or feet crushed before they really

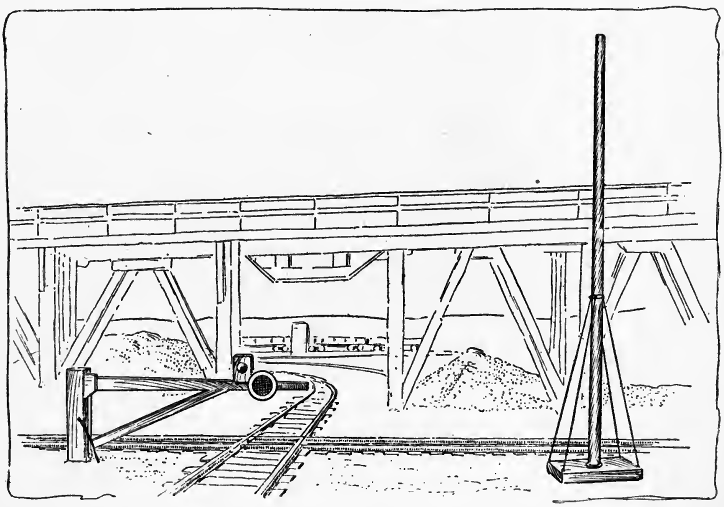


THROWING THE SWITCH PARALLEL TO THE TRACK, A SAFEGUARD

have time to jump out of the way. A simple but effective safeguard in such cases consists of a steel bar bent at an angle and fastened by drop pieces to the frame of the car.

Grounds and premises about the working-place are now receiving careful thought from industrialists, who realize that humane considerations do not stand alone, but are transmutable into well-earned cash, measured by an increased output.

In this connection might be mentioned the provision of good roadways tending to minimize the accidents which occur constantly to men who in trying to take short cuts to and from their work are generally liable to accident through the falling of piled material or unguarded crossings. Minor precautionary measures also should not be neglected, such as leading live-steam exhausts into metal-covered pits, in some instances putting locked screens over stairways, and many other points of a similar character, almost too numerous to mention, but which by



A LONG PIPE PERMITS STEAM TO ESCAPE WITHOUT OBSCURING THE VISION OF THE ENGINEER

careful thought and attention may very easily be worked out.

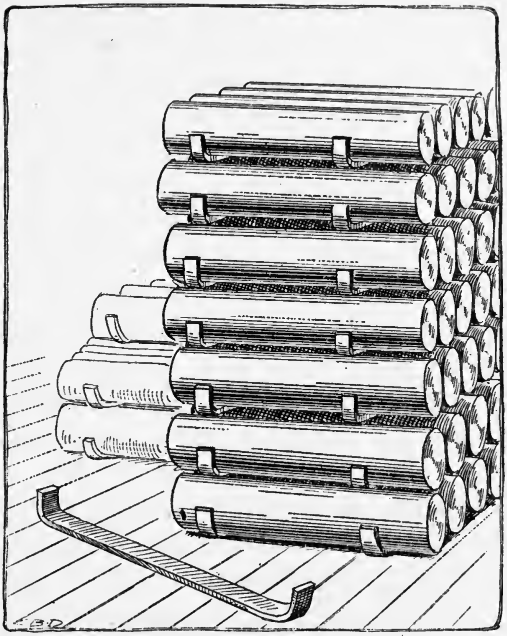
All platforms five feet or more in height should have a railing. Pipe-iron is preferable when possible, and toe-guards at least six inches high will prevent tools or materials from being kicked or pushed off on workmen below. This requirement applies equally to inside conditions.

Flooring should be laid level and kept so, particularly where there are sharp turns and steps. All such danger-points should be suitably illuminated. Stairways, even under the best conditions, are such fertile sources of accidents that the least neglect multiplies the danger many times. Inspectors should make it their business to see that every stairway under their supervision has ample width of tread, well secured hand-rails on both sides; that every step is perfectly firm; that no stairway is so arranged as to provide a chance for accident of any kind at the turns; that some approved type of safety-tread is installed where slippery conditions are probably to be encountered; and that provision is made for keeping off such stairways all who have no business there.

Material carelessly piled, so that odds and ends stick out in all directions, is another source of accidents. The contrast which is brought out by an orderly and systematic arrangement of material becomes evident, not only from a consideration of safety and appearance, but also from the standpoint of increased output. Where system of this kind prevails with piled material, natural passage-ways are always provided, allowing not only instant access to every individual piece, but also the free circulation of men and material.

When piling metal, especially when the individual pieces are in the form of bars, a small strip of metal curved up at each end holds the stock in position and eliminates any danger of slipping. Economy also indorses this device, for more material can thus be piled in the same space.

Problems of safeguarding boilers are largely dependent on expert inspection by regularly constituted organizations; but there are many minor details which an en-



SAFE METHOD OF STACKING METAL BARS

lightened management can provide. It is perfectly possible to maintain a system of walks or runways to give convenient access to overhead valves and water-columns. Walks should go from boiler to boiler, with suitable platforms at individual valves, from which they can be safely operated or repaired. These passageways should be well lighted and free from breaks or obstructions which might interfere with their use. In every case they should be equipped with hand-rails not less than thirty-six inches high, with two horizontal members, and toe-guards not less than four inches high.

Walks and stairways should be of suitable steel construction, checkered steel plate or grids being used for flooring, except in the vicinity of water-columns, where it may be advisable always to have the grid-iron construction, in order to provide a clear view of the water-column from the boiler-room floor. Wherever possible railed stairways are to be used in preference to ladders. Means of access should be provided for overhead walks at both ends of each line of boilers, and in a large plant one or two intermediate stairways are desirable.

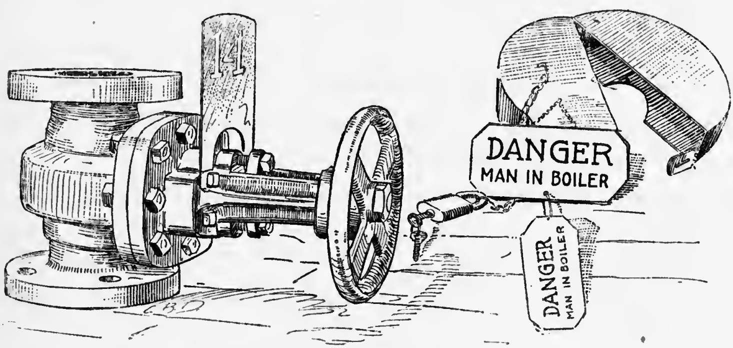
Special attention should be given to securing good illumination throughout the boiler-house. Unless the illumination is exceptionally good, it is advisable to have at least one light at each of the stairways leading to overhead platforms, particularly at the upper end of the main stairways.

An excellent plan is the provision of red incandescent lamps suspended near important cut-off valves or branches from steam mains or headers, to facilitate locating the same in case of emergency. A protected light, preferably an incandescent lamp, should be suspended near each water-column.

In cleaning flue dust out of boilers, experience shows that it is safer for two men to work together, one remaining outside all the time in a position to see the man inside and give him needed assistance. Of course, the men can take turns in cleaning and guard duty.

In planning the installation or rearrangement of machinery, ample space must be provided to avoid the common fault of overcrowding. With only a narrow space between machines, the worker is compelled to run the constant risk of being caught by some moving part. Sufficient space for the machine necessarily means sufficient space for the operator. By sufficient space is meant not only merely enough "elbow room," but space enough so that the operator feels fully at ease and capable of turning out better work at a higher rate of speed.

Experiments have proved conclusively that any additional sum that must be charged to rental because of this arrangement is almost negligible when compared with the savings that may be grouped under lessened accidents, higher working speed, and maintained general efficiency of the worker. The case of spinning-frames provides illustration. Here, where woman operators are the rule, the hair is always in danger of being caught on the upper rail of the spindle when leaning over to reach the lower rail. The skirt is also liable to be caught on the lower rail directly behind. It is, of course, foolish



GUARD FOR LOCKING STEAM VALVE OF BOILER

to advance any argument that an operator of this type is not perfectly aware of the danger which threatens every working moment. And even while it is quite possible that no accidents may ever occur in any particular case, it is certain that consciously or unconsciously every operator is giving up to this factor in her daily life a definite part of her energy—and it is her energy for which her employers pay a certain sum every Saturday. Multiply this small individual daily loss by the number of workers in almost any of the large mills, and at the end of the year the dollars and cents represented by energy total up a sum at which one may well marvel.

Protection from the jaws of various cutting tools, presses, punches, and stamping machines can only be fully afforded by guards so arranged that the power is shut off automatically the instant hands or fingers come within the danger zone.

Among the first steps toward accident prevention in all factories, new or old, is inclosing belts and gears, to prevent stumbling or falling into moving parts. These guards may be of wood or metal, and in the form of a box or cover that can be drawn around the gearing, a screen of wire mesh, or a lattice of iron rods; the best type is the expanded metal mesh, which gives a view at all times of the moving parts and also shows any accumulation of dirt which would interfere with the effective operation of the machine.

The rapid extension of the use of electricity throughout the industrial world has had a most beneficial effect on the safety of the workman. Before the advantages of electric power were realized workmen were overburdened and handicapped, owing to the fact that manual and foot power had up to that time found no substitute. The artisan and the small industrial worker, thanks to the electric motor, now benefit by the development in electrical progress.

All sewing-machines were formerly operated by foot-power, an arrangement which not only greatly limited the capacity of the operator, but broke down health and sapped vitality. These machines in most instances are now driven by electricity, increasing the output of the operator and, consequently, his wages.

When a shop is driven by a single prime mover, the power is transmitted necessarily to the machines through the medium of shafting and numberless belts. A most noticeable defect shown by the swiftly moving belts is the clouds of dust which are continually agitated, filling the whole shop. Many of the vocational diseases, which result from the workman's breathing in the dust of the product, are directly attributable to this cause.

As is pointed out by Arthur Williams, of the New York Edison Company:

> Electric drive has so altered this condition of affairs that now it is customary to equip each machine or tool with a separate motor, which may be an integral part of the machine itself. Belting is thus wholly dispensed with. Better working conditions are also made possible due to this elimination of belting, for the reason that a machine may be so located that the best natural or artificial illumination can be realized. As a perfect sequence of the operation, due to this flexibility of location, much handling and rehandling of heavy burdens can be dispensed with.
>
> A most important factor in the safety and welfare of the employee is to be found in this very elimination. A large percentage of industrial accidents has been caused by a workman coming in contact with or becoming entangled in such belting. This is not possible when the motor becomes a part of the machine itself, for the power-transmitting devices may be entirely inclosed. The possibility of controlling a large machine from several different points has also been instrumental in preventing large numbers of accidents. Many large machines are now equipped with a series of push-buttons located on different parts whereby the machine can be stopped instantly.

A common cause of accidents is due to the small bits of steel liable to fly off from the "mushroom" heads of hammers, sledges, bars, and other tools, causing injuries to the eye and face; daily inspection of such tools to see that they are "dressed" is the only safe method of avoiding this danger.

Signs, warning against danger, to be most effective, should contain some device or symbol, making the danger evident at a glance. In other cases the briefest possible text should be added for any needful explanation. The United States Steel Corporation has adopted a red ball on a white ground as a universal warning-sign for the workman to be careful. For foreign workmen, who neither speak nor think in English, a sign must emphasize

SAFETY CLAW FOR WRECKERS

the warning. It is common in Continental shops to paint red the dangerous part of the machine, thus arresting the attention of the work to that point.

As a proper amount of light is one of the essentials of safety and health, the working-place should have the maximum amount of window space. In one of the most successfully operated factories in this country four-fifths of the wall space is occupied by windows.

Thanks to the advance in iron and steel construction, it is perfectly possible to build structures that are nearly all windows. And while it is often difficult to remodel an old plant, it is frequently possible to make a few structural alterations in the interest of improved illumination.

Of equal importance to light in the working-place is the problem of the adequacy and purity of the air. So essential is this factor in every plant that it will be specially discussed in a succeeding chapter.

PART II

DANGER ZONES

5

IV

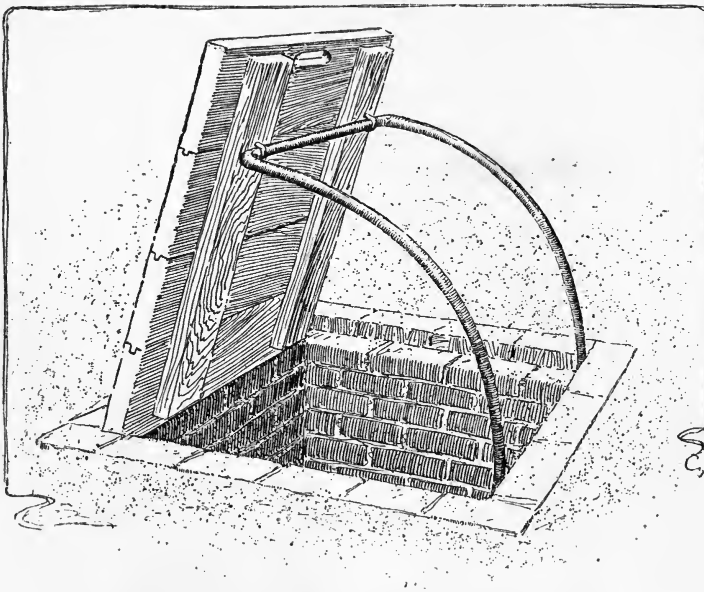
YARDS, WALKS, RAILINGS, AND HOISTS

A MAN going directly from a dark building into the brighter light of outdoors or stepping out into high winds instinctively lowers his face. If there is no guard at hand he is likely to step directly into some dangerous position, such as into the path of a moving train. Even with all conditions favorable to sight and sound men with minds upon something else often take a fatal step when their attention is not arrested in time.

When a siding runs between buildings a gate locked in place forces one to turn and face parallel to the track for a step or two before crossing. The key for unlocking the gate for passage of wheeled vehicles should only be in the hands of responsible persons who will open it for cause and can be relied on to close and lock it afterward. A gate also prevents men from rushing out incautiously at quitting-time.

The increasing use of underground conduits or subways for carrying pipe and electric systems compels the introduction at frequent intervals of manholes and hatchways for access to the valves or switches controlling distribution from mains to branches. While all such openings unprotected are a menace, they are particularly dangerous at night when the ground is covered with snow or when a high wind or rain causes passers-by to lower their heads.

For square openings in a yard a simple construction is a



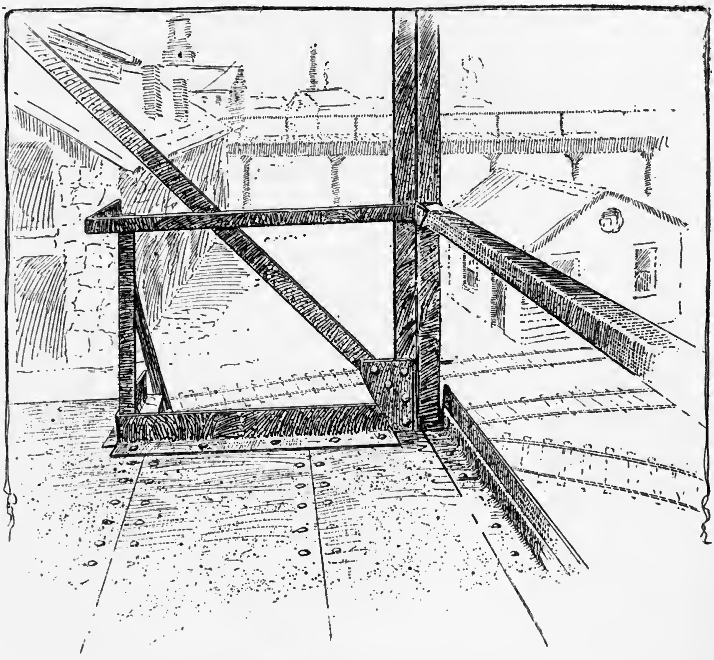
SAFETY COVER WITH SIDE BARS FOR MANHOLES

guard of round iron curved so that it rises easily through staples as the hatch is lifted. The automatic character of this device is more certain and effective than a portable guard, such as is used in street or sidewalk openings and which often is not set up when the time to be spent in the open pit is short.

An empty car on a siding is often the source of two dangers. If some one forgets to set the brakes it may be blown along by the wind until it reaches a danger-point. At night it may be run into by the rear end of a shifting train because it shows no light.

A combination bumper and light-carrier meets both requirements. The wedge, or inclined plane, resting upon the upper face of the rail will go under the wheel as it rolls, and the car will be locked in place from motion by the wind in either direction. The lantern-carrier will be visible in the direction from which the danger comes.

In the standard requirements for safety by the United States Steel Corporation all platforms five feet or more above the ground must be railed and equipped with a stairway or stationary steel ladder. Platforms and walks ten feet or more above the ground must have a toe-board at the base of the railing at least six inches high.



RAILED PLATFORM AND TOE-GUARDS

All scaffolds, when higher than ten feet from the ground, should be railed. On swinging scaffolds this railing may consist of cable or rope.

Concerning the planking of swinging scaffolds, it is always better that they cover the entire space of the supporting rope and be well secured to prevent the planks slipping. A belt should be placed through plank outside of the stringer, and the planking of scaffolds in general should be properly braced and spiked for greater security.

Individual responsibility is the great desideratum; this can only be secured when every workman sees for himself that the scaffolds and its supports are properly built. Of course, sufficient time should be allowed employees to make this examination and satisfy themselves that it is safe.

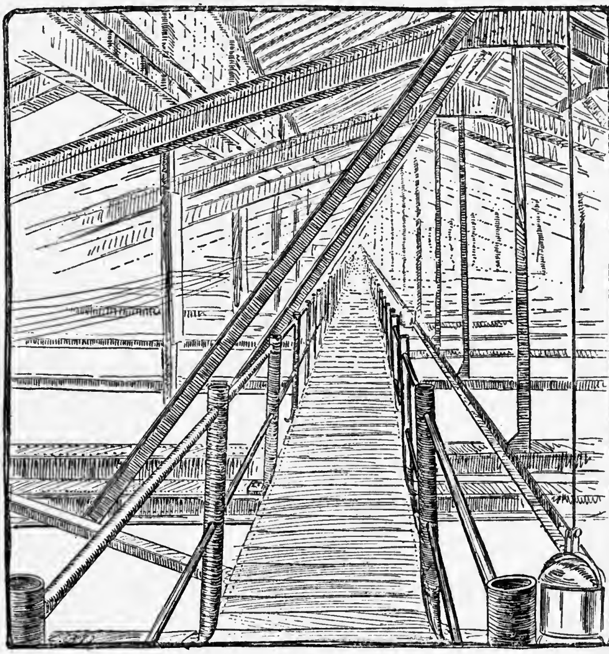
Operating platforms or floors should be equipped with checker-plates, woven steel fabric, rivet-heads, or other approved non-slipping surface. It is not sufficient to equip stairways with hand-rails, but they must be kept free from nails and splinters. Stairs should not be built at a sharper angle than 50 degrees; in other cases ladders should be used. The sum of the riser and tread should equal about seventeen and one-half inches.

The wide experience in safety standardization gathered by such a corporation as the United States Steel points that in general all railings should be at least three feet six inches high with an intermediate rail of equal distance between top rail and floor. They should be made of metal and when ten feet or more above the floor should have a toe-board at least six inches high at the base. Angle-posts should be chamfered.

Pipe railings should be made of not less than one-and-one-quarter-inch pipe. Angle-railing should be made of not less than 2 x 2 x ¼ inch angle-iron.

The careful manager provides that all exhaust-pipes lead into pits closed by metal covers. This provision should be enforced, particularly in the case of all exhaust-pipes within seven feet from the ground or whenever they are in such a position as to endanger the passer-by.

It is preferable that exhaust-pipes from machinery



RAILED WALK FOR ARC LAMP TRIMMERS

should be run outside of the building extended above the roof.

Efficiency takes account of clean windows and sky-lights, and in turn the safety engineer insists that for washing windows on the outside all cleaners be provided with safety belts.

For cleaning windows in the bays of shops and galleries the management can, of course, provide properly equipped cages running on tracks or runways, railed and toe-boarded, as such installation can be counted upon to safeguard the cleaners from traveling-cranes or other moving machinery.

The prudent workman will always have his hands free in going up and down ladders, hoisting materials or tools by rope, and the works' manager who cares to cover every possible point, provides a cage or screening around the ladder, which prevents any one from falling, even when hands or feet slip off the rungs.

In many plants there is a standing rule: "Never try to climb a ladder without the free use of both hands. If material is to be handled, use a rope."

Foremen and others having workmen under them can promote the interests of the management by taking care that loose material is not allowed to remain on any roof where it might fall or be blown off with possible serious injury resulting.

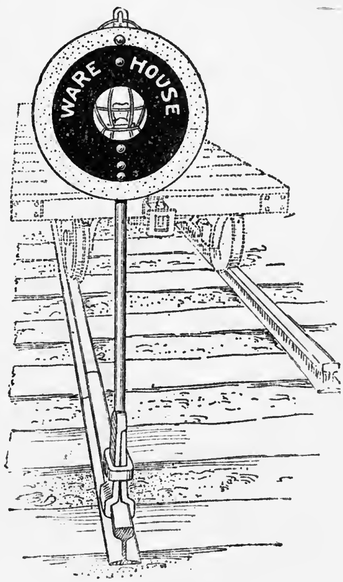
It is always good yard practice to insist that all passageways and gangways be kept smooth and in good repair, free from any obstruction which might cause a stumble or fall.

In the same way there is always danger in allowing passageways to become crowded. They should be sufficiently wide to insure safety in an emergency beyond the regular course of work.

After the completion of a piece of work tools or material should never be left lying around. Temporary scaffolds should always be torn down as soon as they have served their purpose.

It is bad practice for employees to search through scrap for tools, as there is danger of being struck by cranes and crane-loads. All scrap should be kept back at least three feet from the track, and so piled that none will fall onto the rails.

By night and day flags should be at the end of all cars where men are working on or around the cars. Care should be taken in loading material so that no portion will project over the sides or fall off in transit. Weight of the load should be properly distributed on the cars, and large pieces braced to prevent shifting.



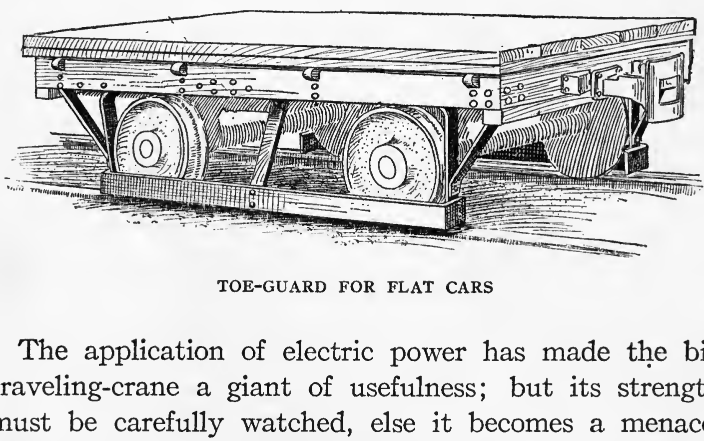
TRACK TARGET

No one should work on cars, or clean tracks around cars, where he cannot be seen by an engine crew.

For the protection of employees working under or about cars the National Tube Company has devised a derailing track target, for day or night use, which can be secured to the track. The lantern is placed in the center of the disk to show light in both directions at night; to prevent unauthorized removal, the derailer is padlocked to the track.

It is found to be safe practice to notify the foreman that a workman has gone into a bin to poke down the ore; another precaution is for the man to have a rope from above tied around his body. When trimming piles of ore, the pick-men should work to the side, and not in front of them, thereby avoiding the danger of sliding ore. Excavations should be protected by barriers during the day, and at night by lights. If there is the slightest risk of a cave-in they should be shored up. All post-holes and other excavations ought to be covered or protected when leaving them, or when quitting work for the day.

In unloading cars the material should be piled at least four and one-half feet from the rail. If it is impossible to do this, place a warning-sign at each end of the pile: "No clearance for man on side of car." Any material which may fall upon or alongside the track must be immediately cleaned up. It is dangerous to walk alongside of cars when material is being unloaded. All railroad crossings should be planked over.



TOE-GUARD FOR FLAT CARS

The application of electric power has made the big traveling-crane a giant of usefulness; but its strength must be carefully watched, else it becomes a menace. Sometimes the thoughtless workman will rest hands or arms on the track, forgetting that the passage of the crane is swift and noiseless, and he is taken unawares. To prevent this type of accident the crane may by supplied with a little pilot brush of wire, so as to push off without injury hand or arm obstructions. For the same reason it is good safety practice to run a line of wire fence along the bays of the shop, to keep any one from getting in the track of the crane.

In former days the craneman got into his cab as best he could by means of the girder or a wooden ladder. To-day the safety engineer provides a flight of railed steps with a platform, so that the cab can be entered in perfect safety. Even there the danger is by no means past; as, for example, in a steel-plant should there be a spill from the ladle carrying the molten metal, although the cab might be distant some sixty feet from the floor, the heat is so intense from the spreading molten iron that in some cases the operator has been literally cooked to death. To protect him from this peril an iron cage lined with asbestos is built on the cab for a refuge.

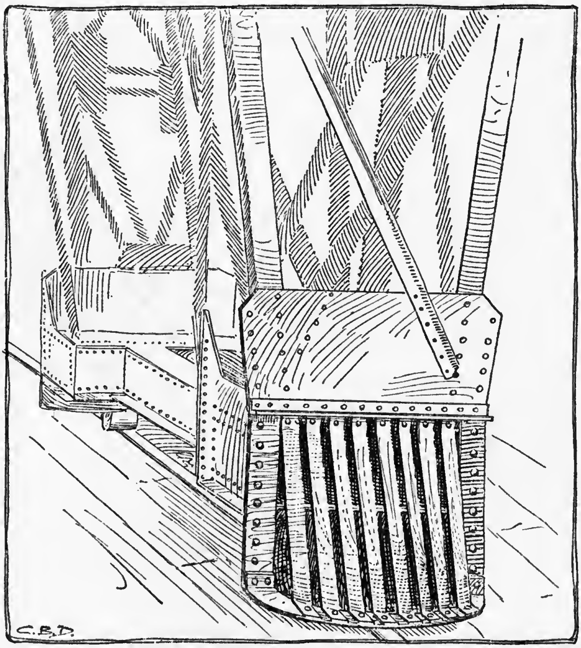
The superintendent knows that among the dangers to be guarded against in connection with gantries is the peril from derailment through obstructions on the track; accordingly, he recommends that the supporting and driving trucks be equipped with adequate fenders to throw off heavy objects, and act as a pilot should human beings get in the way.

To prevent the dangers raised by the stress of high winds upon the elevator structure, the gantry is fitted with rail grips and clamps which can be set and tripped by hand. These, of course, reinforce the braking action to prevent the crane from moving upon its runway when the wind blows and steady the crane from undue motion when it is at work. Chains furnish additional safety in very high winds.

In the case of handling fine material, such as coal and ashes, the driving-gear can be prevented from falling substances by inclosing the mechanism.

When cranes travel the whole length of a shop, between end walls, the chances of derailment from overrunning are nil; but when the runway stops at any considerable distance from the end wall, there is always the possibility that failure of the braking device or careless operation may cause the crane to overrun. This risk can be obviated by means of a bumping-block of heavy springs and steel tie-rods set up on the end of the girder in such a way as to take up the impact.

With a safety rim for the crane-hook there is no excuse for the workman getting his hands in the throat when

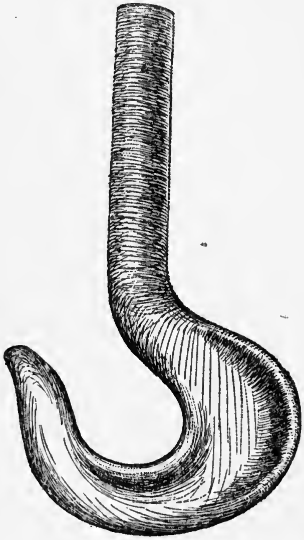


FENDER FOR GANTRY CRANE

adjusting it to a chain sling. The rim also allows better guidance in all directions, thus making for convenience as well as safety.

Whenever practicable it is always safer that slings used on hoists should be made of wire cable instead of chain, as the former gives warning of weakening by broken strands.

The only safeguards against the exposure of crane chains to a continuous action of radiant heat effecting molecular changes in the metal are periodic inspection at frequent intervals, annealing, and rigid renewals of weakened links.



CRANE HOOK WITH SAFETY RIM

In the case of freight elevators it may not always be possible to have the elevator constantly in charge of an operator whose sole duty is to run the elevator, although this should be the practice wherever the use of the elevator is frequent enough to warrant it. However, it is advisable wherever practicable to designate one man to run it in addition to his other regular duties. When the conditions impose the necessity of permitting a number of men to run the elevator, those receiving permission should be as few as possible and chosen for their carefulness and competency. The indiscriminate use of an elevator by a number of persons should be prohibited. Statistics show that the greater number of elevator accidents are due to the carelessness of the elevator operator.

The Inland Steel Company finds it good policy to insist that all elevators used for any purpose should be provided with automatic closing gates at least six feet high at each floor, platform, or scaffold, and also with a danger-sign. A simple precautionary measure is a signal system indicating the movement of the elevators.

Where electric power is used to operate elevators a switch should be provided on each floor, platform, or scaffold to cut off all power so that the elevator cannot be moved until every one is ready. Where the cage travels past beams and floors they should be beveled and sheeted on the under side to prevent injury to the workmen.

A wise expenditure is incasing the sides and top of freight elevators with wire mesh. A small ladder is also frequently helpful in getting to the top of the car.

V

CUTTING AND GRINDING TOOLS

THERE is a particular need for making safe presses and stamping-machines, for they are frequently the cause of serious accidents. Investigation disclosed that a certain brass shop, in which 203 women were employed, showed an accident rate of 26.6 per cent., while another shop employing 129 women showed an accident rate of 11.63 per cent. Both of these were what may be called high-class factories; but in the second mentioned machines had been chosen with the least hazard, and even then additional safeguards had been provided.

A good illustration of the difference in safety percentage caused by attention to a single detail is shown in a comparison of two factories using nearly the same number of presses and producing almost the same kind of work. In one a safety device was used which was not found in the other. In the first in one year out of 187 women employed only 3.21 per cent. had been injured; in the other, not using the safeguard, out of 150 women employed 13.33 per cent. suffered accidents.

Another striking contrast was found between two firms manufacturing hardware; one firm occupied a rather old building in which, owing to the low ceilings of some of the stories, the shafting ran too near the workers. The conditions with regard to revolving parts of machines, unprotected belts, and stamping-presses were dangerous.

The 1,006 men employed by this firm had an accident rate of 17.49 per cent., while the 138 women employed had a rate of 17.39 per cent. The other factory had better buildings and paid more attention to safety devices. Among the 2,488 men employed the accident rate was *3.22* per cent., while among the 500 women workers it fell to *1.40* per cent.!

An example of what can be done in the way of safety for workers is shown by one firm solving the problem of press accidents. They studied the situation and discovered that nearly fifty changes could be made in the machines to make them safer and in some cases more productive.

A curious fact in connection with workers on presses is that where men and women are working under practically the same conditions the accident rate for the women is almost always higher than for the men. In eighteen establishments recently studied it was found that for the whole group the accident rate of the women workers was almost one-third greater than that of the men workers. It would seem, therefore, that among press operators women run greater risks than men. Among these workers the machine was the principal source of danger, although the men showed a slightly larger proportion of injuries due to the use of tools, belts, gearing, and falls; but the accidents to the women were almost entirely through the use of the machine.

It would seem that women are more careful than men, generally, less given to removing the safeguards which are provided, and more attentive to their surroundings; in fact, displaying a tendency to avoid the possibility of accident when working on machines known to be dangerous. But in the matter of taking risks women are much more reckless than men. "Taking risks" includes a number of foolish actions, such as cleaning a machine while in motion, attempting to adjust screws and belts under the same condition, experimenting with another person's machine, and disregarding orders.

The most important cause of accidents on press work to both men and women is found to be in connection with the material, either in inserting, removing, or clearing away the scrap which brought their fingers too dangerously close to the descending die. Perhaps one reason why women have more accidents through this cause than the men is that the men operate the heavier and slower machines, while women workers are given the lighter and more rapid ones. But in almost all cases safety devices can do away with the accidents.

The danger attaching to the crank-driven press in punching or drawing shops with working dies receiving the metal to be acted upon, is lest the fingers or hand of the operator be caught between the operating edges, either from a careless movement as the ram descends or because motions which have become almost automatic lead to carelessness or inattention.

A safety construction closely resembling the collapsible cup used by travelers is fitted to the under side of the ram bottom side up; the moving ram oscillates, as it were, within the cup, which is so adjusted in height that, while the fingers of the operator cannot pass between its edge and the bottom die, the sheet metal, however, can be fed through the space. As the upper ram descends for the working stock the cup collapses, the rings of which the cup is formed sliding within each other. On the upstroke the cup extends itself again, leaving room for the strip to pass beneath its lower edge. If any variation in thickness of the strip occurs the cup collapses as may be necessary.

An ingenious safety device for a stamping-press compels the use of both hands to engage the machine with the driving-power. The two levers, one on each upright, must be held by the operator's hands in the operative position before the ram makes its descending stroke. The work is fed in previously, without the necessity of any hand manipulation.

While operating a shaper or planer the chips of brittle material are often struck off with considerable force. To protect the worker's eyes from this danger there may be placed a bent piece of sheet metal fitted with clamps to grip the body of the tool, forcing the chips to strike the shield.

The experience of another country is always illuminating. Labor inspectors for the northeastern division of England classified the 670 accidents that were reported in connection with lathes in 1910 as follows:

From the driving-belt of the lathe	24
From the cone-pulley or belt of the lathe proper	46
From spindle-gear and back-gear	17
From the change-wheels at the head-stock	17
From other gears in apron and feed mechanism	8
From the driving-dog	71
From the face-plate or chuck	23
From projecting set-screws about the lathe or work	8
From the tool-points or article being turned	297
From flying chips or articles being turned flying out	127
From other causes, including falls upon the workmen.	32
	670

Nearly one-third of these accidents occurred in connection with the work being turned. Next in importance were the accidents incident to the dog or driver catching the arm or clothing of the workman; while the chuck or face-plate accidents might be taken together, making up nearly 15 per cent. of the entire list.

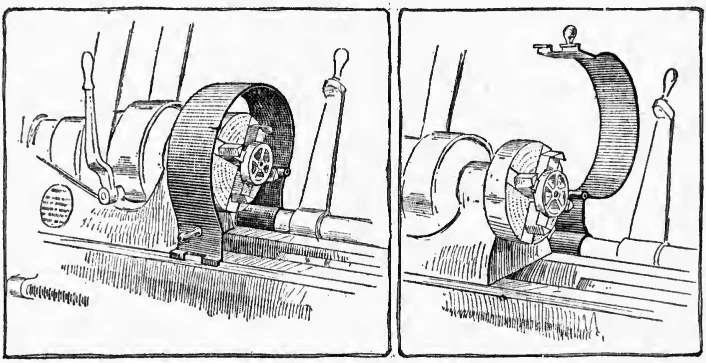
In the common lathe dog the set-screw constitutes, perhaps, the most dangerous detail of this system. A right-handed man filing a surface in the lathe and steadying the point of the file by his left hand runs the risk of having his sleeve caught by the revolving dog.

To obviate this source of accident the projecting square-headed set-screw should be replaced by the hollow set-screw. Another safety device completely incloses the dog within a dish-shaped aluminum cover. The latter is fitted with springs on the inner surface, which pass over the set-screw and the tail of the dog, holding the projecting cover close without rattling or danger of shaking loose. When the work is put in place on the centers and the dog goes in place close to the face-plate the projecting cover incloses the danger area.

The National Tube Company recognizes that the projecting jaws of the lathe chuck or face-plate are a great menace to the left arm of the operator, especially in filing chucked articles which are close to the plane in which the jaws are revolving. To lessen this danger a steel semi-cylinder is swung over the face-plate and locked in place upon the bed of the lathe so that the plane of the jaws is covered. This device can be employed on high-speed tools such as are used on brass and with many forms of turret lathes.

The Allgemeine Elektricitaets Gesellschaft, of Berlin, believe in making their machines as near "fool proof" as possible. For example, their milling-machine has all the driving mechanism incased. A guard of sheet steel and wire mesh protects the transmission from the countershaft to the spindle, and all the feed mechanisms are equally and effectively covered. Even the cutter itself is under cover. There is no possibility of an accident.

In connection with the operation of milling-machines



SAFEGUARD FOR LATHE CHUCK

and metal circular saws the Allgemeine Elektricitaets Gesellschaft issues these rules:

1. All fast-running mills and saws must be surrounded with protecting caps.

2. Special care is to be taken that the stresses on saws and mills are exactly central.

3. Damaged or sprung cutters to be replaced immediately.

4. Small pieces to be cut must be fastened in holders and jigs. Under no condition are small pieces held in the hand to be cut.

5. Chips to be removed by means of sheet-metal dippers or similar apparatus.

6. Wiping off chips in front of the mill or saw is only to be undertaken with brooms or brushes supplied for this purpose.

Again, the National Tube Company, to obviate the increased weight of the motor geared to a direct drive at the head of the lathe, mounts the motor on the wall, leading a short belt down to the spindle. The motor is mounted upon a spring suspension with horizontal adjustment to maintain a belt tension, and the belt drive is protected by wire mesh. All gears are completely incased, and in place of the usual cone-pulley and its accompanying countershaft the varying speeds for the spindle are secured by the ordinary controller whose crank-handle is placed conveniently to the tool carriage. The switches are installed on top of the projecting case which covers the back-gears. The lathe-bed is illuminated by branching from the lighting circuit and projecting the flexible cord except at the very end where it descends to the hanging lamp.

A heavy driven head-stock should have the back-gear from the motor and the belt guarded. The train of gears should also be safeguarded within a wire mesh, and the latter used also to incase the end of the spindle. The mesh lets light pass through it, but not fingers nor parts of garments. It does not reverberate with the hum of the gears behind it. It is clean and at the same time is effective.

For the small cross-cut metal saw revolving at a high rate of speed the machine is conspicuously self-contained by putting the motor directly under the table-top and belting it down to the countershaft below close to the floor.

The saw blade is safeguarded by means of a hood pivoted at the back of the table-top, with a hinge so adjusted that the whole guard can be thrown over below the plane of the table-top. This is necessary when long pieces are to be sawed and the guard is mounted in the plane of the blade.

Dough mixers and choppers, when operated mechanically, are sources of risk to the worker, who is liable to lose fingers or hands from the spiral fins or knives. The Germans pivot the mixer within the protecting casing around the belt-shaft, then a latticework lid is interlocked with the driving-gear so that when it is down the knives cannot be put in gear. Closing the lid entirely depresses the steel triangles until the trough is completely covered, and when snapped in place the knives can be thrown into gear and the process completed. The engaging device is interlocked with the lid so that it cannot be lifted when the knives are revolving. When the knives are stopped at the completion of the work the whole trough can be tilted —the knives out of gear and inoperative by reason of the lifting of the lid—and the contents of the trough emptied.

When asked what class of machines he considered the most dangerous, a superintendent of many years' experience replied at once, "Wood-working." Before discussing the devices to lessen accidents on the machine itself there are certain general observations.

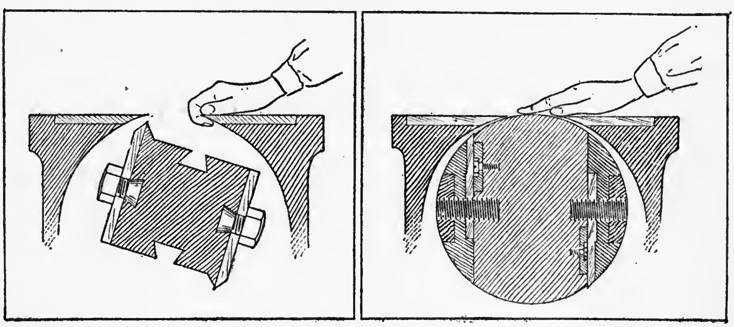
Arrangements should provide absolutely for workmen always throwing their machine out of motion, even when leaving it temporarily. Belting, pulleys, exposed gears, sprockets, and chains should be guarded as a matter of course, and set-screws provided. All lights should be so placed and hooded that there is no glare in the worker's eyes; the light should be thrown on the work and danger zone of the machine or tool.

Generally speaking, all wood-working tools are operated at a high rate of speed. Naturally, they become a prolific source of accidents, resulting in serious disablement of wage-earning capacity. The floor of the wood-working shop is usually so slippery and smooth that the operator runs the risk of slipping and falling into the danger zone of the cutting tool. A rubber mat placed around the machine and secured to the floor is an excellent precautionary measure; but better still are abrasive strips, which can be kept free from sawdust and are practically indestructible.

In working at the buzz-planer it is easy for the fingers of the workman to come in contact with the knives if the wood "kicks." When the pieces of wood are small the danger is even greater.

The Midvale Steel Company have made a feeder for small pieces, very similar to a plane-handle, with the under edge a strip of rough metal, which grips the wood and pushes it along, thus keeping the operator's fingers absolutely away from the knife.

In the old type of unguarded planer, with its square cutter, there was a comparatively wide space between



OLD-STYLE SQUARE CUTTER-HEAD SAFETY CIRCULAR CUTTER-HEAD

the table and the knife. A German device is a circular cutter-head which fills nearly the entire opening, so that if the man's fingers slip nothing more serious can happen than a slight cut.

It goes without saying that the operator should not allow his hands to rest on the wood as it passes over the cutter. Knots in the wood, a change in the grain, or too heavy a cut may throw the wood away from the machine and the worker's hands against the knife.

The type of accident that may be expected from band-saws, causing an ugly wound, is the breaking of blades, even with a skilled operator. The thrust on the blade, turning a sharp corner and at other points, keeps the worker at continual tension. The remedy is incasing the lower part of the machine in wood and metal, so that the doors can be easily opened, while the upper part should be inclosed, preferably by wire mesh. Particular pains should be taken to guard that part of the saw-blade where it comes nearest the table, as a break there might seriously injure the operator's head.

Circular-saw accidents are due, first of all, to the high speed of this tool, which revolves so fast that the workman often does not appreciate how far the teeth extend beyond the revolving disk. In the absence of mechanical feeding on the table, the wood is liable to kick and strike the man's body more or less violently.

An operator should always stand at the side of the piece that is being fed into the machine, never in front.

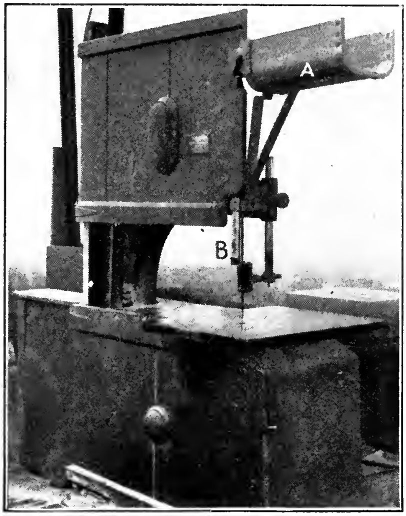
A recent analysis made by the Minnesota Bureau of Labor of accidents from flying boards is suggestive:

1. An edger-man's new helper tried to get a board out which was stuck in the edger saws. From his lack of skill he did not do it properly, and the board, striking him in the abdomen, killed him.

2. A rip-saw operator lifted the feed-roll to release a piece which had stuck, but did not move to one side. When the board flew back it struck him.

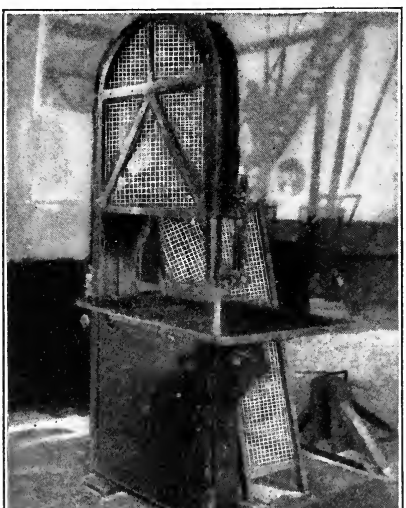
Both of these accidents would have been prevented by the above suggestions.

3. An edger-man started to feed the saw carrying an armful of pieces partly resting on the table. One of these fell from his grasp, and,

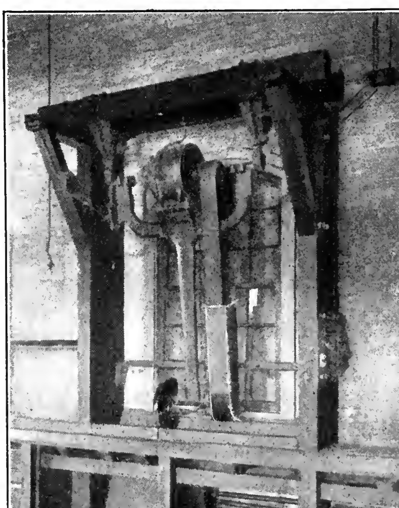


BAND-SAW
A—Basket to catch end of broken saw in case of accident.
B—Protection for operator's head.

METAL SHIELDS FOR BAND-SAWS IN SHOPS OF ILLINOIS STEEL COMPANY



THE OLIVER IRON MINING COMPANY'S BAND-SAWS PROTECTED BY WIRE-MESH GUARDS



A PENDULUM SAW WITH METAL HOOD AND COUNTERWEIGHT IN CARPENTER SHOP OF THE NATIONAL TUBE COMPANY

TYPES OF GUARD FOR BAND AND SWING SAWS

lighting on top of the saw, was thrown against his breast, killing him instantly.

4. A board had fallen back of the saw, and the operator tried to get it. The saw caught it, and hurled it against his head, killing him.

These two accidents could have been prevented by a factory rule that workmen should not pile their boards on the saw-table, but on one adjacent, and feed one at a time; and by another requirement that operators stop their machines whenever loose boards fall near the saws.

5. A rip-saw operator was struck and killed by a small piece that broke off from the work. This was probably an unavoidable accident, although the likelihood of it would have been diminished if the operator stood always at the side of his work instead of in front of it. These listed accidents were fatal, but a large number of non-fatal accidents resulted from the same set of causes.

The best shop practice in connection with the circular saw makes use of a spreader, placed back of the saw, with its lower part of the same width as the saw, and tapering somewhat toward the edge. The object of this spreader is, of course, that it opens out the cut and prevents the saw from binding.

Another effective safety device is a wooden or metal hood for the saw, with a sort of cage coming down from above, so as to leave the table free. This guard rises automatically, according to the thickness of the wood.

Swing-saws should be provided with a metal hood, and so counterweighted that the saw is always swung back and away from the operator. Of course, there must be a periodic inspection of the parts to see that none of the screws work loose, resulting in loss of control.

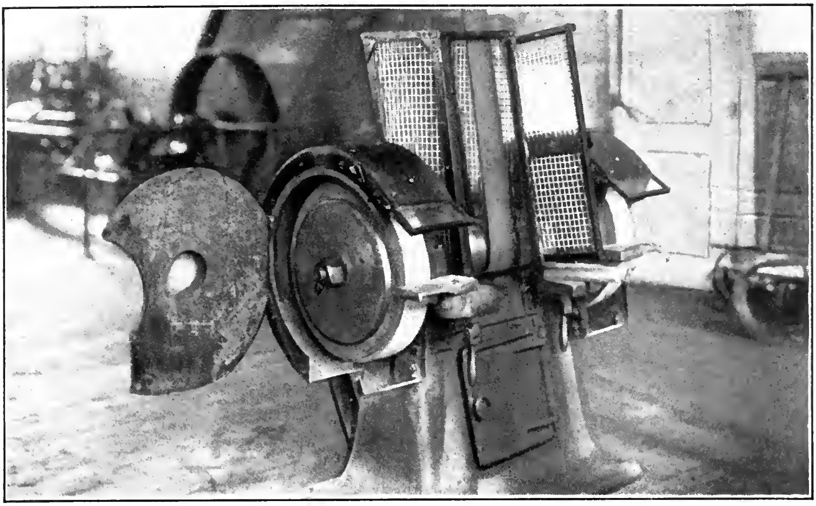
A safeguard for the cross-cut saw offers no serious difficulty, as it takes the form of a hood, hinged back of the saw on the table.

The problems connected with grinding, come up for solution before the shop superintendent, who is very well aware that the use of a rapidly revolving emery wheel in the grinding of tools, or as an abrador, is fraught with the possibilities of dangerous accidents. The wheel may burst as the result of centrifugal force, of outside strain, or from catching the rim of the wheel in the tool, thus tearing the wheel apart; particles of steel or of the abrasive material may enter the eyes, nostrils, or mouth, resulting in serious injury; under the conditions of high speed, the belt governing the revolution of the wheel may break and fly apart; or the dust produced by the grinding, while too light and fine to result in direct injury, may, if inhaled for any length of time, prove very injurious to the health of the worker.

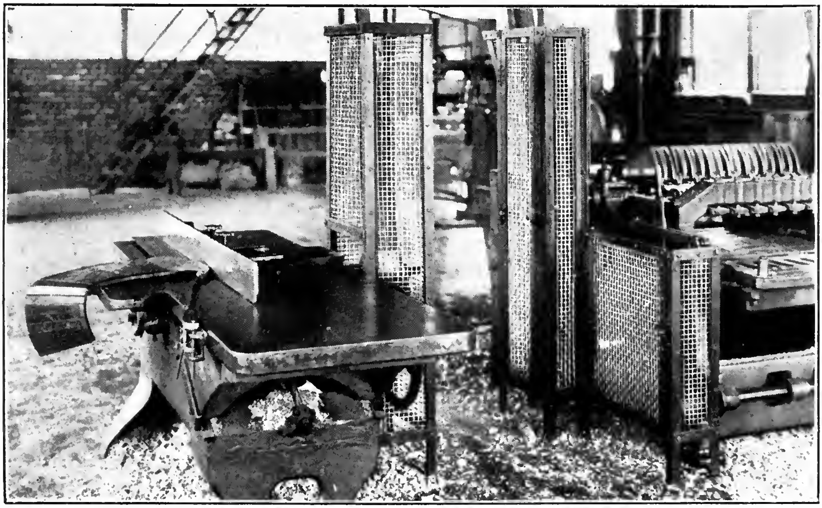
Only a few years ago the bursting of a grinding-wheel was looked upon as a common occurrence. In the majority of cases the cause was given as overspeeding. It was the opinion of the time that all grinding-wheels were dangerous tools, and that if a man ran his wheel a little above the working speed there was great danger of the wheel bursting.

The first thought is for the issuance of hard-and-fast rules regarding the operation and care of grinding-wheels, but these can be supplemented by actual safeguards against the bursting of the wheel. One of these is the use of a concave disk or flange, thicker at the center than at its circumference, which shall so bear against the wheel when tightened that the pressure shall grip as far as possible from the center.

Experience has demonstrated that these flanges, or safety collars, should never be less than one-third the diameter of the wheel. The inner flange should never be loose, but fixed on the spindle. Wheels should never be



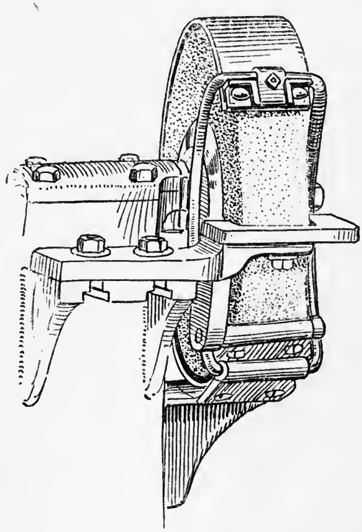
SAFETY COLLAR, METAL GUARDS, PLATE-GLASS EYE-SHIELD, AND INCLOSED BELTING FOR THE OLIVER IRON MINING COMPANY'S GRINDING-WHEELS



INCLOSED BELTING AND SAFEGUARDED BUZZ PLANER

allowed to run when held only by a small nut or a small washer and nut, as this is liable to crawl and cause accident by excessive pressure on the wheel. It is recommended that flanges be used at least one-half the diameter of the wheel, bearing only at their outer edge on a flat ring surface, approximately one-eighth the diameter of the flange.

It has been found satisfactory to use compressible washers of pulp or rubber between the wheel and the flange for the sake of distributing the pressure uniformly when the flanges are tightened. When mounting wheels precaution should be taken that flanges are not screwed up too tightly, as no great pressure is required.



SAFEGUARDED EMERY WHEEL

There are many types of protecting flanges in use, all of which have certain values and which, if in use when a wheel breaks, tend to minimize the danger from flying fragments.

In addition to the safety collar good practice calls for a metal hood wherever possible, irrespective of the type of flange used in mounting. These hoods are generally of steel, plain or corrugated, surrounding the periphery of the wheel; in case the wheel bursts the encircling band prevents the broken fragments from flying, thus safeguarding the operator and his fellows.

The hood illustrated as an example has been in use for the past fifteen years, with the remarkable record that no grinding-machine operator has been seriously injured by broken wheels where the machine was so equipped.

Foremen careful of men and machines know that rests should be adjusted as closely as possible to the wheel, avoiding the danger of catching the material between the revolving surface and the rest. Neglect of this precaution is responsible for many accidents, some of them serious.

Grinding-tools can affect the eyes injuriously by dust and sparks. An inexpensive but effective eye protection is a shield of glass suspended over the wheel from the protecting hood, as the glass permits a view of the work at all times, even when it is necessary for the operator to work close to the wheel. Where it is impracticable or undesirable to use a glass shield an effective guard is a leather flap to the top of the protection hood and so adjusted as to interrupt the sparks. Goggles of various types also afford protection and are used by operators when it is necessary for them to work very close to the wheel.

Of course, driving-belts should be provided with guards of sheet steel or wire mesh in any of the approved forms.

Good light and ventilation smooth the way for accident prevention in grinding-rooms as much as elsewhere.

VI

ILLUMINATION

THE technical side of lighting already forms a vast subject. New illuminants are constantly coming to the front, and merely their uses in industry make up a life study.

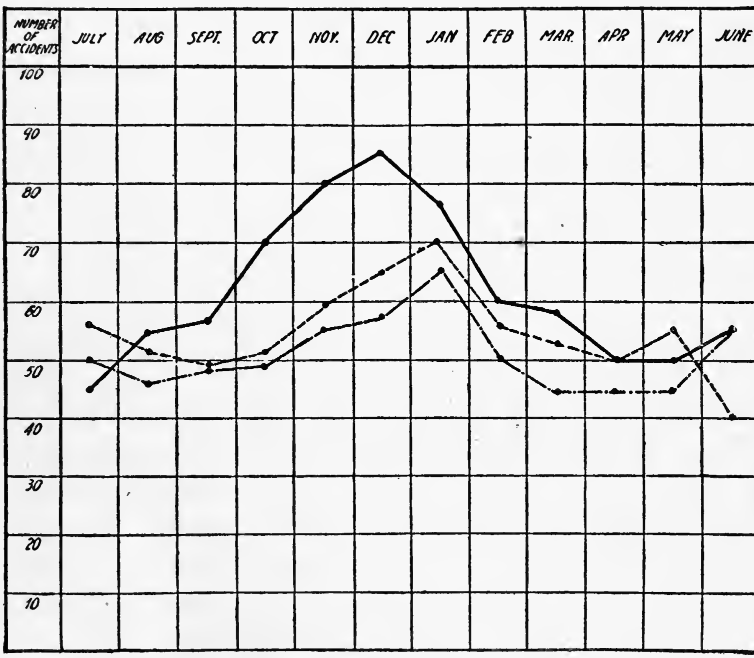
The last century, remarkable for the development of machinery and its application in industry, was also characterized by a great advance in methods of illumination. These two developments may be said to have taken place side by side, and fortunately so, since the complicated nature of industrial processes to-day makes good lighting very important.

Another natural result of development in artificial illumination, is the vast increase in amount of work that is carried on during night hours. Business under some conditions is now conducted by artificial light as a matter of course, and perfected illumination is therefore coming to be regarded as much an absolute necessity in its field, as adequate ventilation, pure-water supply, and proper sanitation are now considered necessary factors among industrialists for maintaining the efficiency of employees, cutting down losses of time, and increasing the output.

To the hygienist and sanitary expert the importance of good lighting is conceded for two main reasons: first, its direct influence in maintaining healthful conditions for workers, especially from the standpoint of eye hygiene;

and, second, its importance as a means of reducing the number of industrial accidents.

With regard to the effect of illumination on health a distinction must be drawn between natural and artificial light. The importance of adequate admission of daylight to workrooms was recognized by authorities even before



SEASONAL DISTRIBUTION FOR THREE SUCCESSIVE YEARS OF ABOUT 700 DEATHS ANNUALLY FROM INDUSTRIAL ACCIDENTS REPORTED FROM 80,000 PLANTS. IN THE MONTHS OF NOVEMBER, DECEMBER, AND JANUARY, WHICH SHOW THE LARGEST NUMBER OF DARK DAYS, THE NUMBER OF ACCIDENTS WAS THE LARGEST

they had begun to consider artificial light. Special emphasis has also been placed on the value of abundant daylight in legislation affecting such trades as enameling, glasswork, and others where there is a possibility of lead-poisoning, and in connection with industries in which special precautions must be taken to avoid a tendency toward tuberculosis.

It is well known that modern methods of combating consumption are based mainly on the beneficial effects of sunlight and fresh air. Rooms into which daylight enters with difficulty are apt to become unclean and unhealthy, or, as the proverb phrases it, "Where the sun does not enter the doctor does."

It need hardly be said that continual insufficiency of daylight imposes a strain on the eyes of workers engaged in printing, knitting, and sewing, but this is only one of the many evils induced by want of light. To work in gloomy surroundings is depressing to the general health and spirits, and almost invariably it will be found that in a factory where the lighting is notoriously bad, the percentage of spoilage and of workers absent through sickness will be abnormally high. Another result of defective illumination is want of cleanliness. It is only to be expected that when appliances and machinery cannot be seen well they should become dirty. In the case of restaurants and trades which are concerned with the preparation of food, proper illumination is, of course, imperative. Again, in trades in which poisonous materials are handled it need not be pointed out how extra hazardous may be the consequences of defective lighting. Dr. R. J. Currie, Medical Officer of Health for Chester (England), recently made a statement that in the schools of Chester personal uncleanliness and defects of vision always occurred together. It is probable that both evils could thus be traced to defective lighting, and the same would doubtless be found in the case of many workshops and factories.

In the report of H. M. Chief Inspector of Factories in Great Britain for 1909 the need for adequate lighting in factories is set forth as follows:

> The importance of adequate lighting in industrial employments is obvious, as a matter of fact, especially where dangerous processes are carried on; as bearing upon health in many ways, directly or indirectly; and as a condition of efficient work. On the health side it is hardly necessary to point out that inefficient illumination entails risk, strain, and ultimate damage to the sight, even apart from interference with work, that it tends to neglect of cleanliness, and adds to the risk of working in poisonous materials; and that it increases the need for artificial light, which can seldom be as satisfactory as daylight.

In this matter of artificial lighting not only must the unsatisfactory conditions that arise in factories through insufficiency of light be dealt with, but there are also other conditions in which artificial light may be wrongly arranged and so give rise to new difficulties. In general, artificial light is rarely as satisfactory as daylight, and there is room for a vast amount of educational work among managers of factories, that they may utilize their light distribution to better advantage.

Recognizing the deficiencies of artificial light, legislation in Holland has recommended that women and young persons should not be engaged in any occupation liable to be unhealthy or dangerous in premises which require artificial light between 9 A.M. and 3 P.M. In the regulations a minimum illumination on the work of 10 lux (approximately 1 foot-candle) was prescribed for general work, and in certain trades recognized to be specially trying to the eyes, such as jewel work, sewing, knitting, embroidery, and engraving, a minimum of 15 lux (1.5 foot-candle) was specified. The first necessity in lighting, whether natural or artificial, is that it should be sufficient.

In Great Britain the authorities have been strongly impressed by the necessity for attempting to frame more definite rules specifying the amount of light required for various purposes, and have given instructions for photometric measurements to be carried out in a large number of factories. The difficulty is to set up a standard, but it is possible that inspectors should be given general statutory powers to require adequate illumination in all places which are a source of danger by reason of insufficient lighting.

Such a recommendation is based mainly on the recognition that insufficient lighting is a source of danger; but it is also desirable from the standpoint of hygiene. In the report of H. M. Chief Inspector of Factories in Great Britain for 1908 various examples of the results of working by insufficient light were mentioned, notably that of girls with weak sight engaged in certain textile mills. In commenting on these conditions, it was remarked, "Sometimes, however, we are met with indifference or reluctance to spend money on this condition for healthy working [*i. e.*, sufficient illumination], and we have no statutory provision to rely upon."

It would appear necessary, however, to move with care in this matter and to collect full information regarding the amount and character of illumination necessary and feasible for different classes of work, and as to the best means of measurement. Any definite specifications of a certain amount of illumination naturally implies that sufficiently trustworthy and convenient instruments for measurements should be available. Fortunately, considerable progress has been made during the last few years toward rendering such measurements more simple and accurate. A considerable amount of work in this direction has been done by the Illuminating Engineering Society in the United States and England in obtaining data regarding illumination in schools, libraries, and factories, where the measurement of illumination is coming to be looked upon as quite a simple and reliable process. The employer by means of a photometer can measure and test the illumination in his own plant.

Perhaps the most exhaustive report ever published on any typical factory lighting installation was that presented in a paper at the annual convention of the Illuminating Engineering Society in 1909 by Mr. L. B. Marks, consulting engineer and ex-president of the society. The data given in this report is based upon several thousand measurements of illumination, and cover not only artificial light but daylight. This report was the first to call attention to the striking fact, that in the average factory lighting installation illuminated by the typical method of local lighting, the intensity of the illumination at night directly underneath the lamps is often several times as much as that in the same location in the daytime, when artificial light is not used.

It is certain that a stage has now been reached at which it is desirable to consider the possibility of making recommendations for "adequate lighting" more definite. In order to do this the necessary data and statistics must be accumulated. Actual measurements of illumination are most valuable for this purpose, although there are many other matters, such as the location and arrangement of lamps, the color of the light, and the absence of "glare," which are extremely important. In the absence of complete information it may be necessary in many cases to be satisfied with wide and general recommendations for the moment.

It must not be assumed that the provision of sufficient light is all that is needed. It is almost equally essential that the light should be wisely diffused. One of the greatest defects to be met with in much of the factory lighting of to-day is that the lamps are not sufficiently shaded, and are too frequently placed in positions in which they dazzle the eyes and impose a distinct strain. Very few of the modern illuminants are sufficiently mild in intensity to be used at close range. When the eye is forced to encounter these bright lights it naturally adds to the strain of the work. An unshaded electric lamp of only one candle-power if used continuously in the immediate field of vision, may be sufficient to cause severe eye strain. In general, lamps should be screened by some form of well-designed reflector which, besides minimizing the glare, directs the light downward on the work, where it is actually needed, and not in the eyes of the operator.

Another point that requires attention is that the lamps should be placed in the proper position. In writing, for example, it is a continual source of inconvenience if the lamps are situated on the right side, so that a shadow of the hand is cast over the page. The light in such cases should, of course, come from over the left shoulder. This defect is not uncommon in banks and offices. It need hardly be added, that in mechanical operations, such as cutting and drilling, the proper direction of the light is even more important. Still another defect in lighting to be guarded against is in unsteady and flickering sources, which contribute to eye injury probably far more than mere lack of light.

Indeed, any defect in the lighting tends to increase the strain of employment and is prejudicial to general health. There are certain occupations which are especially trying to the eyes, such as textile work, sewing, lace-making, engraving, watch-making, and printing, where good illumination is particularly essential. In fine lithographic and photographic work (in which the operator has to observe closely the behavior of the glowing filament), welding, glass-making, and other industries, special precautions have to be taken owing to the glaring effect of brilliant incandescent surfaces.

Good illumination, in assisting an operator in his daily work and diminishing the number of absentees through ill health, is naturally a matter of considerable consequence to manufacturing concerns, especially in those states and countries where workmen's compensation laws are enforced. Insurance companies, which have to meet claims for compensation arising through ill health traceable to bad lighting, find this subject of much importance. It is quite reasonable to suggest that when sufficient statistics are available it can be shown that a great deal of ill health of various kinds, now otherwise attributed, is more or less directly due to this cause.

But the value of good illumination is equally important from the point of view of safety. Those who have studied this subject are well aware of the considerable number of accidents resulting annually from defective lighting. A leading casualty insurance company of New York recently placed bad lighting in a list of accident causes, stating that "the greatest number of accidents occur during the months of diminishing light."

A prominent official of one of America's largest manufacturing companies is authority for the statement that "insufficient illumination" is frequently held by juries to be "contributory negligence," and in the defense of accident suits the lawyers of this company find it a valu-

NO DIRECT LIGHT IN EYES; LIGHT CONCENTRATED WHERE NEEDED

MORE LIGHT IN EYES THAN ON WORK. POOR DIFFUSION. WRONG LOCATION OF LAMP

able point to offer testimony by a competent witness to prove the adequacy of lighting arrangements in this company's plants.

Experience has thus shown it is in the dark winter months, when artificial light has to be largely relied upon, that mishaps mainly occur. It has also been noted that a relatively large number of accidents occur after 4 P.M., this being the time at which artificial light becomes necessary in the winter-time, and that the amount of spoiled work during this period is exceptionally great. There has not yet been concerted effort to trace the percentage of accidents that may be fitly ascribed to poor lighting; but it is highly probable that many unexplained mishaps could be found due to badly placed lamps or insufficient illumination.

It is of utmost importance that the illumination of dangerous machinery be sufficient. It is not of much value to place a guard round a dangerous machine if the light is so poor that every moving part cannot be clearly distinguished, and many a machine that would be considered safe in a well-lighted room becomes extremely dangerous if allowed to run in semi-darkness.

Serious accidents completely demoralize a shop. This demoralization may last for a day or a week. During this period of distress and excitement the operatives are inefficient and expectant of further trouble and the rate of production drops, while spoilage and "seconds," due to nervousness and inattention, increase. Considering also that the absence of employees is greater and the whole spirit and morale of the plant broken down, the economic advantage of accident prevention becomes apparent. It is safe to say that good illumination would probably prevent 25 per cent. of the avoidable accidents.

At the Congress International des Maladies Professionelles held in Brussels in 1910 a special recommendation was made for adequate lighting of dangerous machinery. The Department Committee on Accidents in Factories in Great Britain has also stated that inadequate lighting is a "very frequent cause of accident and of grave danger."

In many foundries the danger arising from insufficient lighting of passages is constant. This often causes men to stumble over slight imperfections in the floor, and in the case of a worker carrying a ladle of molten metal a slip of this kind has serious consequences. When a man's eyes have been dazzled by looking at molten metal he cannot see where he is going. The frequency of accidents among men working overtime at night or in the early morning in ship-building yards is ascribed to the difficulty of seeing what takes place by the feeble light available. A bright light placed at the top of a flight of stairs or in front of some obstacle may actually be the cause of a man stumbling over it, owing to his eyes being dazzled. This occurred only recently, when a man walked off a platform directly under a strong light and was killed. Many other instances of the way in which imperfect lighting leads to accidents could be mentioned.

Besides the avoidance of dazzling lights as before mentioned, the direction from which the light comes is very important. In all establishments where the hand is held quite close to the sharp cutting-edge of a tool, a heavy shadow momentarily obscuring the tool, may not only lead to spoiled work but also to mutilation of the operator's hand.

Good illumination in mines is, of course, supremely important. Here, as elsewhere, it is one of the most effective safeguards against accidents. The question of the peculiar conditions prevailing in mines and their relation to eyesight is a vital one, as it affects such a large percentage of the working population. Recent concern has been caused by the spread of a nervous affection of the eye known as nystagmus. According to the opinions of certain celebrated physicians, the affection is due largely to the defective illumination produced by the miner's lamp.

In a paper recently presented by Dr. Llewellyn before the Royal Society, London, he states that in one year, 1,618 men received compensation due to nystagmus, which is now coming to be regarded as an industrial disease. First among causes of the affection he placed defective illumination. An important suggestion is that "the presence of nystagmus, unsuspected or otherwise, may often be the cause of what is not unnaturally attributed to deliberate negligence." In other words, a defect of vision of this kind, besides being a source of loss to the employer and suffering to the victim, may indirectly endanger many lives and constitute a grave source of danger.

The lighting conditions in many mines do not favor maximum production or the safety and health of mine workers.

The open-flame torch, with its uncertain light and objectionable smoke, is a constant source of danger because of the frequent outpouring of gases as the vein is mined. The Davy Safety Lamp, if not broken by careless handling, eliminates this danger, but it is at the expense of illumination.

From time to time inventors have endeavored to solve the problem by portable electric lamps of various designs, the electricity being supplied by primary or secondary batteries.

The inherent defects of primary batteries, however, are greatly increased when an endeavor is made to construct them of small compass and light weight, with sufficient watt-hour capacity to "burn" an incandescent lamp for any length of time. Then, too, the expense and trouble of constant renewal of the zincs and the destruction of the wearer's clothing by the leaking or spilling of the acid have served to remove these batteries from serious consideration.

The lead-sulphuric-acid storage battery has also proved unsatisfactory, because the virulence of the acid permits the use only of hard rubber or like substance as a container. The nature of such substances makes it practically impossible to keep a vessel liquid-tight when subjected to the rough handling incidental to portable use.

The weight of lead also militates against the use of such a device. The chemical and mechanical weaknesses of a lead battery—the necessity of the frequent measurement of the specific gravity of the electrolyte, the constant care lest the cells be overcharged or left in a charged or discharged condition for too long a time, the corrosion of metal parts and adjacent fixtures by the gases evolved or the escape of the solution — all of these considerations have scarcely recommended a lead battery for portable use by men engaged in the roughest kind of work.

The plan of making the electrolyte in gelatinous form to overcome the leakage, has long since been shown impracticable, as such a composition is soon dried by decomposition of the water when charging, and it is difficult to make the jelly absorb water when once dried. Among other disadvantages, cracks form, and, becoming filled up with sediment, result in short circuits.

The Edison electric safety lanterns are the culmination of years of persistent effort on the part of their inventor, Thomas A. Edison, to solve the difficult problem of safe mine illumination.

In the Edison storage-battery lamp the elements in the potash solution are held by a strong nickel-steel container, hermetically sealed, except at one miniature outlet for the escape of harmless gases which are given off when the battery is charged. The container and outlet are so constructed that even when the cell is violently shaken and inverted the solution cannot escape. The gases given off on charge do not contain any substance to corrode the metal parts, nor is any injury done the cell when overcharged for a short or long period. The cell can remain charged, semi-charged, or discharged for an indefinite period without injury. The nickel-steel container is proof against rough handling.

Specific-gravity readings are not necessary because the inexpensive solution is supposed to be emptied out and replaced with new solution after about nine or ten months of continuous service.

There are no insulation troubles with the Edison electric safety lamp, no sediment to be cleaned out, no renewal of plates or separators, no buckling or growing of plates; nothing but a practical steel tank for the storage of electrical energy for use when and how the operator needs it.

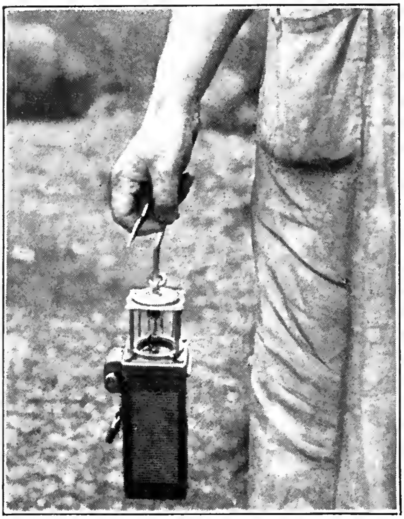
The battery consists of two Edison cells. The twin-conductor flexible cord is provided at one end with a terminal which, when shoved into the socket on top of the battery case, becomes fastened in such a manner that it is impossible to disconnect it until the lock on the side of the case has been removed and the lock bar in the top withdrawn. It is, therefore, impossible for a miner to cause a spark by disconnecting his wire in the mine.

The cap lamp is fitted with a reflector, a tungsten lamp, a socket for supporting the lamp and reflector, and a hook to fit into the regulation cap. The reflector is designed to distribute the light over the proper area so as to allow the maximum illumination. The lamp will burn on one charge continuously for ten hours; in an emergency, up to fifteen hours.

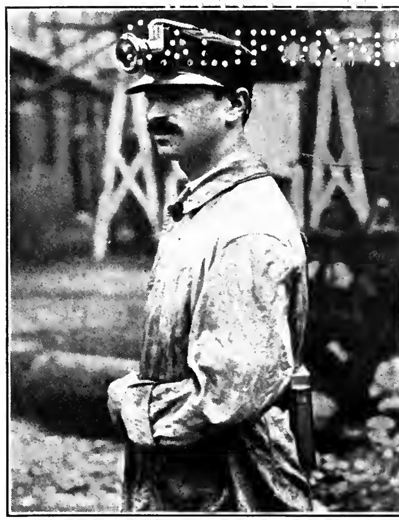
The battery case is attached by a belt to the back of the miner, the flexible cord leading upward through a guide in the back of the cap to the lamp attached to the leather support in the front of the cap, thus leaving the arms free. The complete outfit, without the cap and belt, weighs only three pounds and a quarter.

During the last few years there have been a number of valuable conferences and reports on the subject of factory lighting. Much interest has been taken in illumination by the Home Office in Great Britain, as exemplified in the recent reports of H. M. Chief Inspector of Factories, and the emphasis laid on good lighting by the recent Departmental Committee on Accidents. The Royal Society of Arts, which for more than one hundred and fifty years has made a practice of encouraging investigation on problems of the day, has been instrumental in offering prizes for safety appliances.

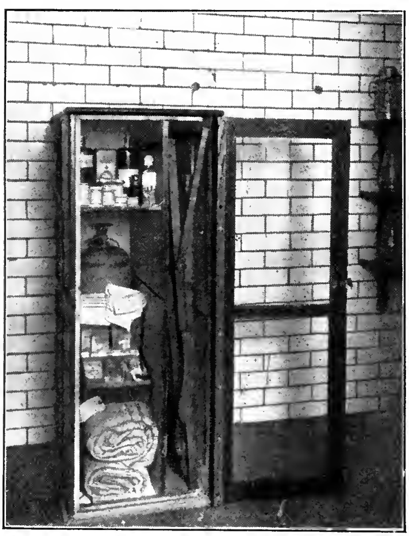
Dr. Thomas Oliver states: "As regards lighting of workrooms, a condition of health almost as important as ventilation, several of the more important countries have provisions. Germany, Austria, Holland, and France by their respective industrial codes recognize



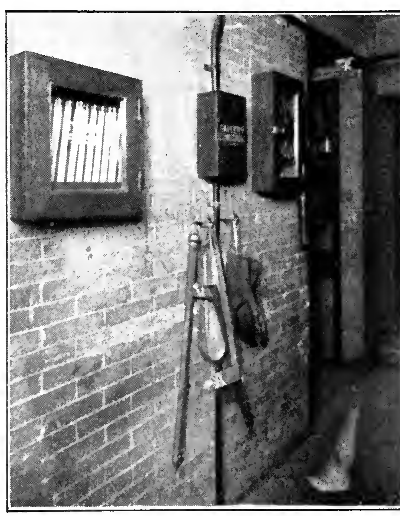
THE EDISON PORTABLE SAFETY LAMP FOR MINERS



THE EDISON SAFETY LAMP FOR MINERS



A NEW YORK EDISON EMERGENCY KIT



SAFETY DEVICES FOR THE ELECTRICAL WORKERS

sufficient light as an essential condition of health in factories."

In Milan the first Institute of Industrial Hygiene, under the supervision of Dr. L. Devoto, is now directing its attention to the industrial importance of good illumination. The German factory law mentions "sufficient light" as one of the conditions to which attention must be paid. The care taken in this respect by German manufacturers is, without doubt, due less to the law or any compulsion, than to their own recognition of the importance of good light in promoting efficient work.

A great step has been taken by the French Government in the appointment of a committee on the hygienic aspect of illumination, composed of prominent physiologists, oculists, engineers, physicists, and inspectors of factories.

The scope of this committee includes the determination, from the hygienic standpoint, of the composition and quality of combustible illuminants; the effects of injurious gases and the amount of heat developed; the effect upon vision of the various methods of artificial lighting; establishing a minimum for normal requirements of vision; practical methods of measuring light, and applying systems suitable to the leading branches of industry.

Of unofficial character but of incalculable value has been the work which the Illuminating Engineering Society in the United States has taken up so actively through its various committees, and the results of which have been gathered in its transactions as authoritative data on the hygienic aspects of lighting.

Very recently the Illuminating Engineering Society, at the request of the New York State Factory Investigating Commission, appointed a special committee of physiologists, lighting experts, engineers, and industrialists to co-operate with the Commission in the preparation of the proposed bill relating to lighting in the series of measures for safety and sanitation in factories and workshops shortly to be submitted to the Legislature.

This special committee held two meetings, and presented its report at the public hearing on the proposed bill, held in the County Court House, New York City, on December 6, 1912. The recommendations of the committee, subscribed to by a committee representing the American Museum of Safety, were accepted by the Commission at a later meeting.

Three important sections of the bill are as follows:

All passageways, and all moving parts of machinery unless properly and sufficiently guarded, where, on or about which persons work or pass or may have to work or pass in emergencies, and all other portions of the factory that the Commission of Labor may require, shall be kept properly and sufficiently lighted during working-hours.

A proper and adequate light shall be kept burning by the owner or lessee in the public hallways near the stairs upon the entrance-door, and upon the other floors on every workday in the year from the time when the building is opened for use in the morning until the time it is closed in the evening, except at times when the influx of natural light shall make artificial light unnecessary.

All workrooms shall be properly and adequately lighted during working-hours. Artificial illuminants in every workroom shall be installed, arranged, and used so that the light furnished will at all times be sufficient and adequate for the work carried on therein, due regard being given to the prevention of strain on the vision and glare in the eyes of the workers. The advisory board to the Department of Labor may, pursuant to the provision of this chapter, make and from time to time change or modify rules and regulations to provide for adequate and sufficient natural and artificial lighting facilities in all factories.

All American industrialists could profit by recommendations made by such a commission composed of their compatriots familiar with our conditions. International co-operation would be of immense assistance through comparative data. In order to arrive at conclusions which will be accepted throughout the entire civilized world it is essential at each step to have corroborative evidence by various authorities, and to make sure that the needs of different countries are borne in mind. It is also important to have available the results of researches made in the different trades independently, so as to avoid being misled by generalizations from the tests of a few individuals.

The question of adequate lighting installations throughout iron and steel plants presents for the illuminating engineer so many more widely divergent problems for his solution than are encountered in other fields, that a special presentation, covering work in this particular direction, seems advisable. Upon the solution of these problems depend in great degree the amount of production and the cost of this production based largely upon the safety, the comfort, and the consequent efficiency of the employee.

An iron and steel plant demands good illumination for a great range of departments and processes, through the executive offices, drafting-rooms, stock-yards, ore-bridges, blast-furnaces and gas-houses, bessemer, open-hearth, blooming, rail, skelp, slabbing, galvanizing, pipe, and wire mills, boiler and power houses, foundries, machine and other shops to its tracks and yards.

As the main object of operating a plant by night as well as by day is to double the output, good illumination at night is particularly necessary if the working conditions are to approximate those of the daytime. When a reliable system of artificial lighting is installed, the plant may be sure of continuous and satisfactory operation, and the same number of night operators may turn out the same amount of finished product as the day shift.

As a result of a study of lighting conditions in a number of mills and plants, it was found that the increase in efficiency due to good illumination was very marked, as measured by the output of the operators and the machines.

Considering a man and his machine or tool as a combination in the science of production, if the efficiency of the workman is increased by better working conditions the efficiency of the combination is likewise increased, the man and his machine producing a larger and better output, with a greater return to the employer on the worker's wages and the cost of the machine.

As materials form a very considerable part of the cost of production, good illumination results in economy of production through reducing the loss due to damage or destruction by improper manipulation or accidental spoilage.

In iron and steel plants especially is the adoption of good illumination an economical safeguard against accidents, as the work is fairly hazardous. Many of the workers are of foreign birth and unable to read or understand the English language, so that spoken or written cautions convey little meaning. The cost of accidents throughout many plants in the course of a year can be directly or indirectly charged to inadequate lighting.

So important are the lighting requirements of iron and steel works that they are receiving the special study of an increasing number of iron and steel electrical engineers. Several of the large manufacturers of lamps and lighting appliances maintain illuminating engineering laboratories and a large force of expert engineers whose duty it is to investigate conditions and to make recommendations covering the particular requirements. This expert advice is usually furnished free of charge.

While much has been written on the subject by physiologists and lighting engineers, there are very few generally accepted practical rules by which inspectors, representatives of insurance companies, managers, and superintendents can be guided.

However, there are several channels through which much valuable information may be obtained. Factory inspectors, as a preliminary to agreement on definite rules, might be instructed by the governments in their respective countries to take note of the lighting conditions in the factories visited, as well as the condition of health of the workers, in order to determine the relation between the two. In the case of trades known to be trying to the eyes particulars of the illumination and also of the eyesight of the operators should be noted. It is possible that occasionally the testing of the eyesight of the workers might meet with opposition on the part of the employers, or that employees might be found reluctant to submit to the test, fearing dismissal if their defects of vision became known. In such cases the inspector should be provided with credentials authorizing him to make such investigations, and explaining that they are carried out for statistical purposes and that the results will not be used to the disadvantage of employer or employee.

Such defects as misplacing of lamps, the use of imperfectly shaded illuminants liable to be prejudicial to vision, and inadequate lighting for dangerous machinery should be noted. In addition, as far as possible actual measurements of illumination should be made to supplement personal impressions. Although not yet perfect, instruments for the measurement of illumination have been very much improved.

Similar records should be kept regarding accidents. This matter is of considerable importance to insurance companies, beneficial societies, and labor associations which are concerned with compensation claims. It may be suggested that when an inquiry is made into the circumstances of an accident particulars should be taken of the general lighting conditions at the time and, if possible; actual measurements of the illumination.

If it could be done it would be to the benefit of several companies to arrange that an expert in measuring illumination as well as a physiologist should work together in making tests.

An improvement in the illumination of factories would benefit insurance companies in that it would diminish the risk of accidents to persons and machinery. Insurance companies should allow specially favorable rates to any business in which the illumination meets a prescribed standard. The employees would certainly be benefited, as they would work with less risk and under conditions tending to greater ease and efficiency. In this way the employer would soon recoup himself for the cost of improving illumination. In one company 43 per cent. time loss through injury or ill health was reduced to 10 per cent., a result due largely to improved illumination.

It is to the interest of an employer to secure adequate illumination on account of improved output and quality of the work as well as the contentment of the workers. The National Electric Light Association recently sent out a circular to a number of mills and general manufacturing concerns covering the entire country geographically, with a view to determining the attitude of industrial-plant managers on the subject of scientific lighting. Of two hundred and nine replies which were analyzed one hundred and sixty-four stated that recent improvement had been made in the lighting, the change generally including the use of high-efficiency incandescent lamps. Thirty-one stated that the quality of their product has improved materially as the result of better light, and sixty attribute to the same cause an increase in their output. Only seven say that they can trace no appreciable results. In the matter of efficiency and economy of the lighting itself forty-six plants report that as a result of substituting modern illuminants for older equipment, they note a decided reduction in their costs, and ninety-seven mention that the new illumination is a notable improvement over previous methods.

Twenty-six, or 16 per cent., of the replies mention specifically that the better lighting satisfies the operatives and overcomes many complaints.

The census experts give 1 per cent. as the gross spoilage in American manufactures in the year 1909, an item of approximately $150,000,000. Of this great amount 75 per cent. is said to have been made under artificial light. The experts agree that 25 per cent., or $28,125,000, of the spoilage could have been avoided by good illumination. The relation of seconds to lighting finds illustration in the cotton industry. Summer-made goods in certain classes are invariably listed at a higher price than those made during the winter, the explanation being, that owing to the inferior artificial light in winter, the quality of workmanship is not so good.

The initial expense of an improved lighting system in a factory is very soon offset by the gain in the quality and quantity of the work. Even an apparently expensive

8

equipment may soon prove true economy. In the experience of one company, it was found that on account of insufficient light the men lost from one to two hours daily on dark days, a complete loss of wages during that time.

A large textile mill in New England employs a consulting illuminating engineer to report on the lighting of the mill, with special reference to cutting down the cost of lighting. The mill purchased electric current for lighting at a cost of $10,000 a year. The consulting engineer reported that the illumination was inadequate and poorly diffused, and recommended an increase of 200 per cent. in the amount of electric current used for lighting. The installation was remodeled in accordance with the recommendations in the report, and the owners are now convinced that the increased expenditure for light has resulted in ultimate economy.

From practically every point of view of the employer, therefore, good illumination offers convincing arguments of economic advantage, to say nothing of the worker's comfort and safety, freedom from strain, and increased efficiency.

VII

FIRE

FREQUENTLY in laying out systems of fire protection the organization and training of a fire brigade fails to receive the consideration which its importance deserves. The most costly installation of pumps, water mains, and hydrants will prove of little value unless handled with skill and efficiency. The principle underlying a fire-brigade organization is fundamentally one of mutual protection; to the manager, the safeguarding and preservation of his plant; to the employee, the permanency of work and wage. When properly developed, such an organization promotes in some degree amicable relations and co-operation between the management and the employees.

Private fire brigades should be organized under a constitution, with their own by-laws, and with provisions for regular meetings. Conduct of the men should be subject to discipline, and acts of unusual merit involving personal risk and endurance be fittingly rewarded.

In department stores, theaters, and similar buildings, wrong constructional details will tend to limit effective work of the brigade in extinguishing small blazes, and fire-fighting of this type, as a rule, will be confined to the interior of the building. In mills, shops, and plants, including railroad terminal yards, any operation for fire protection will be mostly in the open, and generally of more extended character. Any plan of organization to be practical should provide for the features peculiar to each of these classes.

The efficiency of a fire brigade will be almost in exact proportion to the care and judgment exercised in the selection of its members, based upon discernment of character and a somewhat intimate knowledge of the men and their personal habits. The superintendent or manager, in performing this important duty, should have the assistance of the shop foremen and subheads of departments. The first consideration is loyalty. Only those men whose sympathies and interests are well established should be considered. Fitness for fire-brigade service requires a strong, robust constitution, unimpaired sight and hearing, some power of endurance, ability to think clearly and quickly in emergencies, and a high degree of self-control.

The age of members should range between eighteen and forty-five years; they should be able to speak and readily understand English; it is essential that they also have an exact knowledge of the character and construction of the building or plant which they are to help protect. This knowledge should include location of stairways, elevator-shafts, and the means of approach to attics and basements. It is, of course, desirable that members of the brigade should live as near the plant as possible.

The chief of brigade should be some one always in authority, in order to command the respect and obedience of the men. His duties should be such as to insure his presence at the plant the greater part of the time, preferably a master mechanic, store or factory manager, or his active assistant. The assistant chief should have some practical fire-fighting knowledge in addition to his mechanical training and experience.

FIRE BRIGADE AND MOTOR FIRE TRUCK AT THE PLANT OF FRIEDRICK BEYER, LEVERKÜSEN

THE NATIONAL CASH REGISTER COMPANY'S FIRE BRIGADE

As captains, men with mechanical knowledge are to be preferred; they, too, must possess sound and reliable judgment, and be capable of acting quickly in emergencies. For upon them will devolve direct supervision of the active work.

Company organization should afford the men special knowledge and experience in their respective duties. For the average shop plant there should be three separate companies—*viz.*, hose, chemical engine, and ladder company. But where buildings are provided with a complete equipment of stationary ladders the latter company may be omitted. For the department store and factory there should be a chemical-engine company and standpipe company.

A special detail of men should be designated to handle chemical extinguishers, fire-pails, and similar equipment. All employees, however, should be familiar with the use and handling of such apparatus.

A salvage corps should be maintained, with the special duty of protecting stock and machinery from water or other damage, both during and after a fire. For this work, men of at least average intelligence are required; they should be especially instructed as to the proper course to be followed in protecting the most valuable property first.

Attached to each fire-brigade organization and subject to the orders of the chief, or assistant chief, there should be an experienced plumber connected with the plant or store and familiar with the distribution system, location and operation of all valves; also a practical electrician having first-hand knowledge of all conductors, their voltage, and of the location and operation of all protective devices.

At plants where the fire service is supplied by fire pumps, it is advisable to have the engineer in charge and his assistants enrolled in the fire-brigade membership, in order that they may be in close touch with the purposes and objects of the brigade. During fires, and except when prearranged for fire-drills, the engineer and assistant should remain on duty at the pumps.

High efficiency for a fire brigade will depend mainly upon the frequency and character of the drills, which serve a double purpose—namely, promptness in reaching the point of danger and practice in handling of apparatus.

Alarms should be sounded unannounced at irregular intervals, at a time unknown to the men. There should be, in addition to the false alarm, another at regular stated intervals, semi-monthly, at a time known in advance. These latter drills preferably should be at an hour suited to the convenience of the business or plant operations. While these drills designed for practice work with the apparatus consume somewhat more time, they offer the only means for thorough training in fire-department work.

In the case of department stores and other similar risks where the public is generally present in large numbers, the sounding of a fire-alarm might result in a panic, and would therefore be impracticable. For these risks fire-drills will necessarily have to be held after the close of business hours.

When shop or other industrial plants are operated at night, provision should be made for fire-protection equipment and drills similar to that of the day force. Frequently for large plants remote from city or town protection, operating only a day shift, efficient night fire-brigade service may be had by organizing and drilling the watch-men, cleaners, and repair men who may be regularly employed at night. These men should be subject to the same general rules governing the day brigade, and regularly drilled to insure efficient handling of apparatus.

For the regular semi-monthly drills the brigade work should be thorough in every respect, closely approximating actual fire conditions. It should embrace the making of connections with hydrants, unreeling and stretching hose, breaking and making couplings, carrying hose up ladders and over roofs and through the interior of buildings, reaching at various times inaccessible and out-of-the-way places, including sub-basements, basements, attics, and all concealed floor and wall spaces. The drills should cover all buildings and departments, in order that the men may acquire an intimate knowledge of the interior arrangement and construction, including stairways, exits, and elevator-shafts, together with location of all hydrants and connections.

It is important that the men should become practised in holding the play-pipe and in moving and carrying the hose-line while under pressure. As a general rule, water should be turned on for all practice work, except possibly during freezing weather. At times, when conditions are favorable, a sufficient number of hose-lines should be stretched to test the maximum working capacity of the distributing system.

The presence of electric conductors near a building may operate to hinder the work of the fire brigade, through fear of contact with the hose stream. In order that the men may not be unnecessarily exposed to these dangers, and at the same time that the actual danger may not be over-estimated, and thereby delay the work of extinguishment, it is important that the men be fully informed of actual conditions. It would be of considerable advantage to give demonstrations of these conductors where there would be no harmful result.

It has been shown, as a result of a series of tests, that streams of fresh water may be played on alternating-current conductors under certain conditions without injury to the pipemen. With a one-inch nozzle at a distance of ten feet from an alternating-current conductor carrying 4,600 volts there was no appreciable effect beyond a slight shock to the hand. In these tests one side of the circuit was thoroughly grounded and the fire stream played on the other side, which was suspended in the air and thoroughly insulated.

The National Fire Protection Association is authority for the statement, that the total annual loss of life in the United States from fire causes is 1,500. In nine disasters alone during the past six years approximately 1,400 persons have been killed outright in addition to numberless maimed and injured. It is not claimed that all of this needless sacrifice of life could have been wholly avoided by the simple expedient of a fire-drill, as in some instances whole audiences were trapped, owing largely to inadequate and defective exit arrangements. It is true, however, that the absence of any adequate provision for effective regulation and control was an active contributory cause of the panic following discovery of the fire.

The primary object of a fire-drill is to prevent panic conditions by the enforcement of regular and systematic practice in the exercise of restraint and self-control. In this connection it is interesting to observe that these results, which are purely pyschological, are achieved by a series of evolutions exclusively physical in character.

The fire-drill is chiefly concerned with the determination of means and methods of utilizing to the best advantage such facilities as are provided, and should aim to adapt itself to existing conditions. It will often be found, however, that the institution of fire-drill practice will reveal conditions previously unsuspected and point the way for rearranging and improving the means of escape. In devising a system of fire-drills the first consideration is to recognize the two classes of persons whom the drills are to protect: first, those who are regularly present on the premises, such as factory operatives or children attending school; second, the general public.

Those disasters which have been most prolific in fatalities belong to the second class, and largely comprise buildings where the public is assembled in large numbers, and where congestion and overcrowding may be of frequent occurrence. The large percentage of women and children in these gatherings makes it doubly imperative that every possible safeguard be provided.

All factory drills should be under the direction of a supervisory organization constituted as follows: Chief of fire-drill, floor chiefs, room captains, stairway guards, and inspectors. These positions should be filled by male employees wherever possible.

The chief of fire-drill should have general charge of all matters pertaining to fire-drills, practice manœuvers and organization and the appointment of persons to fill the positions above mentioned. He should fix the time for holding drills, and rigidly enforce measures of discipline for failure on the part of any employee to fully observe all the rules and requirements. Also, by personal inspection he should see that overcrowding in workrooms is prevented, and that sufficient space is given to aisles and passageways, permitting quick access to exits.

Where department foremen or factory superintendents possess the requisite qualifications, their selection as floor chiefs is to be preferred. It is important that they be men having the trust and confidence of their employees generally, with a fair degree of self-possession. It is desirable that they possess the knowledge of more than one language. The floor chief should have immediate charge of all employees on his floor in all matters pertaining to fire-drills, enforcing all fire-drill rules, and reporting to the chief of fire-drill any employee who wilfully neglects their proper observance. He should personally supervise the sounding of the general building alarm on his floor, and be responsible for the working conditions, seeing that chairs or benches nowhere obstruct passage.

Where floors are subdivided into two or more rooms the floor chief should be assisted by the room captains. For floors of large area, the floor captains should designate a drill supervisor for every fifty employees, to assist in maintaining the necessary control and discipline. For these latter positions where men with the required qualifications are not available, it has been found feasible to make selections from among the forewomen.

Room captains should be chosen from those highest in authority, preferably a foreman or work boss. The same general care in their selection should be exercised as indicated for the floor chiefs. They should perform the same general duties in their respective rooms as are prescribed for the floor chief, subject to the latter's direction and supervision, excepting that they should have no authority to change the assignment of exits nor sound the general building alarm unless under direction of their chief. Where rooms are equipped with drill gongs the room captains should personally sound the alarm.

Men are to be preferred as stairway guards, and should be strong and alert, capable of acting quickly in emergencies. Two men selected from every floor should be assigned to each exit or stairway—one guard stationed on the stair side of the door leading from the room, and one guard midway on staircase descending to the next floor below. Where stair exits have sharp bends or are poorly lighted additional guards should be provided. On fire-escapes, where conditions permit, the arrangement should be similar to that outlined for stairways, with the exception that the guards should be stationed on the balconies or platforms instead of midway between the floors.

Guards should be subject to the orders of the floor chief or room captains, and should see that the march from the rooms and descending the stairway is orderly, without crowding, at uniform speed, with careful observance of spacing between files. They should be especially watchful of persons stumbling or falling, to prevent trampling, and should be given authority to halt the line when necessary.

An inspector from among the operatives should be appointed to examine each morning the condition of all stairways, fire-escapes, and roof exits, and to report immediately to the chief of fire-drill any obstruction found or any other unusual condition. He should also see that all doors leading to stairways or exits open outwardly, and immediately report any found locked or obstructed. During the winter season proper attention should be given fire-escapes exposed to accumulations of ice or snow, and whenever such condition is found immediate steps should be taken for its removal. Provision should also be made for testing the alarm system and all signaling devices every morning.

Fire-drills should be held weekly without notice, at different hours, and should include all employees in the building. It is advisable that the alarms announcing the drills for each trial should originate on different floors, in order to afford practice in changing the order of precedence for possession of stairways or fire-escapes. Where buildings are divided by fire-walls having protected openings arrangements should allow the transfer of all the occupants on a given floor in the fire section to an adjoining section on the same floor, or where provision is made for ascending to the roof, to exits that may lead to a safe retreat either on or in an adjoining building.

Drill practice should approximate military precision. All drill movements should lead in the direction of the exits, and follow in response to gong strokes, the first indicating the floor from which the alarm is given. Upon the first stroke all operatives should immediately cease work, rise, and as far as possible shut off power from machines. Thereafter each succeeding movement should be announced by single strokes on the smaller drill gongs, sounded by the floor chief or the room captain.

Upon the first stroke of the drill gong each operative should remove the stock, chairs, or benches nearest him in the aisles, placing the same either under or on top of the work-table or machine. Before the sounding of the second stroke all aisles and passageways should be cleared of obstructions and operatives ready for line formation, which should be announced by the second stroke. Line formation should consist of files of two, using the free hand to raise the skirt to prevent tripping those in the immediate rear.

The third stroke gives the signal to march to the door of exit passage, and each file should then move forward, observing a uniform spacing distance. The line should halt at doorway on an arm-motion signal from either the floor chief or the room captain, otherwise it should continue on to the stairway and descend, being subject only to the signals of the stairway guards.

Drill exercises should aim to bring into practice as often as possible all of the signals as mentioned, to insure against possible misunderstanding at a critical time. Upon reaching the street the line should be led away to a safe distance, to prevent crowding and confusion around the exit and danger from falling walls. For this purpose one of the room chiefs or drill supervisors from the first or nearest street floor should be assigned to the duty of leading the line away from the building. It is urged, as often as conditions will permit, that all employees at the close of business be dismissed through the drill exits.

Elevator attendants should be instructed to take cars immediately upon the first sound of the building alarm to the floor indicated, and hold themselves subject to the orders of the floor chief.

In assigning exits where the capacity of the fire-escapes is limited, the occupants of lower floors should be required to use the inside stairways, in order to reserve the fire-escapes for the use of the upper floors.

Where conditions permit it would be desirable in drills to use the regular entrances for exit purposes, on account of their familiarity to the employees constantly using them. In their selection, however, consideration should be given to possible exposure by local hazards, such as proximity to heating and power plants and any hazardous processes connected with the working of the factory product. It is also important, in arranging the fire-drill exits, to allow one or more, if possible, as entrance for the firemen. In these trials every available exit, including those reached by way of the roof, should be considered.

All alarm gongs used as fire-drill signals should be distinctive in tone, and never used for other than drill purposes.

For information of all employees, easily read notices should be posted in each room giving full instructions in all matters pertaining to fire-drills. These notices should be printed in the language or languages of the operatives.

The engineer in every factory, upon the first signal of the building alarm, should be instructed to shut off all power from machines and shafting throughout the building, except in cases where it would affect the operation of the fire pumps, elevators, or the lighting system.

While the subject of fire-drills and fire-protective measures for schools may seem out of place here, considering the subject from an industrial angle, it must be remembered that a large proportion of the children in every school are future employees in industrial establishments, where a knowledge of these same drills and precautionary measures is at a premium.

Because of this, fire discipline in schools should follow as nearly as is practicable the same general principles that experience has proven most helpful in the industrial world.

Fire-drill for public schools should be simple and direct. This can best be obtained by adapting the school organization, through its teaching staff, to the requirements.

The principal should, of course, be supreme; he should fix the time for holding drills and preserve a record thereof, showing the time required in each case to effect the dismissal of the entire school, and enforce measures of discipline for failure of any teacher or pupil to fully observe all regulations. He should designate as assistants one teacher on each floor, who, subject to his authority, shall have general direction of drill exercises. Upon these assistants must devolve the important duty of changing the assignment of exits, either by prearrangement in drill practice or as a result of actual fire conditions. The assistants should be authorized to sound alarms and instructed in the method of operating alarm boxes.

Each class will be under the immediate direction of its teacher, the most important factor for the success of the drill. Efficiency attained in school drills depends largely on the discipline maintained by the teachers. Therefore, any departure from the strict letter of the rules should be followed by proper measures of discipline, as a single act of untimely disobedience might at a critical time threaten the safety of the entire school. Under the direction of the principal, the janitor should make daily inspection of the premises, registering his rounds on a watchman's clock.

In schools where electric alarm systems are installed daily tests should be made, selecting for each trial a different box and reporting to the principal.

To avoid confusion in clearing the school, the precedence of each class should be determined in advance, and care exercised to prevent the lines of two or more classes crossing in reaching the exits. In order to obtain proper supervision of the line while descending stairways, one or more of the teachers on each floor should remain stationed until all of the classes have passed. No pupil should be permitted to leave the line for any other purpose whatever.

For fire-escapes the same general arrangement should be followed, excepting that the teachers should remain on the balconies, with not more than one teacher to each balcony. The practice of occasionally dismissing the school through the fire exits at the close of the session is also recommended.

In schools of the more advanced grades it will be found possible to organize a fire brigade from among the pupils for handling chemical extinguishers and hose streams from standpipes. For this work only the stronger boys should be selected from each class and regularly drilled under proper direction. But in no case should this work interfere with the dismissal of the school under the fire-drill. Where pianos or other instruments are available the use of march-time music is strongly recommended.

No general alarm for fire-drill in any school-building should be sounded on a gong used for other than fire purpose. An auxiliary fire-alarm box connected with the public fire-alarm system should be installed in the school near the main entrance, and the sounding of this alarm should be the duty of the janitor.

There should be displayed in each class-room a card of instructions containing all rules and requirements pertaining to the fire-drill, written in such a way as to be thoroughly understood by pupils of any age reading it.

The primary object of the fire-drill for the department store should be to afford training for its employees in the handling and control of the public under conditions of panic. This must be accomplished largely by individual instruction, and occasionally by execution of drill manœuvers after the close of business, when the public is absent. It is recognized as a serious handicap that these drills must be conducted with no opportunity for testing the working efficiency under conditions approximating actual service, and, if for no other reason, they should be given the closest supervision to insure the trained co-operation of every employee. As a large percentage of employees in department stores generally consists of women and girls, they should be instructed and drilled in taking prompt measures for their own safety. In times of need their example may materially assist in handling the general public.

Department-store fire-drill organization should include a chief of fire-drill, assistant chief of fire-drill, floor chiefs, captains, guards, and inspectors, in addition to all of the male employees over eighteen years of age. The selection and duties of the chief of fire-drill, his assistant, floor chiefs, captains, and guards are governed by practically the same requirements as those already discussed under factory fire-drills.

One or more uniformed inspectors, preferably with fire-department experience, should be employed for day fire-patrol duty, and should make regular rounds of the building, registering on an approved watchman's clock. The rounds should cover all fire-escapes, stairway exits, doors and windows, where the latter are used as exits to fire-escapes or stair towers. The report of inspectors to the building superintendent should cover these points. In addition to the duties mentioned the inspector should also make a daily test of the alarm system. For large department stores of more than 20,000 square feet ground area it is advisable to have an inspector for each floor.

The employees in each department or fire district should be organized into separate companies under the direction of the department manager or the assistant manager, having the title of captain. For fire-drill purposes each floor should be divided into fire districts, with as many districts as there are departments, excepting that the total floor area of each district should not exceed 7,500 square feet, preferably 5,000 square feet. Special provision may be made for those departments where the nature of the stock requires large floor space, and where there is less congestion of both patrons and employees. This would apply to stocks of furniture, carpets, and pianos.

Fire-drills for instruction should be held at least every two weeks, either before or after regular business hours. They should be orderly, without confusion, conducted with marked precision, and the movements should be as simple and few in number as possible.

In the organization of each company there should be designated not less than four of its members to lead the lines, in descending stairways and tower exits to the street floor.

Upon the sounding of an alarm in any fire district the fire-drill companies in the two nearest districts should assemble and stand ready to render any assistance required. These companies may be used to advantage where the regular exits for the section where the alarm is sounded are exposed or cut off by the fire, by assisting in the formation of lines and leading them to other near-by exits.

When stores are divided into sections cut off by fire walls with standard openings, the drill exercises should be directed to their use in preference to stairways and fire-escapes.

Women and girl employees, and boys who are not members of the fire-drill of the section in which the alarm is sounded, upon the first signal should be at attention and assemble for line formation.

When conditions permit, the line should be led off to other exits than those to which the public may be crowding. No employee should attempt to secure any property from locker or cloak-room.

Elevator attendants should remain at their posts of duty and continue to carry passengers, until otherwise notified by the floor chief or captain.

The alarm should be distinctive, but of a type not likely to be recognized by the public; for this reason the ordinary fire-gong is objectionable, because of its association in the public mind. The use of bells somewhat larger and of a softer tone than telephone-bells is preferred; in some cases small air-whistles may be used.

The records of almost every theater disaster will show that the critical moment in determining the fate of the audience has been at the instant following the first indication of alarm, and that many, if not a large majority, of these disasters could have been wholly avoided had there been some prearranged plan for concerted action on the part of the house employees.

Fire-drill training for theater attendants should therefore be directed more to the prevention of panics than to futile attempts at regulating the movements of a panic-stricken audience. The wide disparity in number alone between the available house force and the audience makes any attempt at such regulation ineffective.

To insure the best results, all employees permanently connected with the theater should be organized into fire-drill companies, with special duties assigned to each.

While it is necessary and important that the members of these companies be drilled and instructed in the handling and use of all fire equipment and properly trained in the work of fire extinguishment, the first consideration is the safety of the audience, and every possible effort should be made in rendering assistance to the ushers in effecting a prompt and orderly dismissal of the audience. This work will devolve mainly on the house employees in the auditorium and business offices, including the door attendants. Fire records show that almost all theater fires originate on the stage, and that in the auditorium they are of infrequent occurrence.

All fire-signals should be transmitted by an electrically operated alarm system. Recording apparatus should be placed in the main business office or in the box office, and also in the office of the stage-manager, provided there is some one on duty in these offices during the entire performance.

Upon receipt of an alarm by the stage-manager, or when fire is discovered in the stage section, before an alarm is struck the curtain should be dropped immediately, or some one of the actors designated by the stage-manager should come before the curtain and announce the discontinuance of the performance. Upon the wording of the announcement and the manner of its delivery will depend largely the conduct of the audience, and it is strongly recommended that a form of announcement be prepared and printed or typewritten, and copies thereof placed at the punching register, and also in the hands of the various stage employees. The announcement should be brief and calculated to allay any feeling that the unusual has occurred. Some good reason other than the real one should be given for discontinuing the performance.

While the announcement is being made each usher and doorman in the parquet, balcony, and galleries will move forward in the aisles and give direction to each section as to the exit to be used. The orchestra should begin playing suitable march-time music. It has been repeatedly shown that the orchestra offers one of the most effective means known for controlling theater audiences in times of threatened panic.

The seating-plan on each balcony, as well as on the main floor, should be divided into sections, and to each section there should be assigned certain exits, according to the relative discharging capacities, so that the time required for discharging the number apportioned to any one exit would average about the same for all. Each usher and doorman should be provided with a copy of the seating-plan, on which should be indicated the exit assignment in detail. Ushers should be required to remain on duty in their respective sections throughout each performance.

Fire-alarm boxes should be placed where they can be conveniently reached; but not in general view of the audience. For the average theater there should be a box on each side of the parquet on the wall in the rear of the last row of seats, and one box in the main lobby near the doorway. For balcony and galleries there should be two boxes, one at each side and behind the last row of seats. For the stage there should be one box on the rear wall, and a box on each side near the proscenium wall, and, where necessary, additional boxes in dressing-rooms and carpenter shop. The boxes in the auditorium should operate as noiselessly as possible, to avoid calling attention to them. An auxiliary box connected with the city alarm circuit should be installed in the stage section and in the main business office.

The practice of assigning firemen in uniform to theaters during performances is to be commended, as their presence may serve to reassure the audience in case of alarm and will be of valuable assistance in the work of extinguishing fire.

In addition to the lights over the exits there should be a number of signs, preferably of the illuminated type, conspicuously displayed on each floor, indicating the location of all exits.

The fire-drill organization should consist of two companies, each under the direction of a captain. One company should include all employees in the auditorium and offices excepting the ushers and orchestra. A second company should include all employees in the stage section. The captain of each company should be some one in authority: for the company first mentioned the house-manager, or one of his assistants; for the second company the stage-manager, or one of the more intelligent stage mechanics.

The chief stage electrician should be attached to the second company, and be subject to the direction of the captain. He should make a daily test of the alarm system from alternate boxes and keep a record thereof.

Where automatic sprinkler systems are installed, all valves controlling the water-supply should be strapped open and regularly inspected by the house plumber, who should report weekly to the captain on their condition.

One member of each company should be assigned to make daily inspection of all fire-escapes, exits, and stairways, and where doors are not provided with automatic opening devices to see that they are unlocked and ready for instant use. As before mentioned, particular attention should be given to fire-escapes exposed to accumulations of snow and ice. Prompt report should be made to the house-manager of any condition existing in violation of rules.

Cards of instructions containing full information regarding rules and duties for fire-drill work should be posted in both the auditorium and stage sections.

VIII

TRANSPORTATION

A DISCUSSION of the problems of transportation, as they affect the safety and health of the traveling public, must not be considered in the light of instruction for the technician, who, of course, has more immediate and detailed sources of information than could be furnished in the space at hand. However, summarized information and statistical abstracts are always valuable, both for the instruction of new men and for the inspiration of those holding different grades in the service.

No one knows better than the chief of the operating department of a street-railway system what the changes made since the old days of the horse-drawn car have accomplished. For example, take the case of the type of car known as the prepayment. The first step in its evolution was a lengthening of the rear platform. Then came the side doors, with the attending complication of whether they should slide or fold. The provision of folding steps dependent on the operation of the door was also a serious problem. At one stage it became necessary to find some speedy method for the conductor to collect his fares without lessening the attention he should give to the passengers. Fare registers of a variety of types made their appearance. At first it was a hunt after the lost nickel, but gradually stress came to be laid on prevention of accidents. Fifty dollars paid for damages to clothes or the feelings of a passenger rolled in the dust, was seen to represent a thousand nickels lost at one stroke.

Push-buttons to indicate the passenger's desire to alight, comfortable seats, well ventilated and lighted cars, exit doors pneumatically controlled, avoiding in great measure the risk of injury, and a high grade of skill and intelligence in the crew are conditions which the street-railway management must provide to-day if it is to make the business of transporting the public safe and comfortable.

The modern, thoroughly equipped prepayment car requires the motorman to operate controller, air and hand brake, alarm gong, and sander, and sometimes air-operated fenders or scrapers. The really important new duty of the motorman is the opening and closing of the exit door and step, a hand or foot operation occurring many times daily. The next important step will undoubtedly be the provision of some kind of an interlocking device that will make one initial movement automatically set in motion the sequence of stopping or starting operations. With improvements in cash-registering boxes and other recording devices the conductor need only be concerned with issuing transfers, making change, and calling out the streets.

All this means that the use of the latest type of prepayment car demands a high grade of physique and mentality in its motorman; but in the case of the conductor, strength and intelligence are secondary. In preventing accidents to the traveling public trained intelligence is a prerequisite.

It has been found that side doors with folding steps materially lessen the boarding and alighting accidents. Another advantage is that they anticipate municipal requirements for adequate protection from the weather. The Capital Traction Company, Washington, District of Columbia, uses a pay-within type of car for the sake of reducing accidents to a minimum. Damage costs expressed in figures are: 1 for the pay-within, 4.03 for the pay-as-you-enter, and 14.8 for the non-prepayment. The same company has drawn up a table of settled claims for boarding and alighting accidents.

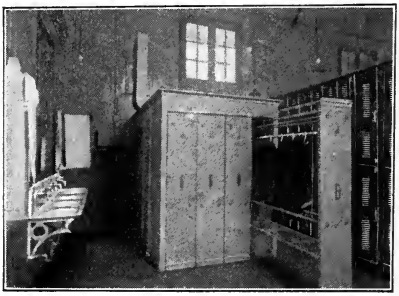
TYPE	MILEAGE	COST PER 1,000 MILES
Non-prepayment	3,663,143	1.97
Pay-as-you-enter	1,893,440	.53
Pay-within	2,405,792	.13

In November, 1911, there were 10 serious injuries as compared with 20 for the same month in 1910. For November, 1911, there were 14 accidents on pay-within cars, as follows: boarding standing cars, 3; leaving standing cars, 6; slipped in street upon leaving standing cars, 4; car starting without signal, 1. It will be noted that but one of these accidents was due to the negligence of the company or its employees.

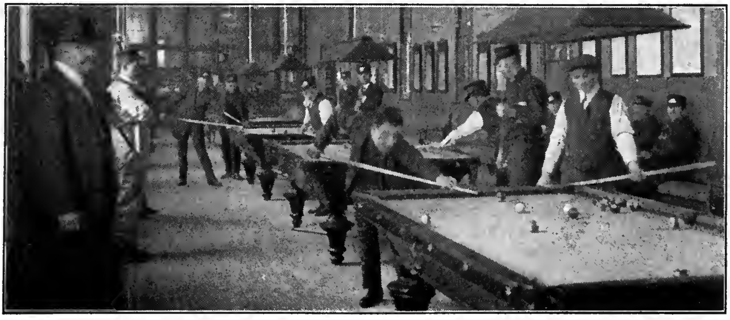
The business of the trolley company is selling transportation, which in most cases is done on the platform of the car. Except in the purchase of tickets, the business transacted is retail, and the car platform the salesroom. Every improvement on the conductor end of the car relieves him of the operating responsibility, and, by putting it all on the motorman, enables him to make safer and prompter starts and stops; in other words, a greater degree of safety for the traveling public. How can the company improve the human factor of its service? One excellent method is the practice of written examinations in accident prevention compelling thought; just as soon as

AT THE LUNCH-COUNTER

CLUBHOUSE FOR EMPLOYEES



DRYER FOR MEN'S WET CLOTHING



IN THE RECREATION-ROOM

MUTUALITY AT THE BROOKLYN RAPID TRANSIT COMPANY

an employee gets the think habit, that moment the management has a real asset and the man is on the road to promotion. It is not a memory, but an intelligence test. This kind of a safety device is in operation on the Buffalo, Lockport & Rochester Railway system and is yielding results. The plan could be improved by the offer of a monthly cash prize for the best answers.

The motorman and conductor are in a class all by themselves. Unlike any other position in the world, paying an equal remuneration, but little preparation either mentally or financially is necessary to become proficient in handling a street-car properly. The greenest young man who never saw an electric car can walk into an employment office on Monday, and on the following Sunday be earning twenty-three to twenty-eight cents an hour, when to reach such a remuneration in any other employment it is necessary to go through years of technical training in schools, or start at the very bottom, spending years learning the work.

The attitude of the public is not always the most helpful in maintaining a high tone in this service; and again, the environment of car-barns and waiting-rooms does not tend to impress upon car-men the importance of their work. But at this very point, those in charge of the crews must possess the ability to impress them in such a manner as to make them realize the importance, even the dignity, of their work.

These unfavorable conditions can be eliminated by the provision of social centers for the men, where they may find wholesome relaxation for those feeling thus inclined, and for the more serious, opportunities for reading and even study. It would pay a company many times over to provide a labor secretary, whose entire time should be at the service of the men to advise them on any point which they should bring, not only about their work, but on any phase of their life. Such a secretary must possess tact, discretion, and sympathy; he must be a good "mixer," in the phraseology of the politicians. In a very short time the good effect of this personal contact with the crews would yield results; the men would then operate as if their own success or failure depended on the result. The men would come to inquire how they could win promotion, what qualities their superintendent was looking for, and would take a personal interest in what otherwise would be routine and mechanical.

The Delaware, Lackawanna & Western Railroad Co. safeguards the lives and promotes the health of its employees and the traveling public by general regulations and special instructions defining and prescribing the respective duties of employees in language so clear and plain as to leave no room for misunderstanding, but requiring, at the same time, that in every case of doubt of correct interpretation an employee must apply at once to competent authority for explanation.

Employees in every branch of the transportation service are carefully examined on their knowledge of the rules affecting their duties, their own safety, and that of the traveling public. They are likewise examined under regulations prescribed by the company's medical department on their acuteness of vision, hearing, clear perception, and general physical condition before being assigned to duties where perfection in these respects is requisite.

Employees are forbidden to employ their time while off duty in a manner that may unfit them for the safe, prompt, and efficient performance of their respective duties. They are strictly enjoined and required to use their time while off duty primarily for obtaining ample rest. The use of intoxicants by employees in transportation service, while either on or off duty, or the visiting of saloons or places where liquor is sold, incapacitates them for such service, and the habit is therefore absolutely prohibited.

The service demands faithful and intelligent discharge of duty, and to this end promotions are based on fitness and capacity for greater responsibility.

This company has in operation, with excellent results, a Safety Department composed of general and divisional officers from the Transportation, Motive Power and Equipment, Engineering, and Maintenance of Way Departments, with a fair representation of employees of each branch of the service maintained by those departments for co-operative work in removing menacing obstacles or conditions, and for recommendations for improvements in facilities and practice.

Health is promoted by providing commodious living accommodations at the terminals for employees away from their homes, in buildings owned by the company, equipped with modern improvements and managed co-operatively with the Young Men's Christian Association, where, in addition to comfortable sleeping-rooms, ample meals and bath facilities, spacious reading-rooms with libraries, magazines, and other current literature, billiard-rooms, bowling alleys, and facilities for other entertainment are provided.

The systematic prevention of accidents on the lines and in the shops of transportation systems through the organization of safety committees will be treated in the chapter on "Safety Committees."

IX

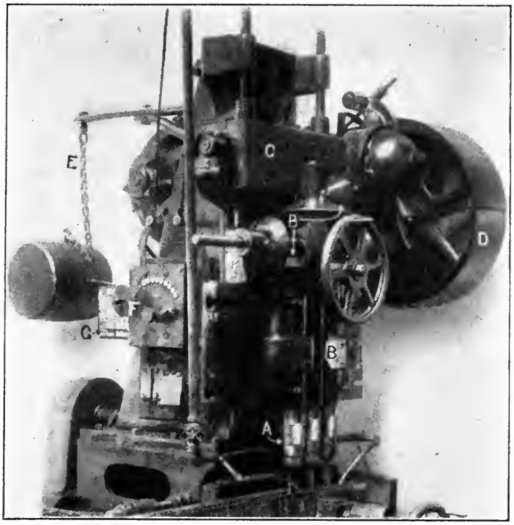
SAFETY COMMITTEES

NO one is so well informed of the dangers of any particular trade or process as the foremen and superintendents under whose care are the men and women to whom the accidents might befall. But the heads of departments often are indifferent, and more often do not like to suggest the expense of such safety devices as may be necessary to better existing conditions. It is indisputable that no one can point out better than these men who are in daily contact with them where the danger zones of machines and processes lie.

How is it to be brought about that the owners, the managers with their foremen, and the workmen themselves shall co-operate intelligently toward the end of safety in the works? The successful answer is, "The Committee of Safety."

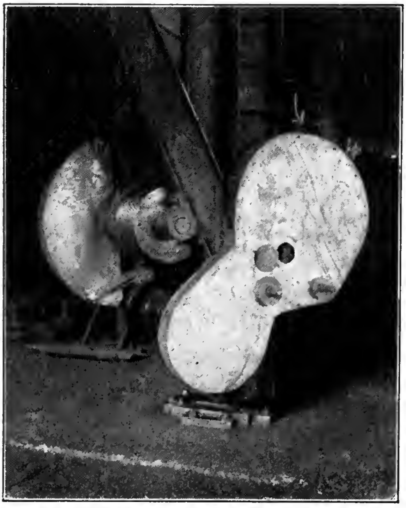
The organization and development of committees of safety among workmen and operatives in railroads, factories, mills, and shops is a most important factor of modern safeguarded industry.

As an instance of a national safety committee the German Empire may be cited, where there are some 700,000 individual or corporate industrialists, associated in 66 trade associations, representing every phase of industry. Through the investigations and reports of their technical experts they now possess the accumulated ex-

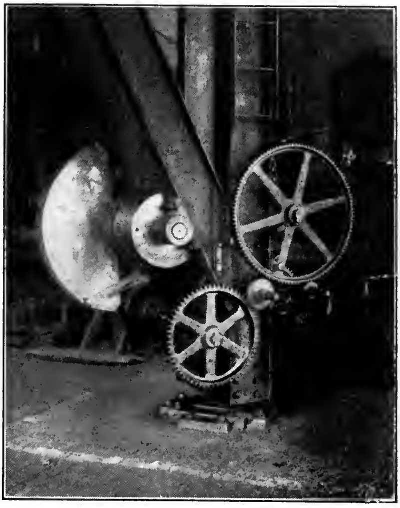


SAFEGUARDED MULTIPLE DRILL-PRESS

A—Drill chuck substituted for set-screws.
B—Gear-shields.
C—Shield over feed mechanism.
D—Shield over belt drive.
E—Safety chain on counterweight.
F—Fiber disk on controller handle.
G—Warning-sign.



SAFEGUARDED GEARS ON JIB CRANE



GEAR COVERS ON JIB CRANE REMOVED

CARNEGIE STEEL COMPANY

perience of twenty-six years in preventing accidents and promoting health. This forms a national committee of safety, a powerful engine for reducing the preventable accidents in the German Empire by at least one-half.

As a distinct branch of its work the American Museum of Safety is prepared to promote the committee-of-safety idea in railroads, factories, mills, and other plants, with practical suggestions for their effective organization.

Furthermore, it will stand back of the committee of safety once organized, by means of a special report service on such devices already in use as have proven effective in the best shop practice. This will include a photographic service for the use of draftsmen and works' managers.

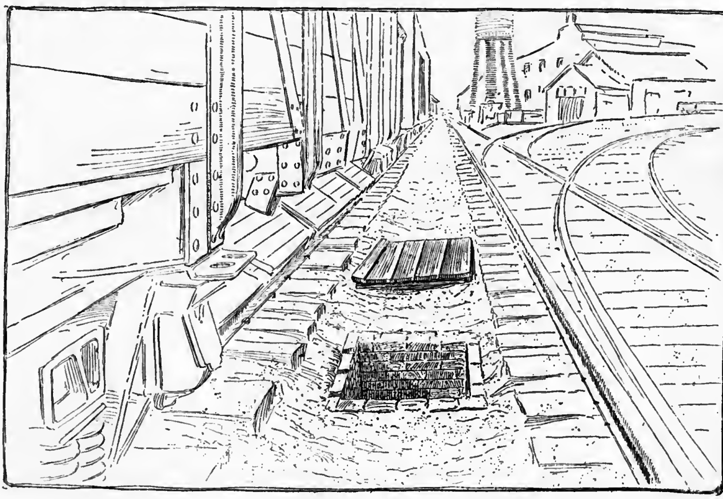
To stimulate safety and caution in the works, and to co-operate with the committees of safety, the Museum of Safety offers lecture studies and talks, illustrated with lantern slides, of the actual safeguards for machines and processes. The value of this practical demonstration has already been proven. "The Museum's safety lecture gave me the very opportunity which I had been vainly seeking, to bring together my men for a conference on this important subject," said a vice-president and general manager of a large plant, on the occasion of this presentation to a body of nearly one hundred men, none of whom was under the grade of foreman. "It is impossible for me to tell you," he added, several weeks later, "how this conference will raise the whole tone of the works and their attitude toward the use of safety devices for the protection of the men under them."

While all the subsidiary companies of the United States Steel Corporation were putting forth individual efforts to prevent accidents, the safety work was not taken up systematically until 1906. In May of that year the corporation called a meeting of the casualty managers of all the subsidiary companies for the purpose of discussing ways and means for preventing accidents to employees. From this meeting and later meetings there was developed the "Committee of Safety of the United States Steel Corporation."

This committee was first made up of six members, an officer of the Steel Corporation acting as chairman, and the five other members representing five of the larger subsidiary companies. Later, two additional members were added, making a total of seven representatives of the larger subsidiary companies.

The primary duty of this committee was to perfect a plan of inspection for the different plants and works of the subsidiary companies, with reference to the best methods of preventing accidents. In addition, the committee was to act as a clearing-house in obtaining and disseminating information and suggestions tending toward the safeguarding of employees. The committee was given power to select inspectors to go over conditions at the different plants and works, to make written reports upon the various methods of preventing accidents, and to suggest further means for the better protection of workmen.

The committee put into operation immediately a system of inspection, selecting men familiar with the machinery and operations of the different subsidiary companies, and sending them to inspect the mills and plants. These inspectors are also men of experience in matters connected with accidents, competent to detect sources of danger, and able to devise means of preventing them. They report directly to the Safety Committee. Their reports are exhaustive, taking up each building in the plant and covering it in detail. They call attention to the smallest sources of danger — worn floors, material piled carelessly, and windows that should be cleaned to give better light; their comments cover loose planks that workmen have left where they might cause falls; railings, ladders, footwalks, and set-screws are given the most careful scrutiny. Unsafe practices by the employees are investigated carefully, and suitable recommendations are made against them. The reports and recommendations



MANHOLE CARELESSLY LEFT UNGUARDED

of the inspectors are gone over with care by the Safety Committee, and are then sent to the proper representatives operating the plant in question. The committee requests the company to submit, within thirty days, a return showing what action has been taken to carry out the recommendations of the inspector; or, if objections are made to any recommendations, the committee, or one or more members delegated for that purpose, makes a personal inspection of the plant with regard to any points in dispute.

At each meeting all the serious accidents that have happened are carefully considered, and recommendations made as to the means of avoiding similar occurrences, not only with regard to the company where the accident happened, but to all subsidiary companies.

The subsidiary companies themselves now have safety committees whose functions are similar to those of the Steel Corporation committee, but are confined to the operations of their own companies. In addition, there are plant committees, made up of foremen and the workmen themselves, who make regular inspections and suggestions as to how to prevent accidents. These organizations differ somewhat in the several companies, but the plan usually followed is to have what are called "Central Committees," "Plant Committees," and "Workmen Committees."

The Central Committee is made up of the important officials from each of the plants or mining divisions, who meet monthly at the head office of the company. As mentioned before, they discuss all serious accidents and recommend ways and means for preventing similar accidents, not only to the particular plant where the accident happened, but to all plants. This information is then sent to the Bureau of Safety in New York, and is again distributed to all the subsidiary companies of the Steel Corporation, with a view to avoiding a repetition of accidents. Safety devices and safety regulations are handled in the same manner. Consideration of the questions that come before this committee does not depend solely upon the judgment of its members; but it is the practice to obtain the advice and judgment of men at the works who are specialists upon the particular branch of the work involved in the question under consideration. The recommendations of this committee are accepted and put into force at all plants without question, unless some special circumstances make it impossible to do so.

"Plant Committees" are made up of superintendents, assistant superintendents, master mechanics, and safety inspectors. They hold weekly meetings at some plants, and at others daily. They discuss operating questions, safety matters, proposed safety devices, and accidents which have occurred since their last meeting. Each department of the plant has a committee of foremen. It is the duty of this committee to make regular inspections, monthly or weekly, as the plan may be, to see that all safety devices are installed and all safety regulations enforced. Other duties of this committee are to investigate all serious accidents. In making this investigation they go to the scene of the accident, examine witnesses when necessary, and make a report as to what they think can be done to prevent a similar accident; also whether, in their opinion, any one was negligent, and what they think should be done with the negligent person. Careless men are laid off or discharged on the recommendation of these committees.

The Workmen's Committee usually consists of three members, and is made up from the rank and file of the mill or plant. The members of the committee are allowed sufficient time once or twice a month, or as often as once a week in some plants, to make an inspection requiring from a few hours to a whole day, according to the size of the plant. Workmen are paid their regular rate of wages while making inspections.

The duty of this committee is to look for defects in buildings or equipment, unsafe practices at work, and any other conditions in the plant which might be the cause of accidents. After each inspection they report in writing to the plant committee such matters as need attention, with such recommendations as, in their opinion, will prevent accidents.

The make-up of these committees is changed frequently, with the result that in time every man in the mill will have been a member of one of these committees. The men are made to understand that after they have served their time upon the committee they should not drop the work, but continue to make suggestions. A good many suggestions come from ex-members of these committees.

One inevitable result of the work of a safety committee where there are many subsidiary companies, is the standardization of safeguards in the interests of practicability and economy. This is exactly what happened in the case of the United States Steel Corporation, which has just issued a book of standard requirements for safety, prepared under the direction of the Committee of Safety, embodying the experience of the subsidiary companies and the committee in preventing injuries to employees. It is to be used as a guide in standardizing the safety appliances and precautions necessary to protect employees from the dangers incident to machinery and working conditions, and aims to insure the provision of efficient safeguards and proper working conditions at the time construction work is planned and machinery installed.

It is also the plan that present operations and equipment should conform with these suggestions so far as practicable when replacement and repairs are made.

Further suggestions for additions and improvements in safety devices and working conditions are always invited.

Through its Committee of Safety the Pennsylvania Railroad reduced its serious shop accidents 63 per cent. At first the idea of a safety committee met with considerable discussion as to what should be the character of its membership, as it was feared that, if workmen were allowed to make recommendations and some of these were not carried out, the men might develop a "grievance"; hence this question as to the make-up of the committees was left to the judgment of the various operating officials, with the result that there is wide diversity in the nature of the occupation of the members. As a rule, the chairman is never lower than foreman. While the terms of service vary, there is practically unanimity as to rotation of membership each three months, thereby insuring that a majority of the members will become experienced and familiar with the work in hand. These committees report quarterly, and the members are paid full time and expenses.

The duties of the Safety Committee are as follows:

First: To make periodical inspections of all departments, each to be investigated at least once in every three months.

Second: To report to the master mechanic the results of the investigation, giving the committee's recommendations for any additional protection deemed advisable, such recommendations to include the cost, if any, of carrying out the same.

Third: To make thorough investigation of all accidents and furnish a report, giving their conclusions as to responsibility for the accident, and recommendations both as to discipline to be applied and action taken to prevent a recurrence.

Fourth: To report quarterly, giving general summary of work done by committee for said quarter, such report to be in shape for transmission to superintendent of motive power for the information of the general superintendent and general manager.

This committee work has also been greatly extended to cover the road and yards, and the reports of these committees show excellent results.

A study of the reports of the various committees shows that they differ considerably in the character of recommendations made, and in their individuality; while some refer chiefly to safety features in connection with train movement, others consider features of a mechanical nature, of construction and electrical hazards. This has suggested the wisdom of exchanging committees on various divisions.

One safety committee, consisting of assistant trainmaster, as chairman, master carpenter, engine-house foreman, and assistant road foreman of engines, gave special attention to the practice of trespassing on trains and right of way. "Citizens on both sides of the yard seem to be almost constantly using the tracks in the yard instead of the public roads in going to and from their homes." "Chairman of committee saw the school mistress at the 'Y' school-house in company with ten or twelve of her small pupils using the track." "Police officer notified with regard to this, and instructed to take matter up with school mistress immediately, with a view to having her discontinue practice at once." The result is that this practice has been reduced to a minimum. This committee is also endeavoring to educate trainmen in regard to strict observance of all rules, orders, and instructions for personal safety in the discharge of their duties, and the protection of property.

From another division comes the safety report that there should be wood platforms at all telephone boxes as extra protection against lightning and ground-rod, instead of grounding wire to iron post, set in cement which supports the box; better clearances between tracks and walls, scale, freight and other buildings, platforms, telegraph-poles, and trees with projecting limbs, boarding up lumber-cars having missing doors, through which pieces of lumber work out to the danger of employees and the equipment.

The safety committee of another division, which made one trip as a body over the whole division, reported, among other things which in their judgment menaced the safety of employees, such items as:

Switches found with spikes in jaws of the rod to take up lost motion, caused by wearing off.

First-Aid Boxes—sometimes carelessly kept and found only after difficulty. Should be kept handy for use at moment's notice.

Lecture given Fireman P—— for lying lengthwise on the footstep of side of polling-car.

Foreman car inspector has no medical box or stretcher.

Storage-Battery Department. Men frequently injured about face when prying open lids of batteries. Glasses recommended.

In only one tower, medical box found.

Found a section gang eating their dinner under the edge of a flat-car, across the rails.

Signalman reading books or newspapers while on duty.

An assistant train director made 124 recommendations for improvements, out of which 114 were definitely put in practice and 10 suggestions were referred to higher authorities. Only one suggestion was considered "not necessary."

The Safety Committee of the Altoona shops, in a later report, especially recommended that some uniform system be adopted for the cleaning of machinery, in some shops the rule being to shut off power at 11.30 on Saturdays; in others twenty minutes being allowed; in still others, but fifteen minutes. In some cases where there is a rush job it is necessary to start the machinery again. Definite rules were advocated, posted in all plants, stating the time allowed for cleaning. Machinery should never be cleaned while in motion. In selecting oilers it was pointed out that adults should be preferred, as a young person is not so likely to realize danger and to exercise proper caution. In this plant fully 90 per cent. of workmen operating machines are piece-workers, who claim time should be allowed for cleaning. If the time allowed is not sufficient, they take chances by cleaning while the machinery is in motion.

Complete covering of dangerous parts, so as to render them "fool-proof," was advocated, also that competent draftsmen study the situation and design effective guards, as many of those in use were only makeshifts.

In addition to recommending guards for all gears, belt and pulley drives, fly-wheels, and shafting, attention was called to exposed set-screws, need of hand-rails around trap-doors and other points of danger, the repairing of worn valves and parts of machines, more substantial car blocks, sidings too close to sheds, badly placed doors, escaping sewer-gas, rough board floor on bed-casting to prevent workmen from slipping, warning-signs, shields to protect workmen from flying sparks and metal chips.

Illustrating the value of repeated inspections, and a verbatim report of a divisional committee:

August 21, 1911.

SUPT. MOTIVE POWER:

DEAR SIR,—Your committee on Safety Appliances, in compliance with your request, have made an inspection of all the plants in our jurisdiction to note the progress made on former recommendations, and also to gather additional data to safeguard these plants. In submitting this report we beg leave to say that, taken as a whole, considerable progress has been made. The former reports which are in the hands of the authorities in the different plants cover in detail all the recommendations made, and are receiving attention, as will be noted in this report. It should be carefully noted that in former detailed report there was attached to same a number of general recommendations which were applicable to almost all the plants, and also the supplementary reports contained a valuable collection of information, which, if acted upon, would materially safeguard all the plants. There seems to be some laxness in following out these recommendations and suggestions, which your committee considers of the greatest importance, and we therefore suggest that a copy of these reports be furnished to each foreman, to be carefully noted, retained, and carried out as applicable and practical to his department.

In making this inspection your committee was approached by workmen in the different plants with complaints and suggestions, some of which were considered trivial, and others not proper questions for us to determine, as they could have been made to the foreman in charge for consideration.

Attached please find report of conditions as we found them in the different plants, together with complaints and recommendations offered.

Respectfully,

(*Signed*) MACHINE CARPENTER,
MACHINIST,
MACHINIST,
ELECTRICIAN,
WIREMAN,
Safety Committee.

As stated, the Safety Committee reports to the superintendent of the shops. The opinion of one of these officials is given in the following report:

I regard the work of the committee as being beneficial in several ways; first, in exciting the interest of employees in a direction outside their ordinary duties; second, in calling attention to defects which might otherwise have been overlooked by the maintenance men.

All the recommendations of the committee have been put into effect, the work having been done gradually and expense disposed of to the proper accounts.

In my instruction to the Safety Committee I told them they should not limit their investigations to any definite line, but anything they saw that, in their opinion, should be called to the attention of the operating officers should be included in their report.

January 1, 1913, there were thirty safety committees, with a membership of five each.

Since January 1, 1912, careful records have been made of the reports of accidents in shops, and the serious accidents show the marked decrease from about 300 per month to slightly over 100. While this experience is gratifying, greater results can be accomplished. The safeguarding of machinery and improvement of shop practices may be considered comparatively easy. In the shops, after everything has been done to safeguard machinery, there are questions of sanitation, lighting, and improvement in work surroundings which are bound to result in better health and greater efficiency. On the road there are great possibilities in safeguarding employees through the elimination of what have heretofore been considered ordinary risks—such as covering culverts, increasing clearance, and the removal of obstructions along the track or right of way, as well as the issuing of bulletins giving the causes of accidents, which will help to develop the safety trend of mind.

On asking James McCrea, former president of the road, for his philosophy of the work of accident prevention for the personnel of the road and the safety of the traveling public, he remarked:

"The problem of safety is not altogether a question of rules and their enforcement, safety appliances and their application, but inherent self-restraint and control. If we can provide instruction in these principles, we will have taken a long step forward in conserving life and limb and increasing industrial safety. We feel that, while much has been accomplished, there remains still more to be done, and the success which has been reached and which we hope to achieve is and will be due entirely to the hearty spirit of co-operation on the part of every officer, as well as the employees as a body."

The magnificent scientific effort on the part of the Pennsylvania Railroad Company, resulting during the year 1911 in a diminution of 63 per cent. of the accidents over the previous twelve months, received the distinction of the American Museum of Safety's gold medal, placed at its disposal by the Travelers Insurance Company for annual award to the American employer or corporation who, in the judgment of the American Museum of Safety, has done the most for the protection of the lives and limbs of its workmen by means of safety devices for dangerous machines and processes.

Synchronously with the Pennsylvania, the Chicago & Northwestern Railway Company made a special feature of safety, through a safety committee. Their work was eminently successful. As a result of twenty months of safety work ending August 13, 1912, personal injuries to passengers, employees, and others were reduced as follows; 51.6 per cent. less trainmen killed, and 42.5 per cent. less injured; 40.8 per cent less switchmen killed, and 20.7 per cent. less injured; 57.1 per cent. less stationmen killed, and 15 per cent less injured; 36.6 per cent. less trackmen injured, and 31 per cent. less bridgemen injured; 50 per cent. less car-repairers killed, and 19 per cent. less shop and round house men injured; 38 per cent. less unclassified employees injured. Of fatal accidents to employees of all classes there was a decrease of 29.9 per cent., and of 31.4 per cent. in injuries to employees of all classes. There were 36.3 per cent. less passengers killed and 16 per cent. less injured.

On the New York Central lines there are division and shop safety committees, for the sake of securing greater vigilance and co-operation by all employees in preventing personal injuries of every character. These committees must investigate personal injuries which may occur in their respective jurisdictions, and apply, where possible within their authority, necessary remedies to prevent a recurrence; another important function is the investigation of all dangerous conditions and improper practices which are contributory to accidents and the application of corrective measures wherever possible.

The management of the road puts the matter of safety right up to the men by pointing out that they and their families are the ones who are going to be benefited by the prevention of accidents, because they are the ones who are getting hurt. Eighty-three per cent. of the people injured on the railroads of the United States last year were the men who work for the roads. The safety department is organized to help them help themselves. The safety committees are going to make safety a business.

Every man on the line, it matters not when, where, how, or at what employed, can become a partner in this business. The investment is caution; the return, safety.

In illustration of the value of safety committees, the experience of the American Foundrymen's Association may be cited.

Three men were selected from three different departments and instructed to make four whole-day inspections during the month. Men were selected who were not only old employees and familiar with all parts of the plant, but who were known to be conscientious and not afraid to report what they saw. They were carefully instructed in their work, and informed that the company did not obligate itself to accept any of the suggestions or do any work They were paid full wages while engaged on inspection duties, and $5 each upon presentation of their reports at the end of the month.

These working-men's committees revealed the immense possibilities at each plant for improving conditions. During the first month about one thousand suggestions in all were received, and at two of the larger plants approximately three hundred each. These recommendations were described carefully in writing, numbered consecutively, and submitted to the three foremen in charge of the departments from which the men were selected, who acted as a jury in approving or disapproving the suggestions made. The jury of foremen visited and inspected all of the dangerous conditions pointed out by the working-men's committee, to be in a position to say "Yes" or "No" to the recommendations. Only a small percentage of the suggestions was rejected as impracticable.

X

IRON AND STEEL

THE care exercised by the workmen is closely related to the number of accidents occurring in any department of industry, and the best way to reduce the number of accidents due to carelessness is by the inculcation of caution and training the minds of men to think for safety. The burden of doing this rests upon the management. The superintendent's attitude and the foreman's attitude toward the prevention of accidents will be reflected by the workmen as accurately as their attitude toward getting out the product is reflected. If the superintendent treats the matter lightly, his assistants will treat it lightly. If he shows an earnest desire to have precautionary rules observed, and makes the prevention of accidents one of the most important features of his department, his foreman will reflect that policy, and by seeing that the men observe the precautions taken for their safety such habits of caution will be inculcated in the men that the number of accidents will be reduced to a minimum.

For a number of years the subsidiary companies of the United States Steel Corporation have carried on a campaign for the prevention of accidents in their plants. The safety work of the Illinois Steel Company, one of the largest of the subsidiary companies, is typical of what is being accomplished through safety committees at all of the plants.

Realizing the necessity for providing and maintaining safeguards and proper working conditions, and of educating the employees to a sense of caution, this company has divided the work into three branches—namely, the safeguarding of dangerous places, the promulgation of rules for safe operation, and the inculcation of habits of caution in the minds of the workers.

The Illinois Steel Company operates five plants, each covering many acres and employing thousands of men. The plant at South Chicago covers about 400 acres, and when running to its capacity gives employment to some 12,000 men. Across the busy train-yard of this plant has been installed a very important safety device, a viaduct 422 feet long, which saves many lives every year. Wherever there is a railroad track between a roadway and a mill, if it is at all practicable, a viaduct is provided. The roadways throughout the plant being macadamized and well defined have a tendency to keep the men from taking dangerous short cuts across the tracks.

At the docks of the South Chicago plant 3,826,000 tons of iron ore were handled in a recent year, during which time there were no accidents causing the loss of more than two weeks' time to any man. At the docks, where iron ore is taken from vessels by machinery, all of the unloaders have been thoroughly equipped with ladders, stairs, and railed walks, and all gears and shafting have been guarded.

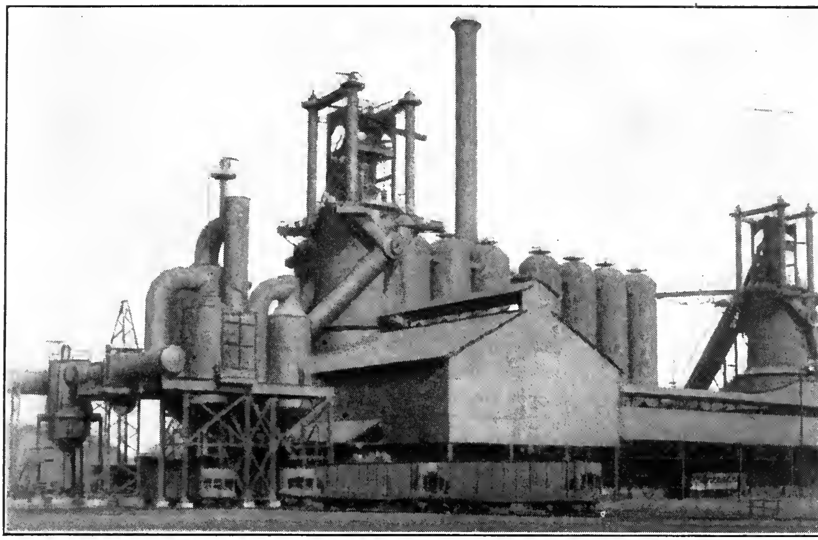
The Illinois Steel Company, like the National Tube Company, has posted at all of the entrances to its plants signs, which are illuminated by night, showing safety mottoes. These little safety sermons continually remind the men of their responsibility. The signs are printed in six languages, and are periodically changed. The

Illinois Steel Company has also followed the example of the National Tube Company in calling to the attention of men seeking employment the necessity for caution and watchfulness.

Conspicuously displayed at different points along the main roadways of the plants are warning-signs, reminding the men of dangers to be avoided and of their responsibility in preventing accidents.

All trestles from which material is handled should be equipped with walks having railings and guard-boards to prevent material and tools from falling on persons passing below. Wherever a driveway or passageway is directly beneath the trestle, at that point it should be completely planked over between the rails and the tracks. If there are several tracks on these trestles, a walk down the center of the trestle for the use of switchmen and men dumping the cars is found advantageous. Under these trestles are often found pockets in which material is stored. The gears operating the drums forming the bottoms of these pockets should be covered, and a rope safety line stretched the entire length of the pockets, which, when pulled, cuts off all power, sets a brake, and stops all machinery.

The new, thin-shelled, water-cooled type of blast-furnace is equipped with stairs and platforms for the safe inspection of the furnace and water-cooling apparatus. The stoves and furnaces are connected by walks, with hand-railings and guard-plates at the base of the railings. Cast-houses should be provided with stairs or runways leading away from the furnace, so that in case of a breakdown the men can get away quickly; elevated floors should be railed, and the cast-houses roofed with steel plate to protect the men from material that may be blown out of



BLAST-FURNACE EQUIPPED WITH "BAER" SAFETY EXPLOSION VALVES, RAILED STAIRWAYS AND PLATFORMS

SAFETY LOCKING DEVICE FOR GAS-VALVES IN BOILER-HOUSE

A—Gas-valves connected to boiler.
B—Padlock.
C—Warning-sign.

the top of a furnace. The side sheeting should be brought down so far that storms cannot beat in on the runners. One of the main precautions to be taken in handling hot metal is to keep all utensils dry.

Where ladles are loaded under the floor of a cast-house, the casting-holes should be guarded by grates. The whistles in the blowing-room should operate by a switch placed behind a shield together with the furnace pressure gage and the snort-valve lever. When the switch is thrown in—to blow the whistle—it lights an electric lamp placed above the switch, which shows that the circuit is complete. It also lights a lamp in the blowing-engine room, showing which furnace is signaling. The shield is for the purpose of protecting the man giving the signal, or operating the lever to reduce the pressure, should something go wrong with the furnace. All bustle-pipes on furnaces should be equipped with railed walks. Modern practice approves of not allowing men to go on the bustle-pipes, or anywhere above the furnace floor, without permission from the foreman in charge of the furnace, who stations another man to watch the man above, to guard him against the danger of being overcome by gas.

In the case of the Illinois Steel Company the mud-gun, which is used in stopping the tapping-hole of the furnace, is equipped with a funnel-shaped casting to prevent the men from attempting to kick the mud which collects on the cylinder into the hole, and thereby running the risk of having their feet caught by the plunger. Before this guard was installed one workman lost half of one of his feet in this manner.

Each blast-furnace plant and each gas-engine plant is equipped with safety helmets, to be worn where there are large quantities of gas, as well as in rescue work. A corps of men carefully trained in rescue and first-aid work is always on hand.

On all large gas-pipes throughout blast-furnaces and at gas-producer plants the tops of the pipes should be provided with hand-lines to keep men from falling off. The weights on the explosion doors should be fastened with safety chains, so that the weight or door cannot fall on passers below if the hinge supporting the door should break. Platforms and stairs built on the gas-washing apparatus are safeguards. In the same way, a railing at the base of the stairs prevents any one who has just descended from suddenly stepping onto the railroad tracks should they lie close to the washers. By causing him to walk around the end of the railing his attention is called to the danger from an approaching train.

In the open-hearth plants of the Illinois Steel Company, on the side of the building and on a level with the overhead electric-crane tracks, are built platforms for the crane-repair men. This does away with the necessity of using swinging scaffolds in repair work.

In order to prevent the dropping of ladle-stoppers as they are lifted from the pouring ladles there has been devised a special hook, called the "pig-tail" hook, which has been elongated and curled so that the stopper is securely held. When ladles of metal are hoisted by cranes to be poured into mixers, it had been customary to attach the hook of the auxiliary hoist, which is used to tip the ladle in pouring, while the ladle was still on the ground; but there is danger that the auxiliary will rise faster than the main hoist and pour the ladle while in midair. To prevent such a catastrophe a hook has been devised which the crane-operator attaches after the ladle has been raised to the pouring position.

On the pit side of the open-hearth furnaces, where the steel is poured into molds, and immediately back of the crane cage, there is a platform for the escape of the crane-man if an explosion of the hot metal should occur. This platform extends along the side of the building, and is provided with railings and stairs, affording the crane-man a quick means of egress from the danger zone.

In rebuilding an open-hearth furnace the furnace and ports are torn down a number of feet below the charging-floor. Before the precaution was taken to build a plank fence at the top of the opening, to prevent material from being knocked down on workmen below, injuries from this source were not uncommon, one man having had his back broken.

The doors at the bottom of the cupola are usually held shut by a steel prop, and in order to drop the cupola when cleaning out refuse these props are knocked out with a long bar. To protect the men from the sheets of flame which accompany the dropping of the doors, steel guards have been set up, with holes through which the bar used in knocking out the props may be inserted. Prior to the installation of these guards a man working on the night shift had lain down behind the cupolas, unseen by the men dumping them, and was fatally burned by the flames.

When cupolas are being relined there is danger of the loose bricks falling from the stack on the men below. To guard against this a screen is put in at the top of the cupola, so that if a loose brick falls it is caught by the screen. Platforms at the tops of cupolas are equipped with railings and high base-guards to prevent material from being knocked off on men below.

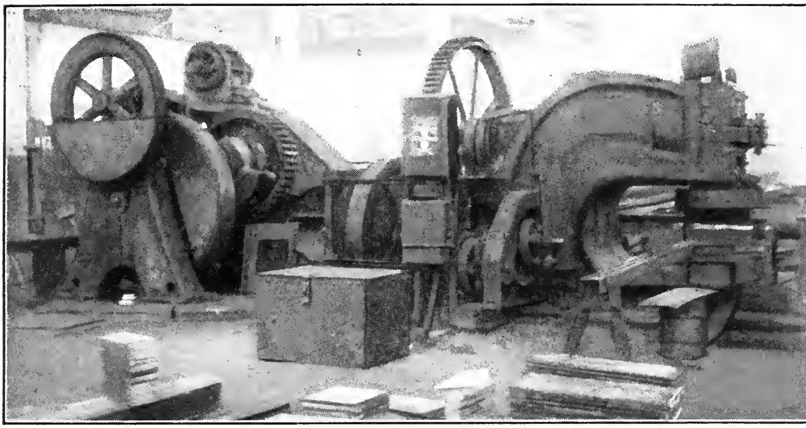
The tops of dolomite cupolas are frequently covered only by the I-beams upon which the tub rests when it is dumped; but at the works of the Illinois Steel Company, cast gratings entirely cover the top of the cupola, excepting where the tub is dumped.

In the mill motor-room, which is electrically operated, the driving-shafts are protected by removable guards. Guards are also placed over all gears and shafting in the rolling-mills. Where the tables are low, the guards cover the table-shafting, the floor-shafting, and the sprocket-wheels, at the same time giving access to the top of the tables. For safe passageway across a mill subways or viaducts are provided, doing away with the dangerous practice of climbing over the tables and running the risk of being struck by the hot steel.

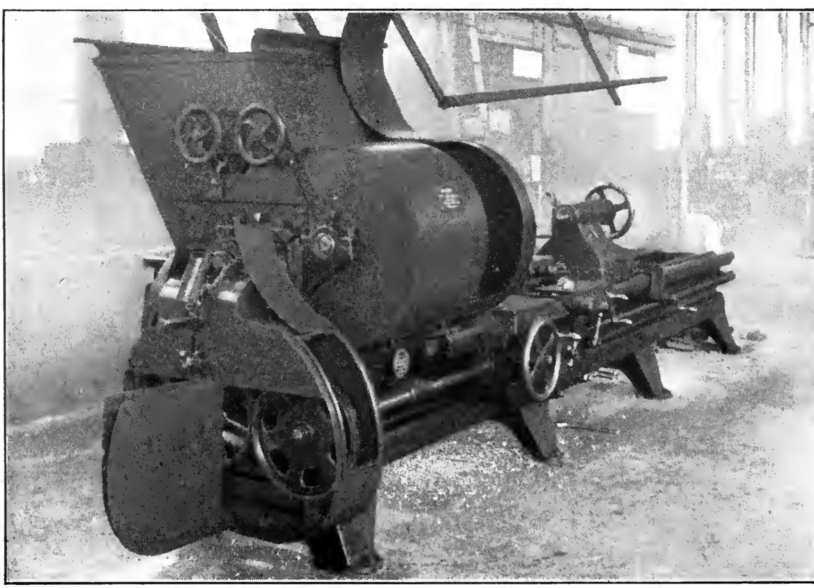
Bending-machines, punches, and shears are made danger-proof. The gears and fly-wheels of bloom shears in rail-mills are completely guarded, the gear-guards being provided with little doors for convenience in oiling and inspection. For the protection of workmen operating the tables against flying scale, glass shields have been installed. Couplings, gears, and shafts of cambering-machines are provided with removable plate, or steel, guards.

All levers controlling the operation of machinery are so constructed that they may be locked, making it impossible for the power to be turned on by accident. Before working on the machinery workmen are required to attach a warning-tag to the lever lock. This lock requires the use of both hands, as the lever cannot be moved without depressing the spring and turning the locking device down.

Large enameled signs are conspicuously displayed bearing the notice: "Never work on a table, crane, or other machinery before notifying the operator and attaching a danger tag, bearing your name, at the point



COVER-GUARDS AND DANGER-SIGN ON FLY-WHEEL AND GEARS OF DOUBLE ANGLE SHEARS



COVER-GUARDS FOR 32″ LATHE. NATIONAL TUBE COMPANY

where the power is turned on. Get these tags from your foreman." The workman's name must be written or painted on the tag.

Guards on legs, light and convenient to handle, are set before the roll-train spindles or driving-shafts of bar-mills. The ends of wabblers on roll-trains are guarded with steel shields, as the unguarded ends have been known to catch the clothing of workmen, drawing them to death or inflicting painful injuries.

At the ends of loading-beds are guards preventing the falling off of material, but not interfering with the loading of cars. The danger from falling material has been brought home in numerous accidents to workmen below.

Semicircular plate shields are used to guard the sprockets and chains on chain conveyors in sheet-mills. All belts and pulleys are guarded to a height of at least five feet. A simple way of guarding shafting is by means of a steel plate bent into the form of a triangle or an inverted U, attached to the bearings and gear-guards.

Lathe-gears are entirely inclosed with shields that can be swung back out of the way when oiling or changing the speed.

In guarding belts on cone-pulleys it was found necessary to devise a belt-shifter which could be worked through the guard, which not only serves as a safety device, but actually increases the speed of operation.

To eliminate the danger of limbs being caught between the table and ribs of a planer-bed, a plate guard may be placed over the bed. When the beds are left open they are frequently used as receptacles for tools and oil cans. Workmen have been known to have their fingers crushed while trying to get oil from an oil well in a planer. To prevent such accidents, plate shields have been placed over wells. Investigation having shown that men have lost the ends of their fingers in attempting to adjust the feed-gears of a planer while keeping their eyes on the job on the planer, these gears are now provided with guards.

When the use of a set-screw is necessary in facing the under side of a cut, the set-screw is countersunk and guarded by a sliding cover. Boring-mills have their gears guarded, a plate guard in front of the mill-table, and a guard around the counterweight, so that if the cable should break the weight cannot fall on any one.

All emery-wheels over eight feet in diameter have a safety taper of three-fourths of an inch to the foot, and are provided with safety collars. If the wheel breaks the pieces cannot fly out, but are held in place. Large grindstones are provided with substantial guards or hoods.

Band-saws have hinged guards covering the top and front of the saw to prevent the flying out of the saw if it breaks, and a head-guard extending down the front of the saw to prevent the workman's head from coming into contact with the saw. The saw below the table is cased in. Circular saws are provided with practical guards.

The National Tube Company has devised a guard for circular saws which, in addition to safeguarding the saw from above, may be used to push the end of the wood through the saw, thus preventing injuries to the hands when working close to the teeth of the saw.

Belts and pulleys in the carpenter shop are entirely inclosed in steel casings. The knives of wood-jointers are guarded with a device having a strong spring to draw the guard back. The best safety device for these jointers, however, is the circular cutter-head, or safety cylinder, which, instead of pulling a man's hand into the knives, throws it out of the machine. In the event of an accident, instead of losing his fingers or hands. as in the case of an old-fashioned "square" cutter-head, he merely sustains slight cuts on the finger-tips.

Men working at high elevations, on poles and smoke-stacks, should be required to wear safety belts and life-lines, which are attached independently of the tackle, so that if the tackle holding the scaffold or rigging breaks the man will be supported by his life-line. Workmen did not take kindly to this safety device when first installed, but now would not work without it.

In the foundry, the large receptacle in which iron is retained before it is poured is provided with a plate fence, instead of railings around the platform, to prevent the crane-hooks from catching. The levers controlling the operation of the mixer are guarded with plate shields for the same reason. Brass converters are provided with spark-shields.

It is very important that foundry workers wear sound shoes to protect their feet from possible burns by spilled metal. The Illinois Steel Company urges upon its workmen the wearing of the "Congress" shoes, which, besides offering protection, can be slipped off quickly in case of accident. A steel shield on the side of foundry hand-ladles has protected the hands of many workers who have stumbled and slopped the hot metal.

In the power-plant, the ends of piston-rods extending beyond the cylinder-heads are guarded so as to prevent any one from getting close enough to the cylinder to be struck by the rod. A railed walk has been placed on the top of each boiler leading from boiler to boiler. Each boiler is equipped with a non-return valve, so that if a tube bursts or there is some other explosion the valve closes automatically and the steam cannot rush into this boiler from the others. Many precautions are set forth in the boiler-house rules, such as numbering boilers, blow-off line relief, stop-valves, valves in feed-water connections, and drains in pockets.

Fly-wheels are guarded with plate or wire-net guards. At all points on engine-beds where it is necessary for the oiler to walk railings or plate guards are provided. The governor is driven by a three-rope drive, dependence not being placed on a single rope or belt. A device has been installed to call attention to broken strands, which strike a board hinged to the pulley-guard, throwing the board back, and thus notifying the engineer.

All overhead cranes are provided with railed walks on both bridge girders, extending the entire length of the crane. The trolley, or carriage, is floored over and provided with a railed walk. Hoists are equipped with a limit switch, which prevents overwinding, breaking of the cable, and dropping the load on the workmen. Each crane has a safety switch, cutting off all power and making it impossible for an absent-minded operator to forget that men are working above. When a man goes on top of a crane he pulls out this switch and attaches a sign reading "Danger—Do Not Move." A box is provided on the crane bridge for tools, oil cans, and other articles. Extending out from the truck-wheels of cranes are brush guards to warn a person resting his hand on the rail of the approach of the crane, which he might fail to note because of other noises. The number of arms and hands lost by persons thoughtlessly resting against the crane runway has made such a device necessary. Trolley-gears and truck drive-gears are guarded. The flooring over the trolley carriage not only prevents the falling off of pieces of machinery, but also serves as a good repair platform.

Where ladders are used to reach the crane-cab, a landing-platform is provided at the top of the ladder, with a short ladder leading from the platform to the edge of the cage, to prevent a man climbing the main ladder to such a height that he could take hold of the power-rails. Wherever possible, stairs are provided for the crane operation, and steel walks with railings and toe-boards placed parallel with crane runways. All gantry cranes are equipped with fenders over the truck-wheels, a walk the entire length of the crane bridge, a safety switch on top of the bridge, and with automatic warning bells.

Switchboards with a voltage of over 250 volts are incased, and all points of danger completely safeguarded.

The danger of being caught between a locomotive crane boiler and the truck-frame as the crane-boom is swung back and forth is met by a device or fence on the truck-frame, which guards the danger zone while the crane is working and can be folded back against the frame when the crane is running through the yard.

When railroad tracks run close to buildings, railings are placed at the corners to prevent men stepping from the buildings onto the tracks. Wherever a man might be crushed in a narrow space between a building and the tracks, an inclined plate at that place makes it impossible for him to get into such a dangerous position.

Cleanliness about the shops and yards is strongly enforced as a factor in preventing accidents due to untidy conditions.

The Central Committee of Safety of the Illinois Steel Company, after careful consideration, adopts and recommends for use at all its plants such devices as have proved most practical and effective in preventing accidents. A book of plans for safety devices has been prepared under the direction of this committee to standardize the appliances and precautions for safety, to insure the provision of efficient safeguards at the time construction work is planned and machinery installed, and to show the conditions to be maintained during operation. This book has been prepared in loose-leaf form, so that additions or changes can be made from time to time. The plates are reduced drawings of actual construction, and are to be used by the engineering department as examples only. The dimensions given are not required to be followed, unless they are made obligatory in the specifications.

All plans or specifications for new constructions, alterations, or replacements must be checked for safety, and it is the duty of superintendents of plants to see that safety devices and precautions specified in the book of standard devices are complied with before machinery or plants are put into operation. No new machinery or plant may be put into operation without the approval of the safety inspector, except upon the specific order of the general superintendent of the plant. No machine tools may be ordered unless the plans and specifications have been checked for safety.

The Safety Committee has also prepared with great care rules for safety in operation. The rule-book for the use of superintendents and foremen is printed in English, and includes general instructions from the president of the company, regulations regarding co-operation of workmen, rules governing the construction and installation of machinery, and physical conditions to be maintained. The second book of rules, printed in the several languages spoken by the employees, is distributed to all employees of the company who are not superintendents or foremen, and contains the same instruction as the other, excepting the rules for the construction and installation of machinery.

Each employee is required to read the book of rules and to satisfy his foreman that he is familiar with its contents. Both the foreman and the employee must sign a statement to that effect upon a form provided for the purpose. When men are placed at work on new jobs entailing any hazard, they must be fully instructed by the foreman in charge as to the dangers of the work. If the foreman is satisfied that a workman understands the danger and is prepared for it, he must certify to that effect to the department superintendent, upon a special form, upon which the workman must also set forth that he has been instructed, understands the danger, and will be careful of his own safety as well as the safety of others.

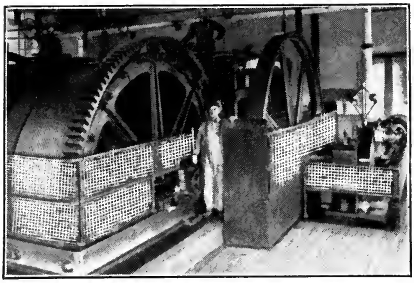
The Central Committee of the Illinois Steel Company consists of the safety inspector and assistant general superintendent of each of its plants; the general attorney, who acts as chairman of the committee; his assistant in charge of accident matters in the law department, the manager of the safety and relief department, who acts as secretary of the committee; and a stenographer to take the record of all the proceedings. This committee meets at the company's main office in Chicago once a month for an all-day meeting. At these meetings all accidents which have occurred at the several plants of the company and are considered serious are discussed; and ways and means devised for preventing similar accidents at any of the plants, if this is possible. The recommendations of the committee are accepted and carried out at all plants without question, unless extraordinary circumstances make such a course impossible.

It is the practice of the committee to obtain the advice and judgment of the men in the various works who are specialists in the particular branch of the work that may be involved in the accident under consideration, thus facilitating the installation of adequate devices.

One of the first steps taken by the Central Committee of Safety to interest the men in safety and to inculcate habits of caution, was the organization of local safety committees at all of the plants. Two plans have been followed in this work—namely, the organization of committees of foremen, designated as permanent safety committees, and the organization of workmen's safety committees, composed entirely of workmen below the grade of foremen.

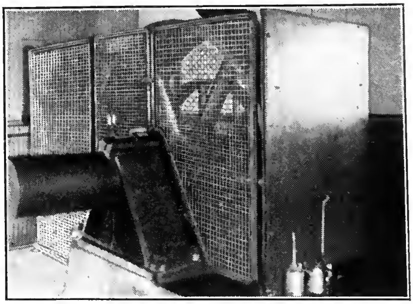
Each department has a permanent safety committee, whose duty it is to make monthly inspections of the department, to see that all safety devices approved by their superintendents have been installed, and to investigate all accidents where the injured man loses ten days' time or more, or accidents having special features. The committee reports how the accident occurred, what can be done to prevent a similar accident, and whether, in its opinion, any one was negligent. Where the injured man has been careless, the committee lets him know that it does not approve of his actions, and this inquiry into the culpability of an employee by a jury of his peers is said to have had a very good effect and to have done much toward reducing the number of accidents.

In forming the workmen's committees the plants are divided into divisions, each consisting of three departments or mills. One workman is chosen from each department to act as a member of the committee, to inspect dangerous places, to consult with the men at their work, getting suggestions as to safer methods of doing

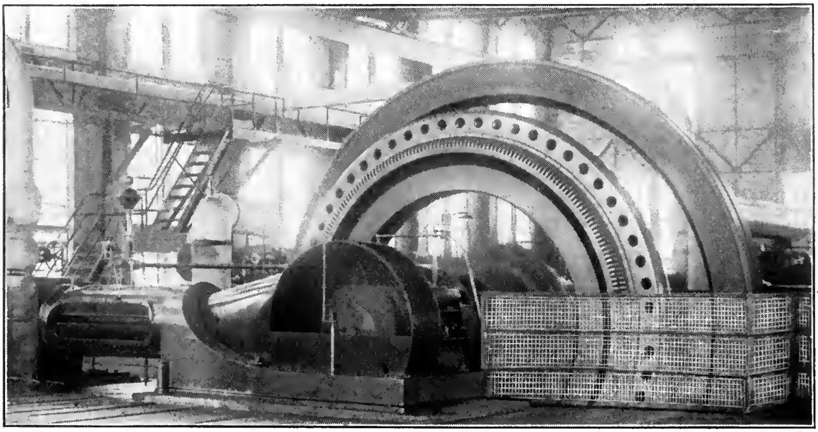


WIRE-MESH GUARDS AROUND FLY-WHEEL AND DRUM GEARS

GUARDS AROUND FLY-WHEEL AND CONDENSER PUMP



GUARDS AROUND HIGH-SPEED ENGINE



GUARD AROUND FLY-WHEEL AND GENERATOR, WITH RAILED STAIRS AND PLATFORM

TYPES OF FLY-WHEEL GUARDS OF THE U. S. STEEL CORPORATION

that particular work, and to sow seeds of caution. The members of the workmen's committee serve one month, and spend one day each week inspecting their division. When a committee is organized all of the superintendents of the departments included in that division and the safety inspector meet with the committee, go over the work with them, and impress upon them the interest of the superintendents in the work. The men are urged not to drop their interest in safety after their term as committeemen has expired, but to continue to make suggestions. Not only do the men do this, but other men who have served on committees are encouraged to come to the superintendents with suggestions. Inter-division and inter-works inspection — that is, having a committee inspect a division or plant other than its own—creates a rivalry among the men, and gives the work greater importance in their eyes, making it seem more of an honor to be selected as a committeeman.

At each plant entrance are bulletin-boards displaying the list of departments which have kept in the "Booster Class" for the past month—in other words, the departments that have kept their accidents below a certain percentage. Newspaper clippings reporting industrial accidents throughout the United States are also posted on the bulletin-boards, together with rules and illustrations of devices in use by the Illinois Steel Company which would have prevented these accidents.

Another stimulus for safety is the distribution of cigars bearing the "Boost for Safety" bands among foremen and workmen who establish records in keeping down accidents or make pertinent suggestions for safety,or in other ways help to promote the cause of safety. "Boost for Safety" paper-weights are presented to foremen and workmen, with a view to keeping always before them the fact that safety is the first consideration. To each man showing a thorough knowledge of the safety rules a badge of distinction is presented by the management. Workmen as well as foremen compete for these badges, in order to obtain which they must first pass an examination on the rules and precautions for safety, with an average of at least 90 per cent. This plan is not only insuring a better knowledge of the rules on the part of foremen and workmen, but the eagerness with which all classes of workers compete for the buttons and the pride of those obtaining them have shown them to be of valuable assistance in inculcating habits of caution in the minds of the workmen.

In the plants of the American Steel and Wire Company automatic stops are provided at the wire-drawing blocks, the rod or wire being carried through the eye of the lever connected with the motive power, so that a snarl in the wire will throw the lever forward and stop the block. In addition to this safeguard a rope is attached to the lever, carried over the sheaves above the frame and down at the right-hand side of the block, so that if a man should be caught and drawn around the block he would strike this rope and stop the block automatically. In its boiler-houses this same company has installed a guard for water-gage glasses, so constructed that it may be turned around, coming between the workman and the glass while the glass is being tested or heated. It may then be turned back of the glass, giving a clear view of the gage. An electric lamp installed at each water-gage enables one to see the water-line clearly. The American Steel and Wire Company has also equipped its small die-grinders with hoods, plate-glass shields to protect the workmen's eyes, exhaust systems, and shaded electric lamps—a model installation for the safety and comfort of the workers on these machines.

At the Inland Steel Company plant what are known as their "Ten Commandments" are the industrial Decalogue, and must be obeyed in the interests of accident prevention and health promotion.

1. Get the safety habit. Don't take chances. Learn all the rules; understand your work thoroughly. Study the dangers incident thereto, and avoid them. Think before you act.

2. Do not work with defective chains, cables, tools, or appliances of any kind, or in an unsafe place. Carefully examine and report dangerous conditions to your foreman.

3. Never work on a crane, table or other machinery until you have notified the operator and attached a sign, "Danger—Do Not Move," bearing your name, at the point wherever the power is turned on. No man except the man who placed it should remove such sign.

4. Do not turn on any electricity, gas, steam, air, acid, or water, or set in motion any machinery, or throw down any material without first seeing if any one is in a position to be injured and if all safety guards are in their proper place.

5. Do not go onto an overhead crane runway for any purpose without permission from your foreman, and then not until the cranemen have been notified and a sign, "Danger—Men on Crane Track," hung in cage before cranemen. After notifying cranemen attach bumping-block to crane rail between where you are working and cranes. Use same precautions when working near crane tracks.

6. Wear goggles when working around circular saws, chipping, handling acid, cutting cables, and working at emery-wheels.

7. Do not ride on or operate engines, cars, cranes, elevators, or other moving bodies or tamper with electrical apparatus unless authorized to do so. Never leave your regular place of work except when required by your duties.

8. If you make an opening or remove the cover from any opening in floor, ground, valve-pit or sewer, guard that opening so that no one can fall into it.

9. Do not pile any material so high it is liable to fall or cause another pile to fall, or allow it to lean against walls too weak to bear the pressure.

10. Commit no nuisance, be clean, and help to keep the plant clean. Conduct your private life so that you are at all times in the very best physical condition, wide awake, and active.

The effect of the energetic safety campaign of the steel companies is an example of what may be accomplished by systematic work in accident prevention. While satisfactory statistics are not available from all the plants in the United States Steel Corporation, from those that have been furnished it is seen that serious accidents in iron and steel works have been reduced by 50 to 66⅔ per cent.

W. H. Cameron, in a discussion before the American Foundrymen's Association, reckoned the average man's value at $600 a year. He then pointed out that each worker in iron and steel stands for an engine or industrial plant worth $10,000, producing at 6 per cent. an income of $600. The death of the average workman, therefore, is equivalent to the destruction of a $10,000 mill or engine. In showing that the legislative tendencies of recent years have been to place the entire liability for these accidents upon the employers, and that the problem of meeting this responsibility is an exceedingly serious one, he stated that the time had come not simply to safeguard machines and working conditions, but to know how to protect workmen against themselves. Employers well know that the workman's carelessness breaks delicate machinery; his ignorance spoils raw material; his idleness blows up boilers; his recklessness destroys engines; and he is just as thoughtless of his fellow-workmen's safety as his own. "In a word, the most difficult phase of the subject is to know how to wake up the employee to a sense of his duty toward himself and his fellow-workers, and to assist in the prevention of accidents."

Foundry workers seem easily disposed to pulmonary diseases and affections of the respiratory tract, rheumatism, and kidney trouble. Lung trouble is increased by breathing dust and gritty air, coming either from the cleaning of castings with steel brushes, emery-wheels, or sand-blast. The sand-blaster should be protected with an adequate helmet, and the emery-wheel provided with exhaust and screens.

Kidney trouble among foundrymen is frequently the outcome of breathing air with a high percentage of carbon monoxide, or CO, present. It is obvious that effective ventilation would relieve this difficulty. Diphtheria and rheumatism have resulted from unsanitary lockers. Foundries are often badly heated in general, although the heat is locally intense at certain times.

The core-oven is a danger-point not only on account of the irrespirable character of air rich in carbon monoxide, but also, in cases where the doors are fitted with a common latch worked only from the outside, because if the oven doors swing shut in a draught or by their own weight, the molder may be imprisoned inside with no one near to hear his cries. Oven doors should always be made to open both from the inside and out, with adequate electric lighting.

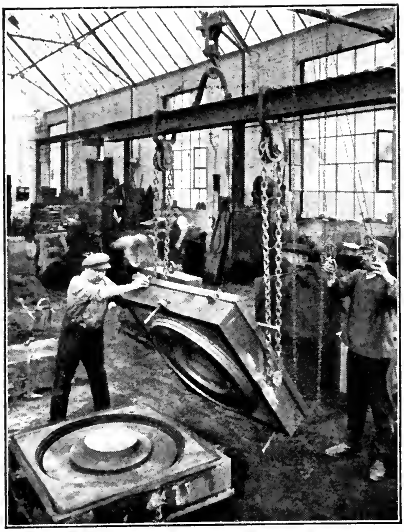
The charging-floor has dangers of its own, particularly during that part of the melting-process in the cupola when large quantities of carbon monoxide are given off.

Burns, bruises, and sprains seem to be the most frequent types of foundry injury. Even in these days of well-arranged foundries the workman often is tempted to lift a cope or springs to prevent the fall of one which is improperly braced, and severe sprains and internal injuries, hernia, and the like are caused. The gangway or available floor space for copes is often so restricted that loaded copes on edge are a menace to passers-by and to the molder himself. Burns may be expected from gas explosions in the molds, and from spilt metal running anywhere over a wet surface where steam-gas can be formed under the iron. Burns of the explosive sort can be very severe, and are always dangerous to the eye. A small particle of hot metal brushing the eye with a glancing blow is sufficient to destroy the sight. Probably, however, the greatest danger from burning is from spills of molten metal.

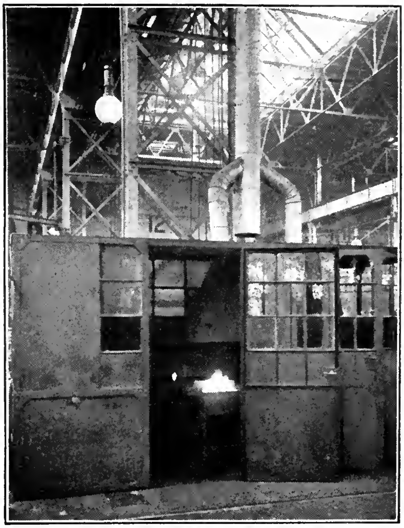
In foundry practice the menace of molten metal is always present. A ladle falling and throwing its contents over men who cannot get away is fatal, and the cutting of hot metal through the side of the ladle from carelessness in repairing its lining, may cause distressing if not fatal accidents.

The danger zone of ladle accidents is where the spout from the cupola delivers into a catch-ladle from which the crane-ladle is filled. The former is a necessity, as it receives melted iron while the crane-ladle is being emptied into molds at some distant point, and it also gives an opportunity for skimming before the iron is decanted into the ladle which is to be used in filling the molds.

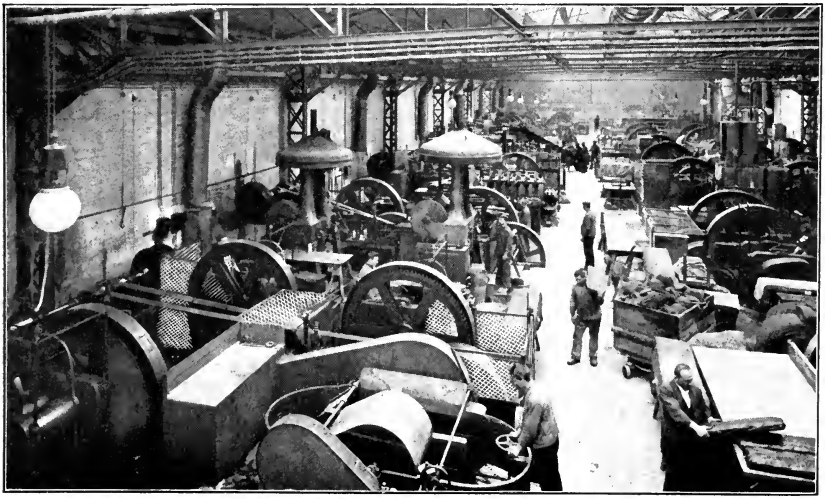
In the shops of the Brown & Sharpe Manufacturing Company it is the practice to depress that part of the floor of the foundry into which the crane-ladle is lowered for filling. This hole not only enables the catch-ladle to be quite close to the ground, but in case of accident and the breaking through of the molten metal, the metal falls into the pit and does no harm beyond the great inconvenience of getting it out.



WELL-LIGHTED FOUNDRY



PORTABLE FORGE WITH EXHAUSTS



WELL-GUARDED MACHINES

THREE VIEWS IN THE ALLGEMEINE ELEKTRICITAETS GESELLSCHAFT, BERLIN

The bottom of the pit has a platen or platform on the upper end of the plunger of a hydraulic cylinder. When the cupola is not running this platen may be lifted in place, closing the hole in the floor for safety. When the ladle is to be filled the platen is lowered to the bottom of the pit. Care, of course, is to be taken to safeguard the hydraulic cylinder from the attack of hot metal should any leak or fall into the cracks at the bottom of the pit; and, of course, there must be no leakage of water to cause explosions. The form of crane-ladle is the conventional design whereby the containing-vessel may be turned around its trunnions by a hand-wheel or gear. If the trunnions are located so as to be a little above the axis through the center of gravity when the ladle is full, they will be proportionately too high when the ladle is emptied. The gearing must therefore be irreversible by friction or other device, so that under no circumstances can the ladle operate the hand-wheel and tend to upset itself automatically.

In all foundries accidents occur through which the feet are burned by slopping metal. The American Foundrymen's Association considers it is very important that workmen wear whole shoes, so constructed that they may be slipped off quickly. They urge upon workmen the necessity for wearing "Congress" shoes and buckskin leggings to fit over the tops of the shoes. They have undertaken to keep a stock of such shoes on hand at all plants, which are sold to the workmen at wholesale prices. The result is that the workman buys the shoes and protects himself from accident, and the company benefits by keeping the workman constantly at his job, and by a reduction of the accident expense account. These shoes and other safeguards, such as leggings, buckskin gloves, leather aprons, helmets, spectacles, and respirators, should be exhibited in a cabinet close to the entrance of the plant, so as to attract the attention of all workmen and stimulate them to self-protection.

XI

MINES AND MINING

ACCORDING to statistics recently furnished by the Director of the Federal Bureau of Mines, for every 183,000 tons of coal mined in the United States one miner is killed. In 1907, about the time the Bureau of Mines commenced its work, one miner was killed for every 144,000 tons of coal mined. This decrease in the rate of mortality has been attributed to the government's activity in the coal-fields; but credit is also due the progressive mine operators throughout the country who have co-operated with the government and in some instances have developed their own safety work so well as to be able to give the federal Bureau some valuable suggestions.

To these operators any detailed description of the investigations of the Bureau into accidents and their prevention, and training in rescue work, would be superfluous; but to the general public a brief account of the National Safety Demonstration, organized under the auspices of the Bureau of Mines, in Pittsburg, October 30 and 31, 1911, will no doubt prove of interest.

After many conferences with coal-mine operators, mine-workers, American Red Cross officials, and others interested in the prevention of mine accidents, the Bureau found evidence of a wide-spread desire to hold at the government's experimental station at Pittsburg an exhibition of various means of promoting safety in mines, including a demonstration of permissible and non-permissible explosives, rescue methods, breathing-apparatus, and a general meet or contest in first-aid work between competing teams from the different coal companies.

Demonstrations were made of safety lamps and various types of artificial breathing-apparatus, and experiments carried out in the Bureau's laboratories and galleries with gas, explosion-proof motors, explosives, and coal-dust.

At the government's experimental mine near Bruceton, outside of Pittsburg, a complete mine explosion was prepared and set off for the entertainment of the visitors, who, after ventilation had been restored, were permitted to enter the mine and study the effects of the explosion.

The first-aid exhibition, in which forty teams of trained miners representing mining companies from all sections of the United States participated, formed one of the most interesting demonstrations of this kind that has ever been seen in the United States.

In addition to the treatment of wounds, burns, dislocations, fractures, and electric shock, a special demonstration of rescue methods was made in connection with the tests of permissible explosives and black powder. Immediately following the explosion, in the case of the black powder, two rescue crews, protected by breathing-apparatus, entered the open and smoking mouth of the steel gallery to rescue the supposed victims, whom they brought to the first-aid corps for treatment of afterdamp, laceration, fractures, and burns.

Since the national demonstration of mine-safety methods, first-aid teams and rescue corps have been organized at many mines where previously there had been no concerted effort in this direction; and safety measures

RESCUE DRILL AT THE MINES OF THE H. C. FRICK COKE COMPANY

RESCUE CORPS WITH DRAEGER HELMETS AND THE PULMOTOR

in general are being applied by enthusiastic operators and managers.

Apart from the deplorable loss of life in a mine fire, there is the property loss, both in the actual expense of fighting the fire and in the injury to existing property, when the fire burns out timber supports and allows the gangways to collapse, the veins to fault, and the surface of the ground to sink, with dislocation of structures on the surface.

In cases of mines where the air is gaseous from leakage or distillation of hydrocarbon gases a fire is easily started from a blaze or any source of flame. In metal mines, which give off no gas, the fire is often started by a comparatively trivial set of conditions. So far as known, the Cherry Mine fire, for example, started from a car-load of hay for the mule stable. The hay being ignited in the midst of an air-current moving at seven hundred feet per minute, the overhead timbers, manway, and air-shaft were quickly ablaze.

The newer practice of some of the best mining companies involves the use of steel timbering in place of the wood formerly used, and the development of reinforced concrete as a building-material for structures under ground. Stables, for example, are made of reinforced concrete, and are not only more sanitary, but are practically non-combustible, and in the event of a fire it can be closely localized.

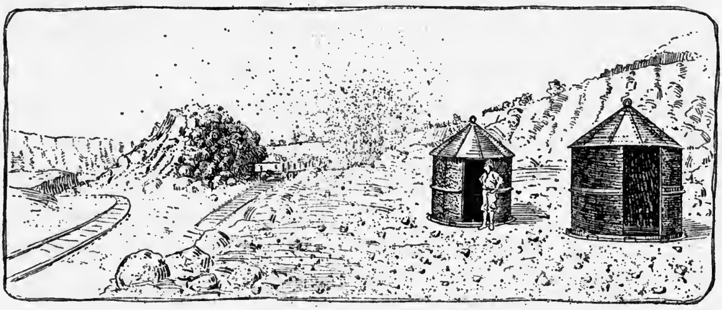
The Bureau of Mines has tabulated the causes of mine fires, in their order of importance, as follows:

1. The ignition of timbers, wooden stoppings, and brattice cloths.
2. The ignition of hay or oil-soaked materials by open torches.
3. The ignition of coal by blown-out shots, or explosions of gassy air, or coal-dust, or from an improper use of explosives.

4. Underground furnaces and boiler-plants.
5. Surface fires communicated to the mine through shaft or tunnel.
6. Fires due to heat of friction in haulage-ways.
7. Spontaneous combustion of coal or greasy waste.

Fire-fighting in mines is further complicated by the low headroom. It is impossible to carry water very far from the nozzle, because no adequate elevation can be secured, even with considerable pressure. In a seven-foot tunnel, for example, under forty pounds pressure the jet can only reach thirty-four feet from the man. Any fire of consequence is too hot to allow a man to go within this distance of it. Or, the irrespirable air prevents effective fighting, unless the fighter dons an oxygen helmet or is supplied with fresh air from behind. The helmet must be supplemented with fire-resistant garments for the attack on the fire to be effective. A hot mine fire makes steam very readily; the water passes into the spheroidal state on contact with the incandescent surface, and does no work of extinguishing whatever. The treatment of inflammable material with fireproofing substances has been an effective means of checking fires; as also the cutting off of the flaming area and the pumping in of carbonic-acid gas, or other non-supporter of combustion. The piping of mines with water under pressure for instant use when an accidental blaze appears would be an additional safeguard. The headworks should be non-combustible, and the possibility of a surface fire running down should be eliminated as far as possible.

In mines, also, the same provision which has been found to work so well in other departments of industry should be carried out, whereby the miners have their own committees of safety, sufficiently trained and experienced in the dangerous features of the work to maintain a continuity of inspection, which the occasional visit of a state inspector is not able to secure. Such men should be familiar with the best methods of using explosives, the dangers surrounding electricity, the treatment of mine gases and coal-dust, methods of preventing and extinguishing fires, rescue methods, and first aid to the injured when unpreventable accidents have occurred. They should be well up in the methods of timbering, to prevent falls of



STEEL SHELTER-HOUSES FOR PROTECTION OF MEN DURING BLASTING

the roof. Such men would, in fact, be special inspectors or safety foremen; and by having the duty passed from man to man every one of sufficient experience to do the work would share the burden of responsibility.

When the Federal Bureau of Mines investigates the methods of a corporation and finds them so meritorious that it adopts them for use in its own work of promoting mine safety, such indorsement of private effort must be highly gratifying to the officials of the company so honored.

This has been the experience of the H. C. Frick Coke and Coal Company, whose measures for the safety and health of its employees have been so perfected that the

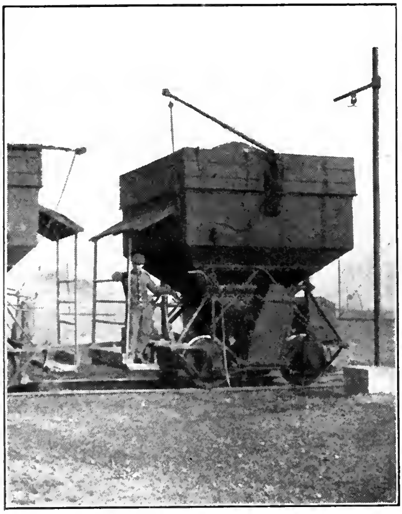
Bureau of Mines is recommending them for adoption by operators all over the country.

This company is one of the subsidiaries of the United States Steel Corporation, and the greatest single fuel-producer in the world. As illustrations of what can be accomplished in the fields of accident prevention, industrial hygiene, and mutuality its achievements afford a worthy guide.

Many of this company's precautions against accidents are not prescribed by law, but are subjects entirely of the company's own initiation and adoption. It has, in fact, anticipated every legal measure laid down by state or national government for mine safety, and the mining code of Pennsylvania has been modeled largely after the Frick regulations.

Systematic timbering is one of the methods adopted for the purpose of avoiding accidents as far as possible. This is accomplished by having the maximum distance four and one-half feet between the posts or timbering in a row, and four and one-half feet between the rows of posts. In all room and rib work this is compulsory; if, in the opinion of the mine foreman or other official, more timbering is required, it is set at a shorter distance. In order to avoid accidents in rib work, experienced men are appointed as "rib bosses" to supervise the dangerous work of making "falls," and to see that every precaution that prudence and experience can suggest is taken. In this class of work a mechanical device, or "post-puller," is used to draw posts where it would be dangerous for men to do so.

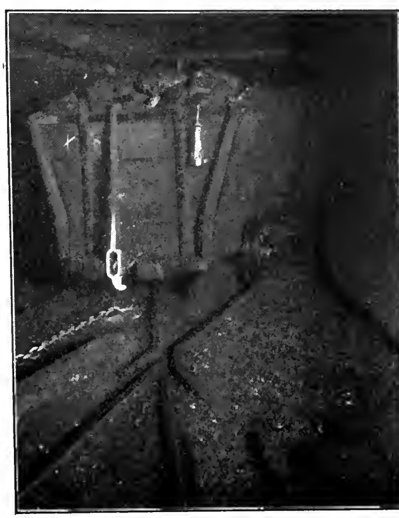
The use of black powder is strictly prohibited. The best permissible explosive is used, and a charge limit of one and a half pounds per shot is maintained. Shots



PLATFORM FOR LARRY OPERATOR

MINE-CAR AMBULANCE

OLD METHOD OF UNCOUPLING LOADED CARS AT SHAFT BOTTOM



SAFETY DEVICE FOR UNCOUPLING CARS AT SHAFT BOTTOM

are fired by electricity, and the charging, tamping, and firing are performed exclusively by specially designated "shot-firers."

"Safety First" is the watchword of the company, confronting the workers at every turn and in every department of the great plant. Rules and regulations for safety, printed in a dozen languages, are posted in every conspicuous place, calling attention to the load limits in pounds for cages and ropes, the proper way to oil and clean machinery, warning against the wearing of frayed or loose clothing while working near moving machinery, warnings for men cleaning boilers, working in shafts or among machines. These warnings are so placed that they cannot fail to be seen. Finger-boards are provided throughout the mines, indicating the way out. Pipe-lines carrying air at high pressure are placed in bore-holes, rather than in shafts, in order to prevent possible accidents when men are traveling in them. Wooden guards are placed along the entire length of all trolley-lines in the mines, and a whitewashed strip is placed along the side of the various haulage ropes.

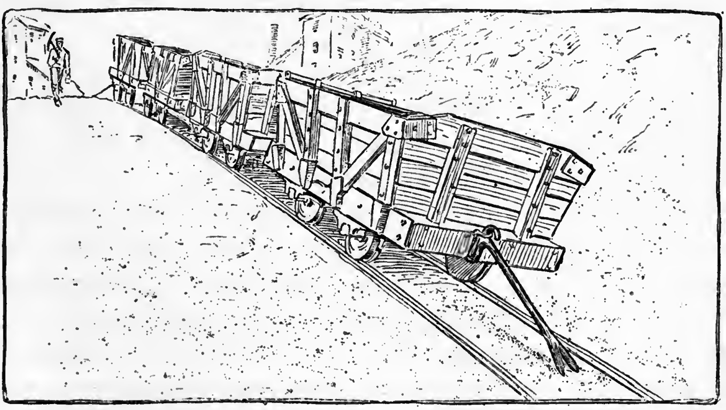
The Frick Company finds a lesson in every accident that happens. Some time ago a miner carelessly walked into a shaft mouth and lost his life. The men who devise ways and means of preventing the recurrence of accidents immediately set to work and evolved a safety device that makes it impossible to open the gate to the cage unless the cage is at the surface landing of the shaft.

On another occasion the man in charge of one of the great hoisting-engines was suddenly overcome and lost control of the cage, which went over the top of the tipple. Now all the hoisting-engines at shafts where men are hoisted are equipped with an automatic device to prevent overwinding.

Another safeguard for the shaft is a steel door which may be dropped over it in case of fire or accident to the wooden tipple and head-frame.

The old method of uncoupling trains of loaded cars at shaft bottoms where rope haulages are in use has been supplanted by an automatic uncoupling device, doing away with the dangerous practice of a man standing upon the cable and using both his hands and his feet to uncouple the car. Safety switches and derailing devices are to be found at the bottom of steep butts.

The lamp-house is as neat as a parlor, the checking system so complete that every man is accounted for by name as well as by number. A system of train signals is



SAFETY DRAG FOR MINE-CARS

used in the mine, modeled after the block system on the leading railroads, and applies as well to the trains in the yards.

The larry-operator has for his protection a substantial, covered platform, and the trip cars for the workers are connected with safety chains, in addition to the customary center hitchings.

Underground rooms and offices are of substantial sanitary and fireproof construction. Take, for instance, the mine foreman's underground office, which in its height, breadth, ventilation, and equipment is as safe and comfortable as an ordinary business office as many feet above, as it is below, the surface of the ground. The underground haulage engine-rooms and pump-rooms are absolutely fireproof and sanitary, as are also the stables where hundreds of horses and mules are quartered from one year's end to another. A unique safety feature is that used in connection with shoeing the mine mules, which greatly modifies that usually dangerous operation.

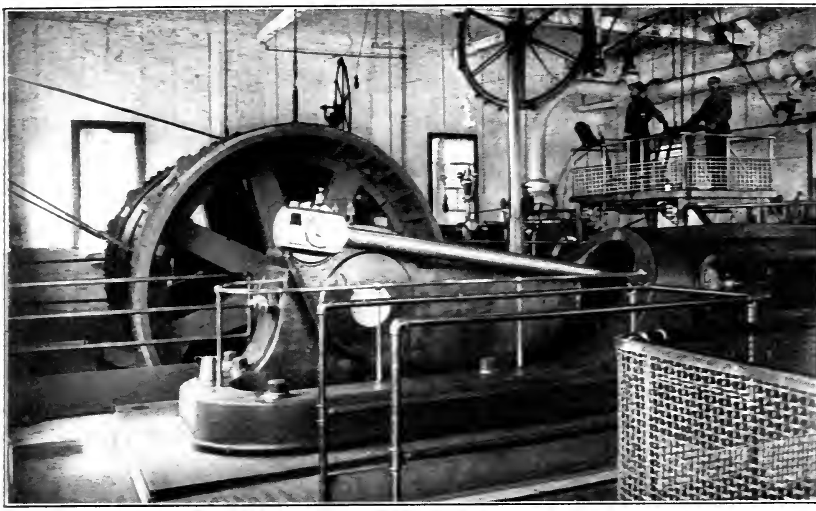
No department of the Frick system is better organized and conducted than the first-aid and emergency work. While the company believes that the prevention of accidents is much to be preferred to the alleviation of accidental injuries, it does not overlook any detail in the way of preparation or care for possible injuries.

At the rescue stations maintained by the company thirty-six corps of five men each practise quarterly, and twice that number of men are fully trained and qualified in rescue and first-aid work. In one year more than $20,000 was spent on this feature of the work, one-half of which amount went as wages to the men who attended rescue practice. The men chosen for rescue work are between the ages of twenty-five and forty-five years, and each must possess a doctor's certificate showing that he is physically able to stand the training and to perform the duties in connection with it. They must be intelligent, cool, prudent, temperate men, able to speak English, and must have a knowledge of underground work. They must also know how to read mine plans and to trace the course of the ventilating current. They are drilled in the use of breathing and rescue apparatus, and are taught the properties and methods of detecting poisonous and inflammable gases.

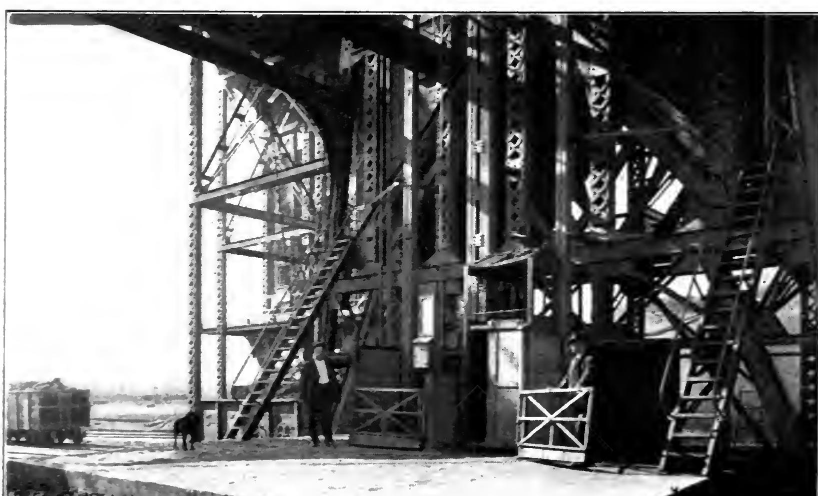
Each rescue corps elects its own captain, who is usually the coolest member, one in whom the others have confidence and whom they will obey. Those who are especially trained in rescue work are given certificates of competency.

The rescue stations are equipped with the latest and best breathing-apparatus, including the pulmotor, oxygen tanks, electric lamps, stretchers, first-aid cabinets, with all necessary supplies, hot-water bottles, army blankets, and a library of the best authorities on first-aid work. Each rescue station has two telephones, one of which is connected with six other telephones in different parts of the mine, so that the office may be notified and a physician secured before the injured person is brought to the surface. In addition to these rescue stations in each mine there are sub-stations, also equipped with bandages, tourniquets, stretchers, and other first-aid supplies.

Connected with the rescue work is the system of emergency hospitals which the Frick Company has established at its various plants and which embody the last word in comfort, cleanliness, and medical equipment. A hospital-car is another example of Frick preparedness for accidents. This is fitted up with an operating-room, and is completely equipped with apparatus and supplies for rescue and emergency work. Although there has never been an accident in the mines to occasion the use of this car, it has been kept in readiness for possible accidents



WHEN HOISTING MEN FROM THE SHAFTS, THE OLIVER MINING COMPANY STATION TWO MEN IN CHARGE



LEVEL CONCRETE PLATFORM AND SAFETY GATES AT THE OLIVER MINING COMPANY'S SHAFT

and has been frequently loaned, together with a rescue crew, to other companies.

In the matter of ventilation the rules of the company call for an excess of at least 50 per cent. in the volume of ventilation to be circulated through the working-places of all its mines. The 20′ x 8′ reversible steel fans are entirely fireproof, and have engines erected on either side, so that in the event of the failure or breaking down of one engine the other is capable of driving the fan.

All air-shafts have steam turned into them in freezing weather to prevent the formation of ice.

Throughout the mines a system of water-lines is laid, for the purpose of allaying dust by sprinkling or washing down the ceilings and sides of galleries and headings.

Within the past two years the H. C. Frick Company has spent more than a half-million of dollars in bettering and improving the mine locations, and the homes and surroundings of its employees. It has practically rebuilt the coal and coke region in which it operates.

This movement is entirely distinct from the safety work and from what is technically known as "physical development" of the plants. It has been a movement to clean up the mining towns, and has included the building of hundreds upon hundreds of sanitary and comfortable houses, and the laying of many miles of concrete sidewalks and drains. Pure water is supplied through a system of mains connected with the great plant reservoirs and fire-fighting equipment.

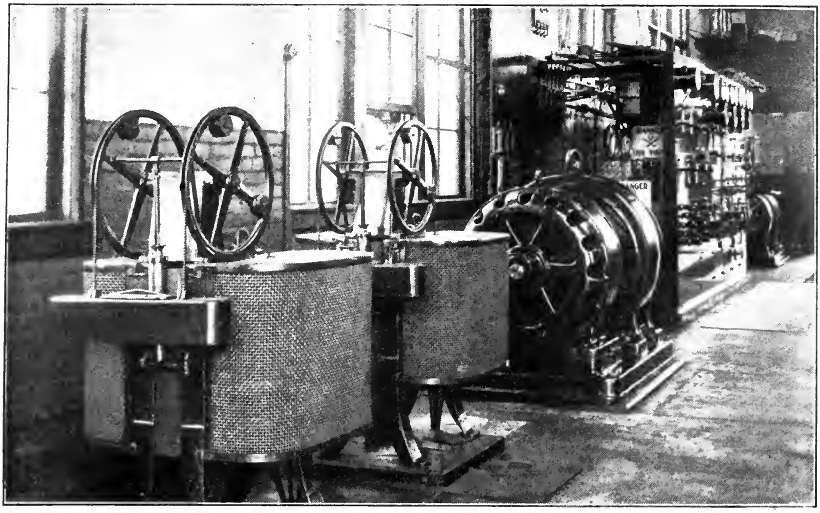
XII

ELECTRICITY

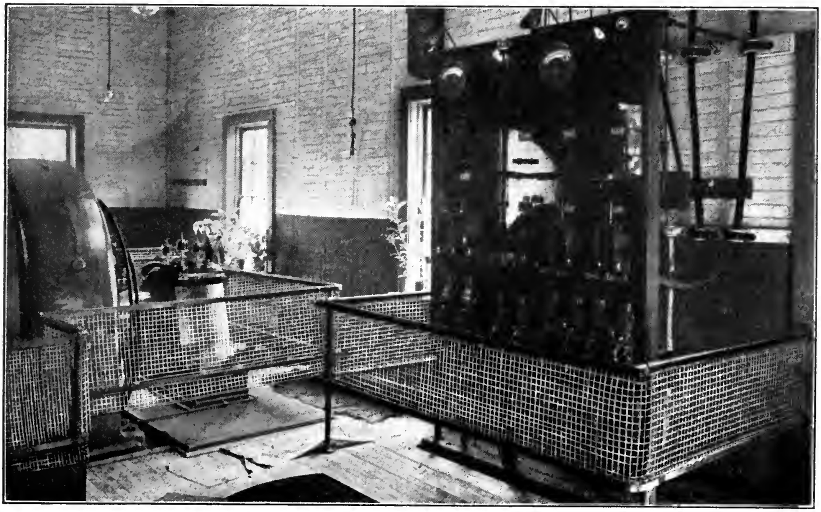
ELECTRIC power-houses using currents of high tension are isolating the control switches in a special switch-house made of incombustible materials. The separate circuits are isolated from each other and from the walls of the building, so that convenient access can be had to them with the least possible danger to the inspector and repair gang. If a separate house is not possible, the face of the switchboard should be installed in the engine-room, the back and feeder lines upon the other side of the wall.

In still smaller power-plants and where there is no possibility of interposing a wall it has been usual to locate the switchboard a short distance in front of the wall, leaving room for circulation of air and for any work to be done between the plane of the switches and the wall of the building. An interesting suggestion for safeguarding switchboards has been brought out in practice in Germany.

The Allgemeine Elektricitaets Gesellschaft, of Berlin, make their switchboards in sections, which, when all are in place, form a sort of cabinet against the wall. Each section is mounted on one side of a frame supported upon wheels which run in a trolley track. By this construction each section can be moved forward beyond the plane of the base of the others, so that any adjustment, inspection,



GUARDS OVER ELECTRIC APPARATUS IN GENERATOR-ROOM



SCREENS AND RAILINGS AROUND DYNAMO AND SWITCHBOARD

UNITED STATES STEEL CORPORATION

or repairs can be made easily, safely, and in the light. As the frame is shoved back in place the knife-switches are thrown in and connections established with the bus-bars. Pulling out the frame disconnects the switches first of all, so that the operator is entirely safeguarded as long as he keeps the section in front of the rest of the cabinet.

Portable lamps should not be installed except where absolutely necessary, and then wire guards provided over the lamps where there is gas or other combustible material or where the lamp is liable to explode or be broken.

To protect electric workers from the possibility of some one else unwittingly closing the switch, the knife-blade may be drilled for a padlock which will lock the knife.

The padlock carries the name of the one locking the switch, so that it cannot be closed except by the holder of the key or some one to whom he may give it. This is a very simple and inexpensive device in the case of machines served by the same main feeder line and having the same control switch, making it impossible for any one interested in starting his own machine below the switch to close it in ignorance of the harm he may cause others.

It is just as easy to install switches so that gravity will tend to open rather than close them. Where practicable they should be mounted so that blades are "dead" when the switch is open.

In the cases of brushes, connectors, terminals, and other parts of high-voltage dynamos, motors, and transformers, they must be boxed or so arranged that no person can accidentally establish connection between two parts at a high potential difference with his body, clothing, or conducting-tool.

Even telephone or signal wires may become crossed with high-tension wires and dangerously charged. Competent workmen are always watchful and careful for such conditions.

Intense pain results from exposure of the delicate nerves of the eyes to the intense light of the electric arc. As this pain does not manifest itself until several hours afterward, in case the eyes have been exposed the workman should immediately seek the advice of the doctor; but this type of injury can be avoided by not looking at an intense arc without the protection of heavy blue or black glasses.

In welding by means of the electric arc there is more or less tendency to oxidation and the formation of cinder. The imprisoned air bursting its way out of the contact surface may cause as dangerous a missile as the old cinder of the hand process. In electric welding the operator's eyes come very close to the danger zone.

It is perfectly possible to protect the eyes of the operator by a mica plate mounted in a frame attached to the upper electrode and enabling him to watch his process at the critical moment. For the protection of the passers-by a fine-mesh wire-gauze screen prevents sparks from flying.

In 1912 a normal method for resuscitation from electric shock was formulated by a commission representing the American Medical Association, the National Electric Light Association, and the American Institute of Electrical Engineers.

It is planned that the following rules prepared by the commission should be posted in some conspicuous place in the shop or power-station, with space on the chart for the names and addresses, with the telephone-calls, of recommended doctors.

RESUSCITATION FROM ELECTRIC SHOCK

FOLLOW THESE INSTRUCTIONS EVEN IF VICTIM APPEARS DEAD

I. Immediately break the circuit.

With a single quick motion free the victim from the current. Use any dry non-conductor (clothing, rope, board) to move either the victim or the wire. Beware of using metal or any moist material. While freeing the victim from the live conductor have every effort also made to shut off the current quickly.

II. Instantly attend to the victim's breathing.

1. As soon as the victim is clear of the conductor, rapidly feel with your finger in mouth and throat and remove any foreign body (tobacco, false teeth, etc.). Then begin artificial respiration at once. Do not stop to loosen the victim's clothing; every moment of delay is serious. Proceed as follows:

(*a*) Lay the subject on his belly, with arms extended as straight forward as possible and with face to one side, so that the nose and mouth are free for breathing. Let an assistant draw forward the subject's tongue.

(*b*) Kneel straddling the subject's thighs, and facing his head; rest the palms of your hands on the loins (on the muscles of the small of the back), with fingers spread over the lowest ribs.

(*c*) With arms held straight, swing forward slowly so that the weight of your body is gradually but not violently brought to bear upon the subject. This act should take from two to three seconds.

(*d*) Then immediately swing backward so as to remove the pressure, thus returning to the position shown in Fig. 1.

(*e*) Repeat deliberately twelve to fifteen times a minute the swinging forward and back—a complete respiration in four or five seconds.

(*f*) As soon as this artificial respiration has been started, and while it is being continued, an assistant should loosen any tight clothing about the subject's neck, chest, or waist.

2. Continue the artificial respiration (if necessary, two hours or longer), without interruption, until natural breathing is restored, or until a physician arrives. If natural breathing stops after being restored, use artificial respiration again.

3. Do not give any liquid by mouth until the subject is fully conscious.

4. Give the subject fresh air, but keep him warm.

III. Send for nearest doctor as soon as accident is discovered.

The alleged rule of American industry, "Product first, safety afterward," has many notable exceptions. Though legislative bodies until recent years have proved somewhat indifferent to the lack of safety in our industrial system, it is gratifying to note the number of private companies which are thoroughly alive to the dangers attending electrical production and have taken the initiative in safeguarding their employees.

Conspicuous among these private concerns is the New York Edison Company, which has taken exceptional measures to insure the safety and promote the happiness of its workers.

The electrical industry has its inevitable risks; and, as it develops, new conditions arise to which the worker must continually adapt himself. The production of power by means of turbo-generators, for example, radically changed the work of the engineers who for years had handled the old steam-drives. A new element of danger was introduced, to which the engineers had to accustom themselves, and which must exist until the men are thoroughly familiar with the new method of generating and distributing power.

In the progress of industry accidents are bound to occur, as it is hardly possible to design safety devices in advance of the mechanisms which demand their existence.

The use of unprotected high-tension apparatus constitutes one of the gravest dangers in the electrical industry, and were it not for the protective measures employed fatal accidents would be of daily occurrence. The Edison Company's provision for the safety of over five thousand employees is the result of years of experiment and effort, during which it has developed one of the most extensive generating and distributing systems in the world. At the generating-stations, where most of the switching is done, dangerous parts are so completely protected that it is practically impossible for an accident to take place. This system is followed up by warning signals and rigid regulations and rules for the operators.

Each of the high-tension switches controlling the generators is installed in a separate compartment and carefully numbered, so that the number and record of the voltage are in plain sight of the operator working in the compartment. The operator, however, is not allowed to enter it unless it is opened for him by the responsible person in charge of the key. Before commencing work many precautions for safety must be observed.

If alterations are to be made in the connection or location of high-tension apparatus, or additions made to it, a sketch of the proposed changes must be furnished the system-operator before the work is scheduled to begin. The foreman of the electrical-construction department, or the employee he delegates to do the work, must make sure from the regulator in charge of the switchboard in the station where the work is to be done that the cable, bus, or switch is not connected with any source of high potential, and also that it has been discharged to the ground since it last carried high-tension current. The regulator must then notify the system-operator that the construction department is prepared to go ahead with the work as shown in the sketch.

Upon word from the operator the regulator blocks switches and connects all conductors to ground and to each other by means of the grounding and short-circuiting device provided for that purpose. The foreman of the electrical-construction department personally inspects this work and places a "Not Clear" card on the apparatus. When this has been done a note to this effect is made in the high-tension log-book, and the apparatus is inspected. When it is pronounced ready for use the regulator notifies the system-operator, and on receiving instructions from him removes the grounding and short-circuiting device, switch-blocks, and "Not Clear" cards, and notes the operation in the log-book.

The same precautions are taken in all work on high-tension apparatus. All live parts are kept under lock and key, and the apparatus is so protected that the men cannot remove any part of it. All cables are insulated, and the greatest care is exercised when they are cut.

The popular notion about the danger connected with electrical current is that any contact with a highly charged conductor must necessarily result in serious injury. The fact of the matter is that the current becomes dangerous from the characteristic of high voltage; but if there is adequate protection against the passage of the current through the body it is harmless. If the workman's shoes are dry, and insulation is provided by dry rubber or wooden flooring, or a rubber mat, a connection with a return conductor is prevented and the man is safe.

All rotary converters in the Edison Company's stations are provided with hand-rails and rubber mats. Employees who handle dangerous apparatus are provided with linemen's rubber gloves, which have been previously subjected to a test of ten thousand volts.

In both generating-stations and sub-stations all dangerous apparatus is marked and the voltage conspicuously indicated. There is also in force a regular system of inspection by responsible men whose duty is to report immediately any fault in any part of transmission or transforming system. Such inspection determines where accidents might occur, and the possibility of danger is at once removed.

Upon his acceptance for employment by the company, each operator is given a book of "Rules for the Government of Employees Operating and Handling High-Tension Apparatus." Each rule-book is numbered, and the operator signing for it is expected to become familiar with its contents.

Under these conditions accidents are reduced to a minimum, as this company's statistics bear witness.

Not the least among the safety precautions taken in the generating-stations should be mentioned a complete system of labor-saving appliances, in consideration of the fact that a man tired out by the strenuous exertion of handling coal or ash is far more liable to danger in moving about among operating-machines than a man whose vigor has not been exhausted.

From this point of view one of the most important labor-savers is the automatic stoker. To-day all the boilers in operation—to the number of one hundred and fifteen—are equipped with the automatic device.

For the disposal of ash an electric railway runs under the hoppers, which discharge at the pressure of a valve into the cars beneath. The ash is then run out onto the dock and dumped by a skip-hoist into a storage bin, from which it is shot into scows and carried down the harbor.

The old method of blowing out of boiler parts has been abandoned and compressed-air apparatus substituted. A pipe-line now runs throughout the stations to which a hose can be attached at any desired point. The relief afforded by this method can readily be appreciated by those who have had experience in power production.

Under the head of prevention come the prompt treatment of those who occasionally suffer injury, notwithstanding elaborate precautions for safety, an admirable system of accident reports, financial aid for those incapacitated through injuries, and, in the event of death, aid for their dependents.

The greatest number of accidents which do occur are slight injuries which, with proper care, are successfully treated; but without such care they might result in death or permanent disablement.

The company retains two of the best physicians in the country who are specialists in injuries incident to the electrical industry. Lectures are given by these physicians, under the auspices of the company's Association of Employees, on the resuscitation from electrical shock and allied topics. In this way the workers are prepared in case of accident to give valuable aid pending the arrival of the doctor. One of these physicians, Dr. John Woodman, has prepared for the benefit of the men a most valuable little book on *First Aid to the Injured.*

Undoubtedly one of the prime essentials for the prevention of accidents is complete and accurate information about the accidents that have happened, how each accident occurred, what machinery was involved, the working-hours, and other details. It is considered of the utmost importance to get every fact that will throw light on such accidents with a view to preventing their recurrence.

When an employee is injured he is treated at the medical cabinet if the injury is slight, otherwise he is immediately sent to the company's physician, who examines and treats him. The physician then makes a report, recommending that the patient be put on "full duty," "partial duty," or "off duty." A return to "partial duty" means that the man is permitted to do light work only, and is adopted more through consideration of its moral effect upon the employee than for any benefit the company may derive from his labor. Some easy occupation serves to divert his mind and acts as a stimulus to recovery.

The foreman and the physician both make out detailed reports of the accident—the hour, place, nature of the accident, its liability, whether due to the carelessness of the employee or one of his fellows or to some outside cause. The doctor's report contains one of the anatomical stamps which the company has prepared, showing all parts of the body and having marked on it in ink the exact location of the injury.

The reports of the doctor and the foreman are then forwarded to the Bureau of Claims.

During the operation of this plan the company has gathered valuable statistics on the nature and cause of accidents. The figures show that the majority of the accidents are of a trivial nature. For example, of those that occurred during 1912 more than one-half resulted in no loss of time. During the same period there were no deaths.

Eighty-seven and four-tenths per cent. were due to the carelessness of employees, and only 11.11 per cent. were due to electrical causes. The most frequent cause is designated by the heading "struck by material," including all minor injuries, many of which amounted to but slight abrasions of the skin. Next in order of frequency come short-circuit burns, material in the eyes, cuts, sprains, and falls.

The treatment of minor injuries calls for no small amount of discretion. If all minor cases were sent to the doctor the loss of time would be considerable. On the other hand, minor injuries cannot be neglected, as they might result in serious trouble. In such cases the medical cabinet proves its usefulness and importance.

There is a regrettable tendency on the part of employees to conceal minor injuries, and also a carelessness in complying with the safety regulations that are posted by the company, but it is believed that the methods it is employing will finally bring forth the heartiest co-operation of all its employees.

Under the head of prevention may also be included the financial assistance rendered by the company to its injured employees. The workman, on his first visit to the physician, takes with him a card signed by his foreman "which entitles him, regardless of the responsibility for the accident, to free medical aid during the period of his disability." He is then given an opportunity to sign a release "wherein he waives all claim against the company in consideration of such free medical care." The company believes that the cost of all such accidents "should fall, not upon the individual or his dependents, but upon the industry as a whole."

The injured workman is immediately put upon what is known as the "disability pay-roll," and is paid, in proportion to his disability, full, half, or quarter wages. In the event of death his widow or dependents receive a sum equivalent to the amount to which he would have been entitled in case of total disability.

That the compensation policy of the company has proved fair and wise is evidenced by the fact that of all the accidents which took place from 1903 to 1907 only six employees refused to sign the release and sued the company; five were unsuccessful, the cases being dismissed upon their merits; the sixth was adjusted out of court. In the case of fatal accidents, which are exceedingly rare, all mortuary expenses are borne by the company, and a special appropriation is made for the family of the deceased.

The management is fully awake to the significance of education as a safeguard against accidents. Not only is technical skill desirable, but education that will develop mental alertness, accuracy of judgment, and a genuine and lively interest in the company. The deficiencies of human nature must be reckoned with, and the mentality of men trained to meet not only emergencies, but the inevitable risks incident to daily routine. Education is imperative for bringing the workman to a clearer appreciation of life and its responsibilities and in making him more alert to the opportunities and dangers of his profession.

In its school for employees the Edison Company not only provides classes affording a comprehensive technical knowledge of the industry, but also gives the men an opportunity to familiarize themselves with the commercial aspect of the company's affairs. The school has been so planned that, without cost, the employee may receive laboratory instruction in electrical science from the elementary principles to the most advanced application. Night courses have been arranged for the day workers, and day courses for the night workers. In this way any man who enters the company without technical training but who has an ambition to become proficient along his chosen line may acquire proficiency by his own effort. He is also given courses in salesmanship and lectures on accident prevention and hygiene.

This school is unique in that its work is done entirely on the company's time and is considered as a part of the company's work. No employee who comes in contact with the public is without instruction along the lines of courtesy and helpfulness. His work in the school is graded, and the results are considered in the matter of promotion.

In every way the New York Edison Company seeks to prevent accidents and to discharge its responsibility, not only as employer to employee, but also as public servant to a community which is warranted in expecting a high degree of efficient service.

XIII

GENERAL AIDS TO SAFETY

IN a discussion of safety it will be of service to recapitulate briefly the causes of industrial accidents.

Again we are forced to turn to German experience for accurate statistical information, this time to the annual report for 1911 of the North German Iron and Steel Association, including 7,853 industrialists, and employing 138,927 insured workmen. The wages were 168,338,234 marks.

The total number of accidents for which compensation was paid was 1,311. Of these 54 were fatal, 15 totally incapacitated, 911 partially incapacitated, and 332 slightly incapacitated.

One hundred and sixty-seven accidents were caused by collapses and falls; 159 by falls from ladders, stairways, roofs, and openings; 178 in loading, unloading, and carrying material; 426 by motors, transmission, and power-machines.

Of the 1,311 accidents, 60 concerned the head and face; 159 the eyes; 595 the arms and hands; 332 the feet and legs; 81 other parts of the body; 50 were internal injuries. Responsibility for these accidents was divided as follows:

Fault of a fellow-workman or outsider	33
Personal carelessness or carelessness of fellow-workman	484
Insufficient care in installation, lack of safety appliances, lack of warning notices	46

Not using safety appliances, disobeying notices......	37
Combination of causes—*i. e.*, faulty installation with carelessness of workmen, neglecting safety precautions with carelessness in handling, etc.................	18
Pure accidents and unknown causes...............	693
	1,311

There are four groups of interests involved in industrial accidents: the workmen, the employer, the community, and the people at large.

The last are involved as sufferers, almost exclusively, in accidents occurring in transportation, and may be ignored in dealing with accidents in manufacturing operations.

The community is involved, because it is very often called upon to care for those whose means of livelihood have been impaired or entirely cut off. Economists claim that this is imposing upon the community a burden which should be borne by the industry.

Modern industry, in its complication and speed, has introduced many elements of danger not formerly existing. The manufacturer, with many matters before him requiring closest concern and thought, can personally give little attention to questions of mechanical safety. Until the inevitable industrial accident occurs among his own people the subject is not brought home to him.

The workman is probably the greatest sufferer, considering his means; and this has led public opinion, as expressed by legislative bodies, to seek relief along the line of least resistance—that of compelling the employer, usually possessing responsibility, to carry the whole load.

Many accidents are brought about by resistance to reasonable discipline, which is characteristic of the American workman. For accidents resulting from carelessness, recklessness, or disobedience, of course, the workman alone is at fault, though the employer is often forced to shoulder the blame.

Another class of accidents is due to ignorance. These more often befall the unskilled worker who enters upon his industrial life without a knowledge of the risks he is to encounter.

A large group of accidents, under present circumstances in this country, is due to the inherent risks of the industry, the accidents which no foresight or care on the part of the employer or the workmen could prevent. These should be made a direct charge upon the industry, in which the consumer ought to be made to share, for it is possible to add a part or the whole cost of the accident to the price of the product.

Still another group of accidents is that for which the employer is squarely responsible, because he does not provide the necessary safeguards, or because he neglects opportunities fairly within his reach to educate the ignorant, to restrain the reckless, or to secure the active co-operation of the intelligent and well-disposed.

It is not enough to spend money and exercise ingenuity in equipping a plant with safety devices and in seeing that they are kept in efficient condition. It is not enough to draw up sharp rules and see that they are obeyed. There should be developed systematically throughout the organization a spirit of co-operation for the safety of the entire industry.

Until such time as the consideration of safety becomes of as great importance as questions of producing, selling and advertising; until it becomes a part of a plant's industrial policy—until this point has been reached, the American industrialist will not have done all in his power to protect his industrial army, who are intrusting their lives and limbs to his keeping during the working period of every day.

To head off unjust legislation it behooves our manufacturers to reduce to a minimum the suffering due to accidents and the inherent risks of occupation, which in themselves constitute a serious burden upon employers and employees.

It would seem that to be successful to-morrow our industrialists must put their house in order; they must cut the ground from under a movement which is dangerous, because there is some justification for it; they must come into the forum of public opinion with clean hands. The most effective means of meeting such a movement, which may become dangerous through possibly uninformed activity, is to remove the cause for just complaint and criticism.

A few years ago the advocacy of safety devices, greater caution, and the protection of human life was considered visionary; but there has been an awakening to the importance of this great subject. It is a duty to surround with every possible safeguard the toiler who makes the wealth of the nation, and to protect his life and health while at work.

What, then, are the causes of industrial accidents? There are two great classes, which, combined, make a third. The two grand divisions of accidents are: Those affecting the machine or mechanical elements of the plant, causing injury, necessitating repairs, and stopping production; and those touching the human factor without accident to the mechanical part. The combination, or third class, is composed of accidents affecting both the machine and the operator.

The suggestion was offered by an experienced shop manager that the designer should not attempt to make a tool absolutely "fool-proof." He should be satisfied to make it safe. This distinction means that to surround the tool so completely with mechanical safeguards that the man who uses it is tempted to grow careless and foolhardy because the designer has overdone his legitimate duty is to do an injury to the operative.

A man who is set to work in the control of great power at his tool or work should not be encouraged or allowed to forget how great is the power with which he is dealing, nor his responsibility in directing it. Sleepy or inert direction never produces as good work as the hands directed by an alert, watchful brain. The over-safeguarded tool may save some bodies of low value, but it does not encourage and foster the development of a brain of high value.

The human factor is uncertain. For example, the greatest number of accidents have been found to take place in the early hours of the morning or on first coming to work. German statistics show that the product of labor is 20 to 25 per cent. less on Mondays than on other days, and that on Mondays and Saturdays by far the greatest number of accidents occur. This is to be explained by the delayed process of waking in the brain, the poor quality of the first meal in the morning, and the results of the previous night's excesses.

The next worst hours of the day are toward quitting-time, when the men are tired, indifferent, and have become careless through their impatience to be off.

A fruitful source of accidents is bravado. This has been cleverly called "the exaggerated ego," which in a man might be taken to mean that he considers himself superior

14

to the dangers which menace the ordinary person, and that his superiority in quickness, skill, or other endowments renders him immune from accidents. This frame of mind makes him impatient of safeguards. It induces him to take risks, showing that he is not brave, but foolhardy. It results also in drawing innocent comrades into catastrophes precipitated by the risk-taker.

SUITABLE CLOTHING FOR WOMAN OPERATOR

Another source of danger is unsuitable clothing. Some interesting advances have recently been made in shop rules which compel men to wear short-sleeved jumpers instead of rolling the sleeve up above the elbow to leave the arm free. Women also are liable to accident in wearing clothing ill adapted to their work. Women operatives should not be permitted to wear their hair in hanging braids or in loose, untidy masses, as this has many times proved a source of painful accidents.

In silk and cotton mills overspeeding of the machinery is the most common cause of accidents to workers. Perhaps one of the greatest causes of danger in any factory or shop where power is used to run machines is the oiling and cleaning of the working parts while in motion.

Textile machinery, properly guarded, has little danger for the worker. The worst, however, is from overcrowding. Very often not enough space is allowed between machines, making the aisles too narrow. The aisles may be made safe by proper guarding of the ends of the machines, but often more space should be allowed between machines.

Dangerous conditions arise in the erection, construction, painting, alteration, or repair of buildings or bridges. The mechanical force here to be treated is the force of gravity. A man, taken unawares, falling from an elevation is reasonably certain to be severely injured.

In this same class will also be found the operation of elevators, hoisting-apparatus, derricks, or lifting-machinery of any kind within or outside any structure in process of erection. The dangers here are from the fall of material from a height, due to the failure of any part of the hoisting-machinery.

The trades incident to the erection or demolition of structures in which there is iron and steel framework include the dangers mentioned above as well as the dangers attaching to great elevation and consequent exposure to wind pressure. The masses to be handled are usually great, and their momentum may throw a man to his death without any mechanical failure or any fault or carelessness of the worker.

The construction, operation, alteration, or repair of apparatus charged with electrical energy is very hazardous.

Such apparatus includes not only wires, cables, third-rails, but also switchboards and similar controlling devices.

SAFETY HOOK FOR HOISTS

An interesting experience in connection with the dangers of electrical apparatus is that of a certain great company engaged exclusively in the manufacture and distribution of electric current.

This company found after careful tabulation that only 13 per cent. of the total number of its accidents during a given period were from causes purely electrical. The causes of accidents, according to their number, were as follows:

Falls from ladders and scaffolds; falls on the level
Hurt while moving material
Struck by material
Foreign substance in eye
Hurt at ash and coal handling apparatus
Steam and hot-water burns
Acid and solder burns
Machinery accidents
Tool accidents
Cuts and punctured wounds
Sprains, strains, etc.
Short circuits

In doing the world's work the first requisite is physical and mental fitness; the employer must have those employees who can stand up under the wear and tear of production. If the business involves lifting or carrying heavy loads an employee with a weak heart is a hindrance; if the work entails the inhaling of irritating dusts and fumes, the flat, narrow-chested worker possibly affected by catarrhal and bronchial troubles is passed by.

"My employment bureau with its medical staff for physical examination of all applicants for work is one of the best time and labor saving devices I have," declared a certain employer. "I sometimes call it my screen or sifter for separating the fit from the unfit. If I appear hard in turning away an unfit I have always in mind my present staff already engaged. The workman must realize that his arms and legs, with a certain amount of directing intelligence, are his only stock in trade, his only working capital, which he cannot afford to risk through the choice of a wrong vocation."

Certain retail trades require constant standing and long hours of labor; when the working-place is damp or insufficiently heated, chills, colds, bronchial troubles, and rheumatism may be expected, with a corresponding decrease in the efficiency of the worker.

In trades requiring close application, accurate measurements, and fine care, poor or impaired eyesight seriously interferes with proper efficiency.

From the workman's point of view his body is a machine or tool which furnishes him a livelihood. Whatever affects injuriously this machine lessens the number of dollars it can produce. Inasmuch as there is a direct connection between the number of dollars earned by the worker and by the man for whom he works, the importance of clean living, education, and physical fitness for the work required on the part of the employee is of as much importance from the employer's standpoint as from that of the worker himself.

Because the wage-earning capacity of the majority of laborers is not enough to enable them to provide for the emergencies of accident, disease, or old age, a thrift or mutual benefit association is an aid to safety in that it tends to make its members more careful, that they may not be compelled to draw upon their savings fund.

The wording of factory legislation in nearly all states insists that "proper safeguards" shall be installed in factories where dangerous machinery is in operation "when deemed necessary" by the factory inspectors. In those states in which the judgment on damages from a factory accident is left to the decision of the courts it must necessarily be that the charge of the judge centers upon a definition of the word "proper."

In one shop there may have been a series of accidents which have emphasized to the owner the necessity of safeguarding certain machines or danger zones in the plant and he has become insistent on the protection of these points. In another shop immunity may have been from that particular class of accident, and consequently the dangers in this class of machinery seem less important. Workmen pass frequently from shop to shop and when they find differences of opinion among employers, superintendents, and foremen they experience confusion of mind and a resulting carelessness of attitude toward any measures for accident prevention.

Standardization of safety devices, either by law or by agreement, would be of advantage to the employer who feels that his duty as well as his interests point toward paying more attention to the problem of safety.

Present relations between employer and underwriter require standardization. If a factory inspector of the state has passed a plant as adequately safeguarded, it takes courage in the insurance inspector to express a different opinion. If he is too emphatic he loses the business. In the same way the factory inspector hesitates to antagonize the opinion of the insurance inspector who had money at stake, by saying that the plant which he has underwritten is inadequately protected.

The factory inspectors of the state are in a position to establish the standards for safety devices to be applied to machines. Such standards, however, can be effective only in the state which adopts them. Some standard broader than that of one state is needed — one which shall be accepted by all states and by the manufacturing community of the country at large. This puts the problem on a plane higher than that which factory inspectors can command. The problem of standardizing shop rules is in the same field so far as the printed and published rules are concerned. There is, however, an atmosphere favorable to securing safety which set factory rules cannot secure, because when set forms are used they often tend to produce a frame of mind which considers that verbal compliance with the rules is all that is necessary. Thus a spirit of good-will toward safety is not necessarily fostered.

A museum of safety would seem to be the organization best fitted to undertake such work of standardization and to secure effective co-operation. Such an institution at which safety devices may be exhibited in competition, in order to receive the criticism of all interested, has a directness of access to the employer on the one hand, and to the employee on the other, such as no legislative body, technical society, or other body can secure.

The opportunity placed in the hands of the purchasing-agent to secure safety in the plant should not be overlooked. In one important company the stimulus takes the form of a rubber stamp impressed upon every letter from the purchasing-agent in regard to the purchase of new materials or machines:

> PROVISIONS FOR SAFEGUARDING WORKMEN SHOULD BE BROUGHT TO OUR ATTENTION, AS WE WILL CONSIDER THEM IN SELECTING NEW MACHINERY AND EQUIPMENT.

This stimulates safety at the fountain-head, in the drafting-room of the manufacturer. It is plain that a completely safeguarded tool which would protect the workers from all accidents whatever could well be paid for at a higher price than another machine which drew in its wake costly compensations or lawsuits.

A purchasing-agent whose work lies in the state of New York makes the following note a part of the order and contract:

"This order for machinery is accepted with the understanding that it will in all requirements comply with the New York State laws as laid down for the preservation of life and limb, and of machine-operators, or any persons whose duties may call them around the machine, as such laws may be interpreted by the New York State inspector. Unless this machine is received in this condition we reserve the right to return it at once without notification, charging the transportation charges to the maker, or to make such changes as may be necessary to make it satisfactory to the New York State inspector, and take cost of same from the price formerly agreed upon."

This company has experienced no trouble in buying machines with this clause attached. It is intended to protect the buyers from the cost of making up the shortcomings of the designer with respect to safety.

A large mining company in western Pennsylvania has inaugurated the plan of presenting coat-lapel buttons to certain of its employees delegated to look after the safety of the mines and the welfare of the men employed therein.

Blue-and-gold buttons with the words "Safety Committee" engraved on them are worn by the superintendents, mine foremen, assistant mine foremen, fire bosses, and rib bosses at each mine, these persons constituting a permanent safety committee. In addition to the men filling these positions three workmen in each mine wear similar buttons—one a miner, one a coal-hauler, and another man doing miscellaneous work; these three constitute a workmen's safety committee, appointed by the superintendent to serve for a period of six months, and it is their duty—for which they are especially compensated—to make regular periodical examinations of the mine, followed by recommendations to promote the further safety of employees. The general officers wear these buttons also, and are included as members of the permanent safety committee.

Red-white-and-blue buttons with the words "First Aid and Rescue Corps" surrounding the monogram of this company are self-explanatory of the duties of the men wearing them. At each large plant five men are selected by the superintendent to do this first-aid and rescue work in case of emergency. These men are required to pass a medical examination, are given instruction in first-aid treatment by doctors paid by the company, and are sent to one of the company's rescue training-schools to receive twelve lessons in rescue work. They are, however, detailed to wear this button only after they have qualified as to their fitness to do rescue and first-aid work. Rescue stations are provided at three plants centrally located and fitted up with complete Draeger oxygen apparatus, pulmotor, and other resuscitating apparatus.

On the evening of June 12, 1912, twenty-five hundred dollars in prizes were distributed by the National Cash Register Company for the best suggestions turned in by its employees during a contest which closed June 1st.

For more than thirty days previous to the contest over six thousand men and women were concentrating their minds and directing their nervous energy toward the working out of ways to better the company's organization and product. The call was made for suggestions in three classes:

1. Safety Devices. In order that the employee may devote his time, thought, and energy to guarding his work against defects, rather than his person against accident or injury, 205 prizes amounting to $1,500 were awarded in this class.

2. Ways to Conserve the Health of Employees. In order that the people who make the National Cash Register may be physically sound, and thus capable of turning out only sound, healthy work, 80 prizes amounting to $500 were awarded in this class.

3. Conveniences. In order that the National Cash Register employees may have the best possible facilities for turning out high-grade work at the lowest possible cost, and considering material, workmanship and what they do, that National Cash Registers be kept as they are to-day—the lowest-priced machinery sold in the world—80 prizes amounting to $500 were awarded in this class.

In all, 3,970 suggestions were turned in during the contest.

A superintendent on the New York Central lines, going through an important yard on his division, saw the coupling-lever of a car lying between the tracks; he said to a group of employees, "Get out your watches and see how long it takes me to throw this aside where it won't cause one of you yardmen to fall under a moving train." It took him less than ten seconds to walk to the lever, throw it aside, and return. Even the ten seconds could have and should have been saved by the man who put the lever there by throwing it aside in the first place.

It is the little things in every yard, workshop, and factory that the men walk over and around and see every day, but do not think about until some one gets hurt. Upon these points attention may be concentrated by means of the suggestion contest.

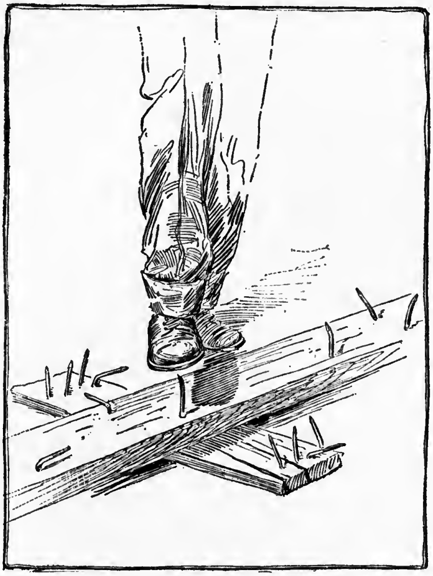
Among these little things may be mentioned:

The loose board with the projecting nail; the pile of cinders or rubbish too close to tracks where employees work, or about the premises; loose and "flapping" doors on moving cars; material stored carelessly; exposed set-screws on revolving spindles or shafting; unguarded fly-wheels, pulleys, or gears; holes in floors of shops and platforms; insufficient lighting; poor ventilation; a weak ladder rung or support; the worn and burred head of hammer, chisel, or bar; the absence of a stop-block for overhead trolley or crane; lump of coal on deck of engine; hose insecurely attached; absence of signals and warning-signs; too high or too low footboard on engine; material or rubbish in passageway of shops, depots, or storehouses; icicles falling from roofs; snow or ice on steps; absence of railings and walks; manhole or ditch left open; even a door-stop placed out on the floor instead of back near the wall.

Responsibility sobers. Let the workmen feel that they are responsible for their own safety and the safety of the other fellow.

A pat on the back sometimes helps the one trying to do his share. France pats collective labor on its industrial back by its annual Fête du Travail, or Labor Festival, when the highest dignitaries of the republic assemble for this purpose.

The setting of a recent festival was the great hall of the civic engineers; on the platform were distinguished



DANGER OF LOOSE BOARDS WITH PROJECTING NAILS

officials of the government and the big men of the industrialists. The president of the republic was personally represented. Parents, relatives, and friends crowded the hall. By diplomas, special mention, awards, medals of gold, silver, and bronze those deserving distinction were publicly recompensed, and the eye of France was on the beneficiaries.

One series of awards included industrialists whose interest in the moral and physical well-being of their apprentices and young workers took the form of schemes to secure safety and the best sanitation in regard to factories and workshops and of general as well as special instruction with regard to the morals of the workers.

The presiding officer called the name of Monsieur Laine, an associate in the firm of Ed. Laine & Co., of Beauvais; he was particularly interested in the Mutual Aid Society in the factory, which he started in 1892; he had also introduced a medical service, simple talks on hygiene, first aid to the injured, and the purchase and preparation of the most nutritious food-stuffs for the employees. A restaurant in the factory and a co-operative society were among his foundations. This firm makes special grants to the Society for Improved Dwellings, so that the workmen may have an opportunity to bring up their children under healthful conditions. For his active interest in these betterment institutions Monsieur Laine was honored by the silver medal of the society.

Foremen and women showing a high degree of intelligence and devotion toward the young people intrusted to their care received altogether some seventy-five awards. A gold medal was given to Monsieur Douselance, who had completed forty-two years of service with the same firm to which he had come as an apprentice and workman; he was honored on account of his kindly personal interest in the workers under him.

An important class of awards concerned apprentices nominated by their employers, societies, professional schools, and local commissions for their ability and good conduct. The prizes in their class were credits in savings-banks of two to three dollars each.

The firm of Boas, Roderiques & Co. make use of the most improved safety devices; they never install a new machine without being sure that they have safeguarded every point of danger. The solicitude of this firm for the welfare of their women workers and apprentices was recognized by a gold medal.

An international aid to safety is a congress devoted to an interchange of the world's best thought in accident prevention and industrial hygiene. To illustrate:

In May, 1912, the first congress of this kind was held in Milan. It was called on the initiative of the French, Belgian, and Italian associations for the prevention of accidents to labor, and had for its patron his Majesty the King of Italy. Its object was to ascertain the practical results of such safeguards as had recommended themselves to the best Continental shop practice. Of equal importance were those measures taken to promote sanitary conditions in factories, mills, and shops.

Former congresses had been composed chiefly of medical men whose problem was the study of occupational diseases, but *prevention* had seldom been touched upon. Problems of prevention so closely concern the chemist, the technical man, and the engineer that there was felt the need of a purely technical congress as supplementary to the deliberations of the medical fraternity.

Some six hundred delegates assembled May 29th in Milan, where the opening sessions were held in the Castello Sforzesco under the presidency of Ing. Pontiggia. Representatives from the government, the ministries and the city of Milan welcomed and indorsed the congress.

There were six main topics of discussion:

I. Belt-shifting under various conditions.
II. Metal, mixing, and rubber rolls.
III. Ventilation, dust-exhaust, humidizing in cotton and wool plants.

IV. Ways and means of purifying air by drawing off steam and vapor in dyeing and cocoon spinning.
V. Construction and operation of drying-apparatus, hydro-extractors with centrifugal power.
VI. Safety in handling high and low electric currents.

Other communications dealt with safety in connection with systems of transmission, elevators, hoists, wire-drawing, dough-mixing machines, engine stops, railway signals, presses, and punches, and with improved sanitary conditions in porcelain, fertilizer, and hat works, printing, and textile establishments.

A small membership fee in these congresses entitles the subscriber to the volume of proceedings, practically a text or guide book in the various fields of effort.

XIV

ORGANIZED EFFORT BY EMPLOYERS

THERE was a period in the industrial history of America when employers were engrossed with the vexing problems of rapid development in the various lines of industry to the exclusion of a consideration of problems affecting the safety and health of employees.

At that time, excepting in certain shops where the owner or manager was in daily and intimate association with the workers, the sole point of contact between management and men was in the pay-envelope. Since then, however, the ranks of labor have demanded—and been accorded—certain needed reforms. Some of these reforms have been brought about by agitation and legislation, but many of them have resulted from a changed attitude on the part of employers themselves who have come to realize the business value of safe, light, and sanitary work-places, compensation for injuries received in the work, and pensions for employees in recognition of long-continued and faithful service.

The modern business organization believes that men as well as equipment must be maintained in first-class condition if the business is to yield its full and legitimate returns.

Elsewhere in this volume attention has been drawn to the work of the Central Safety Committee of the United States Steel Corporation and to the aim of this committee gradually to standardize the safeguards and sanitary provisions that have proved most practical and effective in the experience of the various subsidiary companies of the corporation.

In the same way the great associations of firms and companies engaged in manufacture and production have found it expedient and valuable to co-ordinate and standardize their individual efforts at safeguarding the lives and health of their workers as well as along the lines of what is generally known as "welfare work."

The National Electric Light Association, with a membership numbering upward of twelve thousand, has repeatedly urged upon its member companies careful consideration of their standing in the communities served by them, and the importance of eliminating on their part any conditions that might lead to friction, criticism, or a sense of injustice and unfair dealing.

Where monopoly of service is granted to a member company the association points out the increased responsibility of that company to become an important factor in the better development of the community in which the service is rendered. It believes that even greater efforts toward good service, fair prices, and harmonious organization should be made in such communities than where competition is most keen.

In a recent report the Public Policy Committee of the National Electric Light Association laid great stress upon the necessity of eliminating all suggestion of charity or philanthropy from the relationship between employees and employers. It was pointed out that while an employee performs his specified task for a definite wage he can also render his employer service by working continuously and in showing a degree of loyalty which affects not only his own work, but that of other employees working with him. Continuous service makes for efficiency; increased devotion to his employer eliminates or lessens that attitude known as "soldiering"; and economy may also be expected as a result of a more careful use of tools and materials.

With a view of securing this service and loyalty from employees the Public Policy Committee, in its report to the Thirty-fourth Annual Convention of the National Electric Light Association in 1911, recommended that employers of the electrical industry should take a leading part in the development of the health and safety, material welfare, and happiness of their employees, and that each company or corporation should adopt as its own policy, or encourage its employees to adopt, any one of the following six plans for social betterment or uplift:

1. Accident insurance
2. Sickness insurance and death benefits
3. Service annuities
4. Profit-sharing
5. Employees' savings and investment funds
6. Life insurance

From an insurance actuarial point of view so little information was available upon the cost of accident insurance, sickness insurance, death benefits, and service annuities that it was deemed advisable to secure the services of an insurance accountant to analyze and report upon the cost of maintaining the various forms of insurance relationship.

In addition to referring the technical consideration of these forms of insurance to an expert actuary, information of a statistical nature was requested from the various member companies.

Nearly three hundred companies replied in detail, showing that a very large percentage have adopted some form of welfare relationship conforming with the recommendations of the committee. One hundred and forty of these companies now provide free medical and surgical attendance in the event of industrial illness or accident, and twenty-eight companies regularly employ physicians or surgeons for their employees; one hundred and thirty-nine companies continue their employees on the pay-roll at full pay during full or partial period of illness; ten member companies now provide service annuities, eight have adopted some form of profit-sharing, nineteen have employees' investment or savings fund associations, and a similar number provide life insurance.

The New York Edison Company was one of the first companies to adopt the plan of service annuities for its employees. During the past year the same plan has been put into operation by the Commonwealth Edison Company. The Employees' Saving Fund of the Commonwealth Edison Company, created in 1909, now amounts to $230,000, and owns twenty-three hundred shares of the company's stock; an interesting feature of the welfare work of that company is the continuation on the pay-roll for periods ranging from one-half of a month to six months of fourteen tubercular employees, whose wages or salaries during the period of illness amounted to $2,740.

The Edison Electric Illuminating Company of Brooklyn has in force a plan of profit-sharing, and at the end of 1911 devoted to this purpose $45,674.50, as compared with $38,171.03 at the end of 1910; the employees' savings, in addition to their profit-sharing credits, amounted on April 15, 1912, to $91,641.15; the combined total in the Investment Fund on April 15, 1912, was $176,783.66, and the employees through this fund owned nine hundred and sixty-two shares of stock and $34,000 of the company's debentures.

A most important step in general welfare work has been taken by the Edison Electric Illuminating Company of Boston. The organization of that company had been divided into five bureaus—accounting, construction, executive, operating, and purchasing. A sixth bureau has now been created, called the Welfare Bureau, for which a chief has been appointed. This bureau will have entire charge of the general relations of the company to its employees in all matters outside of their regular duties and employment.

The Philadelphia Electric Company's Beneficial Association continues automatically to take care of all cases of temporary disability due to illness or accident. During the past five years $61,000 has been paid on account of temporary disability, $42,000 paid in death benefits to the beneficiaries of forty-eight deceased employees, while for the full period of five years the total contributions of the deceased members to the death-benefit fund amounted to only $325, or an average of less than $7 per member. On account of the retiring age not being compulsory there is but one member on its rolls. His annuity is equal to about 50 per cent. of what he had been earning. Generous encouragement is also given to activities of an educational and physical character, the Athletic Association having a membership of nearly nine hundred. The annual distribution of cash to employees every Christmas, a custom of years, is being continued, in addition to all other welfare work.

The Cleveland Electric Illuminating Company has for eight years distributed through its Employees' Fund a sum increasing annually from $6,457.72, or 6 per cent. of the annual earnings of 145 members in 1904, to $34,195.58, or 8 per cent. of the annual earnings of 463 members in 1911. The total distribution made up to 1912 was $136,881.55, of which amount $57,817.40 was distributed in cash and $79,064.15 allowed to remain in the fund to the credit of employees at an interest rate of 4 per cent. annually. The company also assumes all medical expense following accidents to employees while engaged in their work, and usually allows full compensation to such disabled employees.

Stone & Webster have adopted throughout the various branches of their organization a plan for welfare work which, while not as yet crystallized into a well-defined system, is, nevertheless, extremely effective and has given, so far as can be learned, entire satisfaction. The Stone & Webster Employees' Investment Association was organized with a board of trustees acting under a deed of trust. The trustees are made up of a number of employees and also the members of the firm. From the board of trustees is elected an executive committee, whose duty it is to attend to the affairs of the association and make the necessary investments. The firm furnishes, without expense, the necessary headquarters and most of the clerical force necessary for carrying on the work, and in addition gives the association an opportunity to invest in any undertakings upon the same basis as the bankers or original syndicates which invest in the enterprises. Besides this the firm at the start contributed a substantial amount of money to form a guarantee fund to provide against possible loss. The employees of the organization have availed themselves very largely of this opportunity to invest, and there is at present deposited in the association between $600,000 and $700,000. The association has paid for over a period of ten years an average of about 7 per cent. The various branches of the Stone & Webster organization also have special funds deposited in trust for welfare work. A certain amount of money is set aside each year, to be used at the discretion of the officers for the benefit of employees. So far it has been used mainly in providing help in cases of illness and for pensions for men who, through illness or for other reasons, are incapacitated for work. As yet no old-age pensions have been established, but in the course of time this will undoubtedly be necessary. In the various camps where engineering work is carried on the company has provided special lodgings for its men and has organized clubs among the men, to which the men themselves contribute in part and the company in part in order to provide comfortable living-quarters and hospital accommodations in case of illness. In the operating department of the business similar clubs have been organized in the cities where Stone & Webster have street railway, lighting, or power plants, and colony houses have been established partly by the employees and partly under the patronage of the organization.

H. M. Byllesby & Co. now have an investment club, through which the employees of their various interests may invest their savings. Membership is entirely voluntary. Starting in 1910, there were 350 members, with subscriptions amounting to $57,064, upon which in eight months a substantial profit was realized; in 1911 the investments amounted to $225,710, divided among 857 subscribers; a further series of investments was started in August, 1911, for which there were 864 members subscribing $301,952.

The Milwaukee Electric Railway and Light Company and associated companies have established a service-annuity system, loan-fund, and mutual-benefit association.

The Consolidated Gas, Electric Light and Power Company of Baltimore has adopted a service-annuity plan, issuing to the beneficiaries a service certificate.

The National Electric Light Association, believing that the productive value of underpaid, underfed men and women cannot be equal to that of workers who earn enough to insure good health and a reasonable degree of contentment, has expressed itself in favor of a minimum wage, especially as applied to beginners, unskilled workers, and women employees.

Believing also in the direct relation between suitable hygienic conditions and operating efficiency, the association has urged upon its members the importance of providing proper toilet conveniences, sanitary washing facilities, pure drinking-water, and fresh air by adequate means of ventilation.

The Commonwealth Edison Company offers a striking illustration of what can be accomplished in restoring sick employees to health through intelligent care.

Of 11,834 examinations of employees made for indications of tuberculosis this company found 35 tubercular cases—24 of an incipient and 11 of an advanced nature. Of this number 19 were transferred to outdoor positions in the company's service; 5 were given positions in a more suitable climate; 4 recovered and returned to duty; 3 left the service of the company, 2 of them going to a more suitable climate; and 3 died; the company's doctor reports that only 1 now appears to have no chance of recovery. Thus, of the 35 cases, incipient and advanced, 23 remaining in the service of the company have good chance of full recovery; adding the 5 for whom positions were secured in another climate brings the total of 28 of the original number whose health has been restored through the company's efforts in this direction.

The National Electric Light Association believes, however, that means should be taken to prevent accidents and ill health, as well as to care afterward for the injured or sick worker.

Recognizing the importance of the new movement for industrial safety, the Denver Gas and Electric Light Company recently had all of its plants surveyed and reported upon by the American Museum of Safety with a view to eliminating any dangerous conditions.

No one can question the greater contentment and the enhanced efficiency in their work on the part of workmen whose safety is well assured. The initial cost fades into insignificance in comparison with the reduction in human suffering and individual loss of earning power.

The National Electric Light Association has, therefore, urged upon its membership the investigation of every accident, the adoption of such means as may be necessary to prevent its recurrence, and the careful inspection of member companies' plants to insure that no element of protection is missing through which injury may occur to their workmen.

The National Metal Trades Association numbers in its membership upward of seven hundred companies in good standing.

Among the subjects with which the association has concerned itself and upon which it has spent much time and energy are: industrial education and the training of apprentices; legislation in the states and in Congress; co-operative profit-sharing plans; the publication of a periodical, in conjunction with the National Founders Association, under the name of *The Review*, for the purpose of placing before workmen matters mutually advantageous to employer and employee; the fostering of the movement for greater safety and improved sanitary conditions in shop and factory; and the establishment of local employment bureaus to provide capable workmen for employers and suitable positions for employees.

The National Metal Trades Association has always advocated the payment by its members of the highest wages possible in the locality in which the manufacturer finds himself. Wages being a purely local question, the fixing of rates of wages is left to the localities affected, and is a matter in which the association takes no part.

Profit-sharing plans have been discussed at annual conventions of the association and are in operation among members. One of these is the Crane Company's plan of an annual distribution among their employees of a certain percentage of the earnings of each man for the past year. The payment is made about Christmas-time, and is known as a Christmas present. A man discharged for cause or leaving of his own accord forfeits his share, while one who is away without fault is entitled to participate pro rata.

Another plan contemplates first the payment of a given dividend on the investment of the manufacturer out of the profits, and an agreed division of what remains between the company and its employees.

Other plans are based on the purchase by the employee of stock in the employing company, to be paid for by instalments out of dividends or the wages earned.

The payment of a bonus, or a premium, as distinguished from the old piece-work system, for work done over and above an agreed amount gives the workman of exceptional ability an incentive to increase his earnings by steady and consistent work, and this plan is in use in a great many members' shops and factories. It leads to suggestions for shortening the time in which operations can be done and for improvement in equipment.

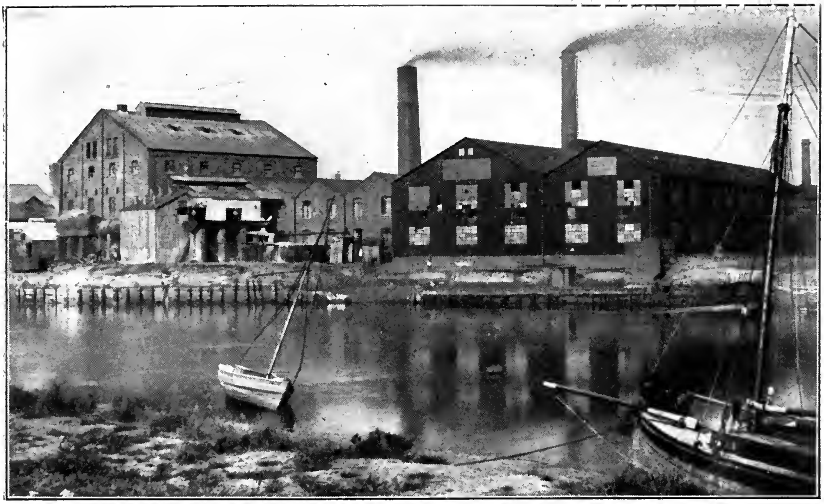
Among certain companies a plan of paying to workmen a reward for inventions which are patentable and improvements which are valuable has encouraged employees to use their brains for industrial betterment.

The National Metal Trades Association believes that a profit-sharing plan tends to decrease the possibility of industrial disturbance, encourages thrift on the part of employees, and gives them an interest in the operation of the plant which is otherwise wanting.

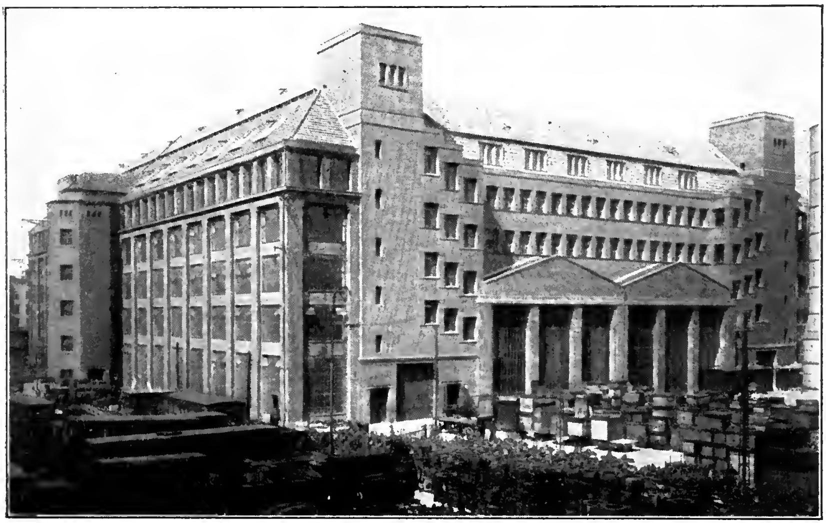
Also this association has taken the position that the first step in the plan of compensation for industrial accidents is the prevention of accidents. The question of greater safety in the shops of the members has been discussed at the annual conventions for years, and the association has sought in many ways to influence its individual members to reduce to a minimum the number of accidents in their plants.

In furtherance of this plan a mechanic of ability who has given considerable study to the subject was appointed safety inspector of the association, to inspect the shops of members with a view to pointing out dangerous conditions to those in charge and of suggesting the remedies to be applied. The employers were a unit in the cordial reception of the plan, officials of the plants which were well protected seeming equally anxious with those who formerly had given the matter only casual thought to receive suggestions for increasing the safety of their equipment.

Lectures and talks illustrated by lantern slides have



AN OLD-TYPE FACTORY—POOR LIGHTING, NO SAFEGUARDS FOR MACHINES OR CONSIDERATION FOR THE HEALTH OF WORKERS



ALLGEMEINE ELEKTRICITAETS GESELLSCHAFT AT BERLIN, DESIGNED BY PROFESSOR BEHREND, ONE OF GERMANY'S FOREMOST ARCHITECTS

been and are being given by the association's safety inspector to groups of workmen and employers, to classes of students and apprentices, and wherever interest in the subject has been displayed.

The association has also published a pamphlet on safety appliances, with the object of placing before its members and others interested a convenient list of devices for the prevention of industrial accidents.

The economic value of sanitary surroundings for employees has been discussed and constantly called to the attention of members, although many employers are humane enough to provide these things on other than a commercial basis.

The National Metal Trades Association early in its history took the position that the old common-law basis of fault as a ground for recovery or defense, as the case might be, was ill-suited to the conditions of our times. This common-law doctrine grew up when individual effort and undertaking was largely the order of the day and vast aggregations of capital and the use of machinery by considerable numbers of workmen were things unknown. It was early recognized that the burden of inevitable accidents should be carried, not wholly by the victim and his dependents, but in part at least by the industry responsible for them, so that the cost could be in turn charged to the consumer. When this subject was first broached in the annual conventions of the association its members, like all other employers, were doubtful as to the best plan to pursue, but a committee was appointed and has been continuously active in keeping the members informed and in working for uniform provisions throughout the country. The movement has gathered headway very rapidly, and to-day a large number of the states have legislated for systematic compensation for industrial accidents.

The welfare work in behalf of telephone operators is particularly interesting because it was an early undertaking intended to benefit the public through the resulting improvement of the service.

The standard switchboard has been designed with reference to the reach of the arm of the average young woman. Special receivers and transmitters have been designed to permit her hands to be free to operate especially designed cords and keys. Careful experiments were made to discover the right sort of a chair for her to sit in and just how high her foot-rest should be. The engineers have not stopped here, but have gone on to solve the problems of light, heat, and abundant fresh air, so that hygienic conditions would be as nearly ideal as possible.

The establishment of rest-rooms with competent matrons in charge is perhaps the one most important accomplishment in this direction. Before going to work or during intervals of work at the switchboard the rest-room becomes a sort of clubroom—comfortable, attractive, with all of the conveniences of a home, and with many of the luxuries of a club. In connection with the rest-rooms it is quite common to maintain dormitories for girls who are belated and simple hospital arrangements for girls who are suddenly taken ill; and in most of the larger cities there are either restaurants or facilities for cooking. Some of the rest-rooms contain a piano so that the girls can dance, and generally the rooms are stocked with magazines and games. Often there are flowers or growing plants, and in some cases libraries built up by joint contributions from the girls and the telephone management. Roof-gardens have been a recent innovation, and calisthenics for students are growing in favor.

It is customary at practically all offices to furnish individual lockers where the girls may keep their outer clothing and individual telephone sets.

Very often the rest-room is the starting-point of social life among the girls, and leads to lectures, entertainments, and other social activities which naturally result from the association of young people.

A very important feature of the welfare work is the operators' school, which has become a recognized necessity, especially in cities. In order to become members of this school applicants for positions must pass preliminary examinations as to their physical, mental, and moral qualifications.

The Western Union Telegraph and allied telephone companies have recently created a pension and disability fund for the benefit of their employees, which became operative on January 1, 1913. This has called for the establishment of a medical department, the function of which is intended to extend beyond the ordinary work of such a department, for it will deal not only with sick and disabled employees, but will carry out preventive measures in the interest of the employees and employers.

While the companies do not expect to furnish medical attendance for their employees, except in special instances, every reasonable and practical effort will be made to insure them prompt and skilful treatment.

The preventive measures will include careful observation of the employees in order that disease or impairment of health may be promptly detected, particularly diseases of an infectious character, as, for instance, tuberculosis.

Prompt removal of the case not only secures a far better chance of recovery for the person involved, but extends valuable protection to other employees. The preventive work will also deal with ventilation, lighting and heating, safe plumbing, modern sanitary arrangements, and protection against injury.

By various means the employees will be instructed in modern sanitation, one of which will be the monthly publication of a bulletin presenting some article on this subject which will be generally and extensively distributed.

These various methods are expected to prove not only of great benefit to the employees, but also of value to the employers, who will secure better and less interrupted service on the part of the employees as well as their co-operation.

According to the United States census of manufactures taken in 1910, the manufacture of malt liquors ranked sixth among the great industries of the United States in amount of capital. In 1909 the 1,414 breweries in the United States distributed $41,206,000 in wages. For the same year the census gives the value of the products of the brewing industry as $374,730,000, ranking the industry seventeenth among the industries of the United States in point of value of products.

The United States Brewers Association, organized in 1862, is one of the largest and most influential of the various exchanges and associations peculiar to the brewing industry. At present it carries on its rolls some seven hundred member companies.

The association has generally achieved excellent results in regard to labor matters by a policy combining fairness and firmness with an appreciation of the workman's point of view and sympathy in meeting demands and making plans for improving the wage-earner's condition.

One of the most important of the association's activities has been its effort to consummate a workmen's compensation and old-age-pension plan for the employees of American breweries. After much arduous work in conjunction with a committee of the Brewery Workers' Union a plan was evolved which attracted much attention and favorable comment from those who have made a study of these subjects. Unfortunately, the plan was rejected by the International Union of Brewery Workmen to whom it was referred. In spite of the present failure of its own plan the United States Brewers Association has strongly urged upon its members cordial support of compensation plans pending in the various state legislatures.

Believing, however, that the prevention of avoidable accidents is of far greater value than compensation for injuries sustained, the association stands ready at all times to furnish its members with suggestions and advice, based upon expert experience, for the safeguarding of machinery and working-places.

The members are strongly urged to support actively proposed legislation in their respective states, tending toward improvement in factory inspection and the use of safety devices on dangerous machines, and to do all in their power to make the breweries of the country models of cleanliness, sanitation, and efficiency.

The National Association of Manufacturers is another influential organization which as a body has manifested a practical and progressive attitude toward the modern problems of accident prevention, compensation for injuries received, and industrial education.

At a meeting of its board of directors in July, 1909, a special committee was named to make a thorough investigation of the subjects of accident prevention and relief with a view to improving conditions in American industry.

As a result of the replies received to the committee's inquiry among the employers of the United States, and of its report before the annual convention of the association in May, 1910, the following resolutions were adopted:

> That the present system of determining employers' liability is unsatisfactory, wasteful, slow in operation, and antagonistic to harmonious relations between employers and wage-earners; that an equitable, mutually contributory indemnity system, automatically providing relief for victims of industrial accidents and their dependents, is required to reduce waste, litigation, and friction, and to meet the demands of an enlightened nation, and that prevention of accidents is of even greater importance than equitable compensation to injured workers.

To continue the investigations undertaken the association authorized the chairman of the committee and its special counsel to visit Europe for the purpose of personally observing the operation of the prevailing systems for the prevention of and compensation for accidents. The information gained was published by the association in a book.

More recently the National Association of Manufacturers has been extending its educational work by means of lectures in various parts of the country by its special committee, by inspections of the plants of member companies, and by illustrated articles on accident prevention and related subjects in *American Industries*, the association's official magazine.

The association has also given its consideration to the need of a better system of industrial education, and at its last annual convention in New York City pledged support to the following principles of educational betterment:

1. Continuation schools for that half of the children who leave school at fourteen years of age, and mostly in the fifth and sixth grades, these continuation schools to be liberally cultural and at the same time to be extremely practical and related as directly as possible to the occupations in which the several students are engaged.

2. The development of a modern apprenticeship system wherein by contract the respective and equal rights of employer and employee are fully recognized, the entire trade is taught, and such other subjects as are essential to good citizenship.

3. The development of secondary continuation or trade schools by which, from the great army of boys and girls who will enter the continuation schools, many may progress from these lower continuation schools, as in some other countries, to the foremost places in industry and commerce.

4. Compulsory education through adolescence being until the seventeenth or eighteenth year, attendance being in all-day schools until the fourteenth year, and thereafter in either the all-day schools or in the continuation schools for not less than one-half day per week without loss of wage.

5. The strengthening of all truancy laws and the development of public sentiment in support thereof.

6. The training of teachers in thoroughgoing methods of industrial practice, including as part of such training extended experience in actual shop work.

7. The establishment of independent state and local boards of industrial education, consisting of one-third each professional educators, employers, and employees, thereby insuring, as in the more successful European countries, the proper correlation of the schools and the industries.

8. The development of the vocational and creative desires of the concrete or hand-minded children now in the grades, discouraged, anxious to quit, and often called backward only because the education now tendered them is abstract and misfit.

9. The establishment of shop schools and part-time schools whenever practicable.

10. The establishment of departments or centers of vocational guidance so that the great majority of the children who now enter industry at fourteen with no direction, 85 per cent. falling into the "blind alley" occupations, may reverse the figures as abroad and enter, under advice, intelligently and properly upon progressive occupations.

During the past few years many corporations have instituted educational courses for their employees as described in the chapter on "Industrial Education." Several of the larger industrial organizations have as many as three schools. Just how many corporations have instituted educational work is not at this time known, but the number is probably in excess of two hundred. A concerted movement to organize these individual corporation schools into a national association has been going on quietly for some time. Finally, on January 24, 1913, representatives of thirty-seven corporations met in New York City at the New York University by invitation of Chancellor Brown and organized the National Association of Corporation Schools.

The object is to maintain a central office where a paid force will gather data regarding the various schools, arrange these data, correlate them, and make them available to all corporations, firms, or individuals who desire to institute educational courses for their employees.

The purposes of the association in brief are to render new corporation schools successful from the start by warning them against the pitfalls into which others have fallen and to provide a forum where corporation-school officers may interchange experiences with a view to improving the instruction in their respective schools. The control is to be vested entirely in the member corporations, thus admitting only so much of theory and extraneous activities as the corporations themselves feel will be beneficial and will return dividends on their investments of time and membership fees.

It is proposed that the membership shall be divided into three classes: Class A (company members), Class B (members), and Class C (associate members).

Class A members shall be commercial, industrial, transportation, or governmental organizations, whether under corporation, firm, or individual ownership, which now are or may be interested in the education of their employees. They shall be entitled, through their properly accredited representatives, to attend all meetings of the association, to vote, and to hold office.

Class B members shall be officers, managers, or instructors of schools conducted by corporations which are Class A members. They shall be entitled to hold office and to attend all general meetings of the association.

Class C members shall be those not eligible for membership in Class A or Class B but who are in sympathy with the objects of the association. They shall be entitled to attend all general meetings of the association.

A discussion of the activities of organizations of employers in the field of accident prevention is not complete without special reference to the work of the German trade associations, each of which has its own staff of experts and inspectors who devote their entire time to making the association's plants safe and efficient workplaces.

Every year these inspectors present a summary of the conditions under which accidents have happened in their plants, and these accounts are printed in the annual report of the association, so that each member may receive the benefit to be derived from such collective experience.

By way of illustration, the North German Iron and Steel Trade Association recently received from its inspectors the following condensed report on conditions under which accidents have occurred:

MOTORS: 6 accidents; 1 fatal.

One accident occurred with a donkey-engine. The man testing the boiler had a finger crushed. Four workmen were maimed testing the boiler of a gasolene-engine. In two cases the crank kicked, and in four cases the jack fell and crushed the man's foot. The death, which occurred in handling an electrometer, was from cause unknown, presumably, however, from a belt running in the neighborhood of the motor.

TRANSMISSIONS: 19 accidents; 4 fatal.

Four workmen were injured, one of them fatally, by revolving-wheels. The man killed fell from his ladder while cleaning windows and was caught by the wheel. In two cases the injured, in spite of warnings, attached the belt to the wheel while in motion and were caught up; the last case was struck by a free wheel. Two workmen got under and over the belt, one workman used a stick, which was caught up by the wheel and was driven through the man's body, causing death. In repairing and slipping on the driving-belt twelve further accidents were caused (mainly by neglect of rules on the part of the operatives). Two of these resulted in death; one of the men was caught by the belt and carried clear around; the other was caught and thrown against a bucket, wounding his leg. Erysipelas set in, and he died.

PRESSES: 37 accidents.

These were mainly with eccentric presses, handscrews, and burnishing-presses. Twenty-three accidents occurred with presses in full operation. Insufficient safety apparatus, neglect to use same, and general carelessness were the usual causes. Eight cases occurred through failure to turn off power on finishing work. Six more accidents, all due to carelessness, occurred in testing and setting up presses.

HOISTING-MACHINERY: 90 accidents; 9 fatal. Passenger and freight elevators: 7 accidents; 1 fatal.

The death occurred in the installation of a freight elevator. The man was found dead in the shaft. Presumably, he fell down in the dark. In a private house the rope of an elevator broke, and, as the safety catch was out of gear, the lift fell with the woman. The other accidents occurred in repairing lifts and shafts. The men were careless in handling machinery.

FALLS FROM LADDERS, STAIRS, SCAFFOLDING, OUT OF SKYLIGHTS, INTO PITS, AND ON SOLID GROUND: 145 accidents; 10 fatal. Falls from ladders: 24 accidents; 1 death.

The death was through falling from ladder while stopping holes in a wall. The man slipped from the rung. This was the cause also of a number of other accidents.

MISCELLANEOUS ACCIDENTS: 237 accidents; 10 fatal.

Splinters flying in riveting, chopping, and trimming caused 113 accidents (mostly to the eyes) which might have been prevented by wearing goggles. Eighteen men were maimed by chips and splinters from working machinery; 3 more by woodwork and pounding limestone; in 2 cases an eye was lost through flying splinters.

ELECTRIC WIRES: 2 accidents; 1 fatal.

Both accidents occurred in connection with electric cranes, the workmen coming in contact with the wires. The death was from heart failure. The victim had just finished repairing a traveling-crane from which the power had been shut off. On leaving the crane he dropped his shoe and caught at the wire to keep his balance, the current, meanwhile, having been turned on.

PART III

INDUSTRIAL HYGIENE

XV

COMMITTEES ON SANITATION

MANY among the largest companies and corporations of to-day have accepted the idea of a safety committee, and are putting it into successful practice. Wage-earning efficiency is impaired just as directly by unsanitary conditions as by unprotected machines. The problems of sanitation are so important in the maintenance of a steady and regular force of workers that these matters should fall to the consideration of a sanitary committee consisting of physicians and specially trained engineers.

Some time ago the United States Steel Corporation was confronted by epidemics of communicable diseases, occasioned by impure water, insufficient drainage of streets and alleys, and the inadequate removal of garbage and fecal matter throughout their mining-camps.

Realizing that inattention to these questions entail large losses, a sanitary committee was organized. In some of the subsidiary companies this work varies from a consideration of these matters by operating men in connection with their regular duties to well-defined organizations under the charge of sanitary engineers, and including periodical inspections and regular meetings for the discussion of problems such as piping water into dwelling-houses, building new water-closets and rebuilding old ones, systems of sewage disposal, surface drainage, provision of garbage cans with periodical emptying of same, proper disposal of refuse, and cleaning up streets, alleys, and yards in general.

This sanitary committee considers of greatest importance the purification of drinking-water and the disposal of fecal matter. If there is any question as to the purity of the water-supply, it recommends that a bacteriological analysis be made at least once a year, or oftener if necessary.

Details of sanitary installations are collected from each company by the committee, and are then sent to the others, with a view to assembling the best thought and looking toward an ultimate standardization.

In the same way, confronted by the unsanitary conditions of its mining-camps, the Tennessee Coal, Iron and Railway Company set about improving them.

As these camps are located so that they do not fall under the jurisdiction of a municipality, all work relating to health and sanitation is looked after by the committee organized by the company, under the direction of the president himself. The vice-president, general superintendent of mines, superintendent of the labor department, and the sanitary engineer constitute the committee.

Periodic inspections are made by a trained sanitary inspector. Analysis of water is carried on by a chemist and bacteriologist at the company's laboratory. The reports are submitted to the superintendent of labor, who, upon approval, transmits them to the vice-president and general superintendent of the department in question. Sanitary recommendations made in these reports, upon approval by the executive department, are executed by the general superintendent.

The designing of filtration-plants, systems of sewage disposal, and general sanitary considerations come within the province of the sanitary engineer, who is charged with the duty of preparing plans and estimates covering the cost of installations. It is his duty also to issue rules and regulations covering health conditions, instructions, and methods to be pursued in case of infectious and contagious diseases, acting, of course, in conjunction with the medical department of the company.

The entire organization considering matters relating to health and sanitation, comes under the Medical Sanitary Bureau, and is divided into the following sections: statistics, sanitation, commissary inspection, epidemiology, health and food.

The chief surgeon is responsible for the sections of skin-diseases, and statistics, including costs, exhibits, and commissary selling-prices.

The section of sanitation is directed by the sanitary engineer, and is subdivided into considerations of water-supply, disposal of feces, garbage and surface water, weed-cutting, hogs, and housing conditions.

The commissary includes inspection of meat and vegetable markets in the various districts, the recommendations made being carried out by the chief of commissaries.

Ventilation, heating, hygiene, milk, and disease are matters included in the health section, under the direction of the division doctor and division nurses. The community itself is reached through special lectures.

The food section, under the direction of the division nurse, concerns itself with instruction, in classes and at the homes of the miners, in the proper preparation of simple foods.

Complete inspections of the various camps are made at regular intervals with a view to maintaining the sanitary standards adopted by the company. Particular attention is given to the matter of closets, and the infected ground liberally covered with lime. The requirements relating to the frequent collection of feces are rigidly enforced. In the case of dry closets, fecal matter upon the ground must be removed once a week.

Experiments made with closets provided with sanitary cans, which can be easily and neatly removed, have proved so satisfactory that these are now being introduced in nearly all of the camps. The closets have been built or remodeled for this purpose to accommodate a receptacle 16 inches in diameter and 16 inches high, the standard used and recommended by the Health Department of the government; but further experiments have shown that a receptacle 14 inches in diameter and 16 inches high is better adapted to the requirements of the camps, and the cans are being made accordingly. The cans must be water-tight, the body made of one piece with hinged handles for side-holds. Lids and bottoms should be stamped of one piece, the lid fitting over the outside of the can, and the bottom concave.

Feces are collected in a sanitary wagon of special design to prevent the emission of obnoxious effluvia and exposure to insects. This sanitary wagon is of the two-horse type, mounted upon platform springs, which allows for making short turns; twenty-seven compartments accommodate the sanitary closet-cans in a removable rack.

The mere dumping of feces on the ground at remote points is not considered proper disposition, as this method does not prevent the pollution of streams or access by flies to the infected material, with the possibility of later contamination throughout the camp. Where the septic-tank system has been installed fecal matter collected from closets is conveyed by sanitary wagon to the tank at some distance from the camp, and there purified and filtered. In other camps, pending the introduction of the septic-tank system, the fecal matter is mixed with wood or coal and burned.

Complete camp sanitation calls for special effort in collecting garbage promptly. Weekly or half-weekly collections are made, the material being taken to a remote point and burned.

Work of cleaning yards, streets, and alleys, filling in gulleys, washouts, and stagnant pools is also vigorously prosecuted.

A healthful water-supply is, of course, a prime requirement. As far as possible all drinking-water, wells, and springs should be properly guarded from sources of contamination. In the case of a well this means the provision of a proper cover to prevent the infiltration of polluted surface water.

Springs should be covered with an apex roof made of tongued and grooved flooring-boards properly painted; wherever possible, provision should be made for removal of the water by pipe rather than by buckets.

Water samples from all drinking-water sources should be systematically collected for analysis, with a view to detecting any pollution before it is evidenced by sickness in the camp drawing its water from that source. In the case of the company before mentioned a complete equipment for the proper analysis of water has been installed at the company's laboratory with a capacity of about twenty-two tests a week. Both chemical and bacteriological tests are made of the water and records of same are filed for future reference. These records will ultimately include maps of all the sources of water-supply for the various camps. The tests thus far have resulted in the condemnation and destruction of numerous wells and springs as unsatisfactory sources of supply, while improvements have been made upon others to prevent contamination.

It is impossible to lay too great stress upon the requisite purity of an industrial water-supply.

The bottles used for samples are of hard, clear, white glass, provided with glass stoppers and of one-gallon capacity. Before using, the bottles are treated with sulphuric acid and potassium bichromate, or with alkaline permanganate, afterward with oxalic and sulphuric acids, and then thoroughly rinsed and drained. When clean the stoppers and necks of the bottles are protected by tying cloth or thick paper about them.

In some other cases observed the bottles used in the bacteriological examination are required to be of 100-c.c. capacity and provided with stoppers of the mushroom type. After being sterilized with dry heat for one hour at 160 C., or in an autoclave at 115 C. for fifteen minutes, the necks are covered with tinfoil and the bottles placed in separate tin boxes.

A suitable wooden case covered and locked is provided for transporting samples. Space is allowed for refrigeration. When carried or shipped, the case must be kept locked, and only unlocked when ready to take the samples, which must be delivered at the laboratory within eight hours from the time they are taken.

Samples are taken with the greatest care to prevent contamination. The stopper is removed from the bottle only in the act of filling, and then quickly replaced. The fingers must not be allowed to touch the inside of the bottle neck, and to prevent the stopper from coming in contact with other substances while the bottle is being filled it must be kept in the stopper-holder or in the cover of the case.

When samples are taken from taps or faucets the cock must be opened full and allowed to run for at least five minutes; when the water is taken from a pump it must be operated for at least five minutes in order to empty all pump connections; in the case of springs, running streams, with still waters, the sample bottle must be plunged beneath the surface, with the mouth toward the current—if there be one—and great care taken to avoid collecting sediment from the bottom.

Each specimen must have attached to it a card or label noting the name of the works or department, the designation of the camp or quarters, the geographical location of the source of the water, its character, the date and hour upon which sample is taken, the turbidity, temperature, and odor of the water, and the condition of the source. In the case of a well details must be given as to whether it is dug, bored, or drilled, also its cover and drainage. In the case of a spring the label must note whether it is a boiling or seeping spring, character and extent of its protection, depth, method of removing the supply it furnishes, drainage and character of the immediate surroundings, number of houses and persons supplied with the water. In each case the card must be signed by the person taking the sample.

In addition to giving written instructions to the men whose duty it is to take the samples practical lessons are also given them in the field, with demonstrations and explanations of the reasons for the rigid enforcement of requirements. The engineering department at each division furnishes a blue-print map or tracing of each operation or camp, showing the exact location of the water-supply and giving to each well or spring a number, so that all may have numerical location.

Thorough and frequent inspections are made of the commissaries belonging to the company, especially the meat markets, where the sanitary requirements call for the exclusion of flies from the stalls by the use of screen-doors closing tightly into their frames, and sufficient fly-paper within the stalls to catch any flies that do gain entrance. The wearing of clean linen and neat clothing is enjoined upon meat clerks; adequate lavatories enable them to keep their hands thoroughly clean. All counters are furnished with marble slabs.

Cheese, butter, bread, cake, candies, and other commodities must be kept in closed cases, not only to prevent contamination by flies, but also rapid drying out of the goods. Live fowls are not allowed to be kept within meat stalls, but must be stored in separate pens outside the commissary. Vegetables exposed for sale must be covered with netting or stored in bins with screened tops.

To prevent the stirring up of dust, which would work through the screens around the stalls, moistened sawdust is used or the floor is well sprinkled before sweeping. Commissary-keepers are instructed to prohibit the indiscriminate scattering of melon rinds, fruit skins, and any other organic matter which might attract flies.

In camps where the milk is supplied by a neighboring farmer an attempt is made, when necessary, to improve the sanitary conditions in connection with the care of cows and the sale of milk. Wherever objectionable conditions are found to exist the dairyman is asked

SANITARY AND WELL-ARRANGED GENERAL STORE IN A MINING TOWN. UNITED STATES STEEL CORPORATION

WORKMEN'S DWELLINGS IN ONE OF THE TOWNS OF THE OLIVER MINING COMPANY

to correct these conditions under penalty of having his products barred from the company commissaries.

Attention is often necessarily given to the sources of mosquito-breeding; stagnant pools must be drained or filmed with oil, rain barrels kept covered, and old tin cans and bottles removed from the premises. Weeds must be cut at regular intervals by the tenants; where this requirement is not complied with the work is done by the company at the expense of the tenant.

Elimination of swine in various camps is gradually being carried out, not only because they are potential carriers of disease, but also on the ground of being a public nuisance. Thirty days' notice is generally given to the owners of such stock in order that it may be disposed of to the best advantage.

With a view to preventing epidemics very stringent regulations are issued for the treatment of any cases of typhoid fever that occur in the camps or quarters. At least two sets of specified sanitary equipment and disinfecting agents must be provided and kept for emergency use at each camp.

When a true or suspected case of typhoid fever develops the company physician must immediately notify the sanitary department through the superintendent of the division in which the camp is located. He must also prepare two disinfecting solutions, one of bleaching-powder and the other of bichloride of mercury, and see that a gallon bottle of each solution is kept in the home of the patient.

Detailed instructions are required to be posted in the sickroom covering the bathing, care of linen, bed-linen, and dishes of the patient, disinfection and destruction of the urine and bowel discharges. The destruction of discharges must be continued for weeks after the patient has recovered. Detailed directions are also given for the complete disinfection of the sickroom and bed-clothing after the recovery of the patient in order to minimize the danger of subsequent infection.

When typhoid fever is present all other cases of fever should be regarded as typhoid until proven otherwise, and the destruction of discharges from the patient ordered as in known cases.

XVI

INDUSTRIAL POISONS

IN the fight against industrial disease and industrial poisoning systematic co-operation of all concerned is absolutely necessary. The services of the medical man are required as a toxicologist, as a hygienist, as a practical physician, but particularly as workmen's doctor; the technical man is called upon to co-operate as constructive engineer, as manager or official of the works, as factory or insurance inspector, or inspecting engineer. Of utmost importance for the success of protective measures is the energetic co-operation of employers and employees and of the organizations of both.

An effective measure for protection against occupational danger is the selection of workers whose physical qualifications develop high resistance. Only those of the best physique should be employed in occupations endangered by poisons.

A selection of the physically strong is partially made automatically, inasmuch as the weaker ones are compelled by repeated illnesses to leave, or are eliminated in consequence of chronic ill health and shortened life. This natural selection, causing not only social and physical misery, but also unemployment, disease, and early death, should be supplanted by a selection of the physically capable through an expert medical examination before they are accepted for employment.

Suitable instruction should be given in schools as to the dangers connected with the various occupations; and there should be medical examination of pupils, particularly of scholars entering into industrial trade-schools, with a view to their physical suitability for the occupation selected.

As before mentioned, those persons naturally weak should be entirely excluded from work offering any possibility of poisoning. It is advisable, further, not to expose to this danger for too long a time workers who are accepted for such employment. They should be granted, apart from other protective measures, a shorter working period and frequent recesses.

Change of work—that is, change from injurious employment to work in the open air—should occur at periodic intervals. These changes are particularly recommended where industrial poisoning may result from the gradual absorption of poison; during the period when the dangerous substance is not handled the organism has time to eliminate the stored toxins, thereby avoiding any serious results.

By means of rational change of work in dangerous employments schooled and strong regular workers are obtained who are acquainted with the danger and know how to meet it. On the other hand, an enforced change of work, due to frequent illness among employees, causes a further increase in the frequency of the disease, as the new-comers, not being skilled, are more exposed to the danger. The prosperity of an industry often materially depends on the existence of a trained set of workers. A change of work rather than a change of workers is, therefore, particularly desirable in establishments where there is great danger of poisoning. Employees in these places should be medically examined not only when accepted for employment, but also at regular periods afterward. In this way the physically unfit may be eliminated and handed over for treatment.

Records should be kept of the workers exposed to danger of poisoning, their state of health, the result of the periodic medical examinations, and of the diseases, their duration, symptoms, treatment, and cure. In many countries where the keeping of such records is required by law it has been found of great advantage to the employers.

The health of the workers should be a matter of constant supervision by inspectors, foremen, or anybody able to recognize the first signs of poisoning, capable of rendering first-aid treatment and of supervising proper precautionary measures.

In addition to the customary first-aid equipment oxygen apparatus is especially useful. Helmets and respirators should always be at hand for members of the rescue corps. These should never enter premises, apparatus, gas-tanks, drains, and similar places in which poisoning has occurred, or in which there is the probability of a poisonous atmosphere, or into which poisonous gases and vapors may enter, without protection. Provision should also be made for giving trained medical aid promptly.

Workers who handle poisons should be instructed with regard to the character and action of these substances, the initial symptoms, and, particularly, all the means and measures necessary for rendering first aid to their fellows. The best hygienic provisions, protective devices and measures are valueless when the worker does not use and follow them. Not only should instruction be given with regard to the object and use of devices, but workers should be urged and, if necessary, compelled to use them.

Instruction to workers, especially those just entering dangerous employment, may be given in various ways. Apart from lectures on the subject concise instruction should be available in the form of notices and illustrated placards displayed in the workrooms or handed out as leaflets. Official leaflets are drawn up and published by some governmental departments, the employers being obliged to make known and distribute the same.

Of individual protective measures, those have the greatest importance which, as far as possible, prevent poison from contact with any portion of the body and from inhalation. If this is not completely possible, however, the poison should be quickly removed, so that it shall not penetrate more than is absolutely necessary. Such protection can be secured by means of suitable equipment for the worker, as, for instance, proper clothing, protectors for the mouth and nose, and scrupulous cleanliness when eating. It cannot be sufficiently emphasized that only these measures afford effective protection against industrial poisoning, particularly against those having a lingering chronic action.

The importance of wearing suitable clothing on the premises should be strongly impressed upon workers in dangerous trades. The ordinary or street-clothes should be taken off and replaced by special suits to be worn during working-hours. It is not sufficient for a working-suit, jacket, or apron to be put on *over* the ordinary clothing. The working-suit should be taken off before the midday meal and before leaving the factory and exchanged for the street-clothes. Working-garments should be cut perfectly plain, without folds or pockets, and should be made of strong, smooth, washable materials. By removing the working-clothes before meals and before leaving the factory the poison is not carried into lunchrooms or into the homes of the workers.

Direct contact with poisonous substances should be avoided as far as possible. If, however, it is necessary for the workman to handle poisonous materials, moisten or dust his hands with them, gloves should be worn. This is particularly necessary when the poison is of such character as to easily enter the skin, producing skin-diseases, sores, and the like. When there is danger that poisonous substances might come in contact with the body it is wise to order that extra strong and impermeable working-garments be worn. When dealing with dusty, poisonous materials the workman should be provided with a suitable head-dress, as poisonous dust readily adheres to hair and scalp.

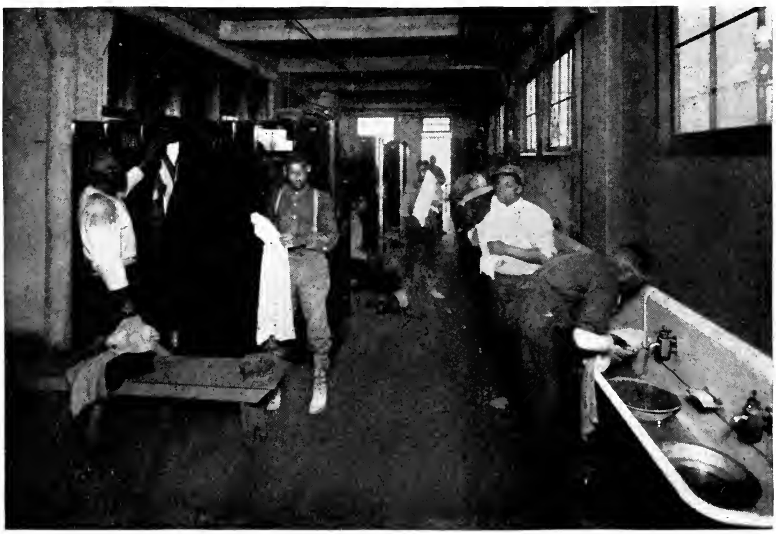
Employers should see the advantages of providing and maintaining suitable working-clothes for employees, where there is danger of poisoning. But, as before mentioned, the mere provision is not enough; employees must be compelled to wear them if the benefits are to be at all apparent.

Of very great importance is the provision of rooms for changing clothing, with adequate washing facilities and lockers for holding both the street and working clothes. Each worker should have an appointed washing-place and a locker for his individual use. The best type of locker is one divided by a partition into two separate compartments closed by separate doors, one compartment for the working-clothes and the other for street-garments. This separation of the clothing worn inside and outside the premises is of importance in factories dealing with poisonous materials.

Direct protection for the nasal passages is also necessary. For this purpose specially designed respiratory apparatus should be worn. Sometimes simply sponges or rags tied in front of the mouth or nose are sufficient. Generally, however, conditions require more complicated devices. Some of these surround only the mouth and nose; others, the entire face, like a mask; and there are still other types, as a helmet, which take in the entire head. These devices are all fitted closely by means of India-rubber mounts, and possess a breathing-aperture closed, generally, by two parallel grids of wire gauze, between which is a layer of cotton wool, through which respiration takes place. The cotton wool acts as a filter and retains all the dust. The outer grid either is removable or can be turned on a hinge so that the wool can be taken out and replaced by a fresh supply. Whether the mask surrounds only the mouth and nose of the wearer or the entire face and head, it should be constructed of material impermeable to air and provided with protected openings for the eyes when the type of protection renders it necessary.

There could be mentioned many different types of respirators; but in selecting the model best suited to any particular need, it must be remembered that, to be effective, respiration must not be obstructed, and the apparatus should be fitted with a valve to close automatically when inhaling and allow the air to escape unimpeded when exhaling without passing through the filter. Many respiratory devices do not fulfil these requirements, or do so only imperfectly. In course of time the pressure of the respirator is generally found to be troublesome, and often causes the face to become unbearably hot. Undoubtedly, breathing is rendered more

INDIVIDUAL RESPIRATORS AND CHECKROOM AT THE NATIONAL LEAD COMPANY'S PLANT



INDIVIDUAL LOCKERS AND BASINS IN ONE OF THE NATIONAL LEAD COMPANY'S WASHROOMS

difficult through a respirator, but this can be largely minimized by choosing a proper type. Discomfort is particularly felt when, for protection against poisonous gases, sponges or rags soaked in liquids are employed as respirators.

In general, respirators should be used merely as auxiliary means of protection. When a worker must temporarily be in an atmosphere filled with poisonous dust, the wearing of respiratory apparatus, preferably covering the entire head, is recommended. Respirators offer no, or very imperfect, protection against noxious gases and vapors, and respirators saturated with neutralizing liquids can be borne only for a short time.

When rooms filled with poisonous gases must be entered, the workman should carry with him the requisite stock of oxygen in a suitable apparatus, the oxygen in such apparatus being supplied to the helmet worn by the workman freely enough, so that his respiration is completely independent of the surrounding atmosphere.

Workers should be instructed about the importance of cleanliness. When dusty or vaporous materials are employed, the hands and mouth should be thoroughly cleansed before meals and when leaving the factory. Factory regulations should make compulsory frequent washing, as well as the removal of working-clothes before meals and before leaving the factory in the evening.

Washing and bathing should take place during working-hours, and without any loss of time and wages to the employees. Certain hours should be definitely fixed by the management during which the workmen may bathe in turn.

Eating, drinking, smoking, and chewing tobacco in premises endangered by impure air should be prohibited.

If possible, clean dining-rooms should be so constructed that the workers may enter them only through the changing-rooms and washrooms. In these rooms workers should eat the food brought with them or prepared in the factory kitchen. When no provision is made for dining-rooms, the workmen usually eat their meals in the workrooms, sometimes in the midst of unhealthful dusts and poisons. By providing separate lunchrooms it is possible to enforce the rule that working-clothes shall be changed before eating.

The old saying, "Cleanliness is next to godliness," holds especially good with regard to the welfare of workmen in factories endangered by poisonous materials. In numerous large industries the demands of cleanliness are now being met by the provision of bathing establishments for the employees.

For cleansing the hands, face, and other parts of the body exposed to dust and dirt, simple individual washing-basins are recommended; washing-arrangements used by several persons, such as troughs and channels, are entirely unsuitable. The basins, to be easily cleaned, must be made of porcelain or glazed enamel. The dirty water must readily flow from them; for this reason experience has proved tilting-basins to be best.

In all washing-arrangements, including baths for the workmen, an adequate supply of hot and cold water must be available. "Mixing-cocks" should be provided, in order that the desired temperature may be quickly obtained.

Workmen's baths can be arranged as shower-baths, full baths, or swimming-baths. Some establishments are furnished with all these types.

The shower-bath has many advantages, and, therefore, is most frequently used for workmen's baths. The cost of providing this type is relatively small, as the apparatus is exceedingly simple. For this reason it is possible for the employer to place the baths at the disposal of the workmen free of charge. The bather is quickly and thoroughly cleansed. Shower-baths are also more easily maintained in good condition. When this type is installed it is a good plan to provide double compartments as bathing and dressing rooms. The walls as well as the floor of the compartments should be constructed of smooth, impervious materials. In the bathing-compartment the floor should slope down toward a trough from which the water may flow away. It is better to control the flow of water by means of a chain or other device than to have the water start automatically on entering the bath.

Suitable food for the workers is well-nigh essential for protection against industrial poisoning. Well-fed, strong workers are better able to resist the action of poisons; while badly fed workers, who generally suffer from digestive disturbances, are very sensitive to toxic influences.

It has been found that the excessive use of alcoholic liquors can be checked by provision of suitable beverages. In most cases of industrial poisoning the combination with chronic alcoholism has most serious consequences. Owing to the pernicious effects of alcohol on the kidneys, liver, digestive organs, nervous system, and assimilation of food, a number of points of low resistance are created for attack by the poison. Not only good drinking-water, but in certain cases coffee, tea, fruit syrups, and the like should be furnished the workers; milk is especially to be recommended. In many industries where the danger of poisoning is great—notably of lead-poisoning—milk is supplied to the workers free of charge.

Every measure for strengthening workmen physically and increasing their general resistance to disease must be included in protective measures. Above all should be mentioned all movements whose purpose is to keep the workers as much as possible in the fresh air when not at work, to cultivate sport, and to strengthen the body. Much has already been accomplished in this respect by certain employers and by the workmen themselves in their various athletic organizations.

Experience has shown that the industrialist is more than recouped for the comparatively small initial expense of making the working-place as healthy as possible in advance, and using every precaution to maintain the health of the workers at the highest point of efficiency.

The greatest danger for the workman is occasioned by those poisonous substances which, by virtue of their dusty nature, their volatility, or gaseous form, render it impossible to keep the atmosphere of the workroom pure. Among the measures of protection the avoidance and removal of poisonous air plays the greatest part.

When the spread of impurities into the atmosphere of the factory cannot be entirely avoided, these must be overcome by introducing a sufficient quantity of fresh air. In addition, an attempt must be made to prevent the poisonous materials in the air from collecting and settling.

As far as possible those processes should be avoided in which poisonous materials are employed and by which the air is rendered impure. A substitution of less dangerous methods is sometimes possible without added expense. International prohibition of certain modes of production has been under consideration, and in part carried out. To paralyze branches of industry by prohibitory measures works, of course, economic damage, not only to employers, but also to the employed and the community in general. Economic considerations must be weighed before carrying into effect prohibitory measures. If effective substitutes for injurious methods can be found, ways and means can also be developed to effect the change in production.

For instance, the dangerous development of dust can be avoided by employing "wet" methods when the product or material admits of it, such as the moist cleaning of white-lead chambers and wet dressing in smelting-works. Injurious gases and vapors can be avoided in glass-silvering by substituting the safer process for mercury amalgamation; also in fire-gilding, where the articles to be gilded are coated with mercury amalgam and the mercury is vaporized; in the manufacture of incandescent lamps, by replacing the mercury air-pumps and switches by apparatus without mercury; in the manufacture of matches, by using the red instead of the poisonous white phosphorus; in the manufacture of hats, by soaking rabbit-skins in a solution free from mercury salts.

As in the case of the individual, the most important factory protective measure against industrial poisoning is cleanliness—that is, in keeping the rooms and air of the factory free from impurities. Workrooms should be so constructed and arranged that they and the air contained in them can be easily kept clean.

Of course, light, high workrooms having jointless—preferably water-proof floors—are the best. The walls should be coated with a light-colored washable paint. Angles and corners should be avoided, just as in hospital construction. The rooms should be frequently and carefully cleaned by washing or, better yet, by the more recent vacuum method. Impregnating the floor with oil is recommended in some cases. But this method of binding dust is not its removal, and where the action of the oil is relied upon regular cleaning is more likely to be neglected.

For keeping the air of a factory pure there must be sufficient air space and suitable change of the air in this space. These measures are of far more importance than may seem at first glance, as almost all the throat and lung disorders to which workmen are subject are in many cases directly related to the amount of oxygen contained in the air in which they work.

With regard to the cubic volume of fresh air allowed to each workman, the minimum amount has been legally fixed in many states and countries, but it has been found that when three or four times this quantity is provided the efficiency of each individual worker is raised to a point that far offsets any charge on the rental account.

Only rarely will the natural change of air in workshops—that is, through the pores of the building-material, cracks, joints of floors, through windows and doors—provide the necessary renewal. Under ordinary circumstances air is renewed only once by natural ventilation in about one to two hours, so that in keeping employees up to "concert pitch" the need of artificial ventilation is apparent.

The simplest method of airing rooms is by opening doors and windows—so-called draught ventilation. During work-hours, however, such ventilation causes annoyance, distraction, or indisposition, due to the impossibility of controlling the temperature accurately during winter and summer. By providing ventilator windows these defects may be obviated and the windows used for permanent ventilation.

This method calls for the upper section of the window being made to rotate about a horizontal axle, so that it can be opened to the desired extent by means of an adjustable lever. Such arrangement, however, only proves satisfactory in summer.

Artificial ventilation is best provided by means of special openings and flues, arranged at the part of the room to be ventilated, and by means of which fresh air is introduced or the impure air drawn away. The former method is defined as pulsion, and the latter as aspiratory ventilation.

The difference in temperature between outer and inner air which causes an upward force can be artificially increased by utilizing the action of the wind, by heating the air in the ventilation flues, by mechanical force, blowers, and so on. When the force of the wind is used the openings of the ventilation flues should be changed for summer and winter ventilation. To increase the current of air in the ventilation flues the outside sections should be provided with top pieces—that is, suction and pressure head-pieces.

For increasing the draught the air may be artificially warmed by providing flames or stoves in the flues. The action of ventilating-flues is materially aided if they are introduced into existing chimneys and smokestacks. In some cases vertical ventilating-shafts are built into the building, or ventilating-chimneys, usually with top pieces, are extended above the roof.

For factories endangered by poisons, either in gaseous or dust form, ventilation is best secured by means of mechanical force or blowers. Where other driving-forces are employed and the draught is dependent on such factors as the wind or outside air, it is hardly possible to secure proper regulation. This, however, is fully secured when ventilating with mechanical power, as the quantity of air supplied or drawn away by the ventilator may be mathematically calculated and adjusted to the power employed. The ventilating-plant, its form, mechanical equipment, consumption of power, and dimensions, depend, of course, on the requirements. But sufficient attention should be given the subject to obviate all waste of capital and energy. As correct design and arrangement determine the action, result, and fate of the plant, the services of an expert are required. This is particularly so when problems of ventilation in factories endangered by poisons must be solved.

When steam jet blowers are employed a jet of steam or compressed air is introduced into the flues through a nozzle, whereby a powerful suction action is produced. This action can be regulated by the action of the jet.

Injectors are recommended for removing acid vapors which corrode machinery, for exhausting explosive mixtures of dust, or in any case where the employment of other ventilators is not advisable and where there is sufficient excess steam, compressed air, or water for the motive power.

Rotary blowers are substantially wheels having blade-like flat spokes. They are inserted at various places in the ventilation flues according to the movement of air intended, and depend for their action on the fan principle.

According to the mode of construction, ventilators are differentiated into screw and centrifugal ventilators; and according to their action, into low, medium, and high pressure ventilators. They can be driven by belts, water, steam, or, as is now very common, by electric power, in which case they may be coupled directly to the motor.

Screw-blowers, like ships' propellers, are almost always constructed of iron, and generally have spiral blades—sometimes only four light ones—inserted by means of frames, transversely, in the ventilation flue, on whose column of air they are to exercise a suction or pressure action. The air is driven in the direction of the axle of the ventilator, and generally it is possible by reversing the ventilator to exhaust or drive the air as desired. Such fans produce a low pressure, and are therefore called low-pressure ventilators. The current of air produced by them has a relatively low velocity, but when suitably designed such ventilators can move large quantities of air, and are particularly suitable for bringing about a general change of air within the workroom.

Centrifugal blowers are provided with cases inserted in the ventilating-flue in such manner that the air enters on one or both sides of the axle and passes between numerous straight radial spokes, by whose rapid rotation the air is thrown to the periphery, where the outlet is located and from which the ventilating-flue continues. As the speed of rotation is great, considerable velocity and high pressure are imparted to the current of air. When the pressure is at 120 mm. centrifugal blowers are called medium-pressure blowers; when higher they are called high-pressure. In the former a casing of sheet iron suffices, but in the latter cast-iron cases are usually required.

Medium-pressure centrifugal ventilators are employed for local ventilation—that is, removing impure air from its point of original high pressure for technical purposes; for example, conveying a current of gas at high pressure.

Shutting off the rooms affected by impure air or danger of gases from the remaining sections of a factory facilitates measures for limiting and combating the danger. This plan, however, which protects only the workers not directly occupied with the poison cannot be considered sufficient. The workman endangered must also be protected and enabled to work at his fullest efficiency. Completely inclosing apparatus and processes producing poisonous dusts and gases is possible only when it is not necessary to reach the apparatus or when the work may be carried on by mechanical means.

When, however, such arrangement is not possible the impurities must be removed at their source. As far as the work permits, the source of origin of the impure air should be shut off by means of boarding or sheet-metal partitions, so that only the working-place remains accessible. If this is impossible a funnel must be arranged in immediate proximity to the source of the impurities; this boarding, casing, or funnel, of course, to be connected with the ventilating-pipe in which the necessary draught is produced to carry away the dust or vapors. In the case of only slight development of dust, gases, or vapors, flues above the boiler, or chimney draughts, may suffice for successful local ventilation; but generally force must act on the ventilation tube to obtain the desired result. Medium-pressure blowers are most frequently used as exhausters.

In large factories, or in cases where exhaust is found to be necessary at many points, it is profitable to provide a centralized exhaust-plant. Such a plant consists in the opening of all the pipes leading away impure air into one common flue in which the necessary draught is maintained by the work of one or more powerful exhausters connected with the flue. When the ventilating-flues are located near the floor, it is wise to provide outlets for the purpose of removing sweepings. Then, when cleaning, if the dust is swept near these outlets it is drawn off.

In removing impurities at their source the apparatus must act so that the current of air at the place of work moves away from the worker. It is preferable to draw dusts or gases vertically downward and, laterally, from the workman into the pipe or flue along the floor.

In calculating the amount lost every year through sickness and reduced speed on the part of the operator, it is well to consider this seemingly minor point: whether the poison-laden air is drawn away from the employee or flows past his nose and mouth.

The dimensions of the pipes and flues must accord with the force and nature of the exhausts. The system of pipes should offer as little resistance as possible to the passage of air; this may be accomplished by eliminating sharp bends in the piping, and by having them always open into the main flue at as obtuse an angle as possible.

Apparatus generating poisonous dusts and gases, wherever possible, should be inclosed and constructed in such a way that its action and ventilation are automatic.

With regard to the development of dust, the following processes must be considered: disintegrating apparatus of every kind, stone-breaking, and mills. In general, these can be provided with closed and ventilated cases. Ball-mills can always be completely inclosed, as they consist only of a rotating iron cylinder in which the steel balls are thrown to and fro, crushing the material. Poisonous, dusty materials—*i. e.*, white lead, gypsum, cement, and others of like nature—can be transported by conveyors, or pneumatically, in closed piping.

The dust created in packing certain materials can be almost completely avoided by using ventilated packing-machines.

More difficult is the confinement of dust when strewing, sifting, and mixing materials, because hand-work generally must be employed.

It is sometimes possible to inclose even this source of dust, however, by using boxes with armholes and having the top wall of glass. Ventilated tables can also be used for this purpose, having wire tops and connected by a funnel underneath with the exhaust-pipe. Such tables may be installed to advantage where the poisonous dust is a waste product, as, for example, glazing with lead or inspecting porcelain products.

When grinding, polishing, or similarly treating materials from which poisonous dusts are given off, wheels should be hooded as far as possible and connected with the exhaust system.

For preventing the spread of noxious gases and vapors, distillation and furnace-plants should be as tight as possible. It is better to have fans act directly on the furnace or distilling-apparatus, so that their walls are relieved from the pressure of the gases generated. In this way a small fall of pressure is produced within, which provides for their non-escape. Mixing-apparatus should be provided with mechanical stirrers, inclosed and well ventilated. The same principle applies to dryers.

Of great importance is the question of the ultimate disposal of the poisonous dusts, gases, and vapors removed from workshops and factories. When these are of non-rising character and large in volume, consideration of public opinion in the neighborhood of the works demands that noxious emanations shall not be distributed; efficiency of the workers requires that they be rendered non-injurious in the factory; and economy demands that any usable substances contained in these by-products be recovered and turned to account.

Poison-laden air led away by exhausts must be subjected to suitable purifying processes, the valuable dusty or gaseous admixtures collected as far as possible and suitably employed, and the waste rendered innocuous by destruction.

Dust may be deposited in chambers in which the air remains stationary, or in special collectors where the air circulates in a closed funnel and settles the dust in the point, from which it can be removed. This is accomplished most thoroughly by filtration, the air to be purified passing through one or more layers of fabric, in which the deposit remains. Filters are generally like pockets, or in the form of tubes, and are stretched in various ways on frames. As the filter would become impermeable, owing to the collection upon it, and would offer always increasing resistance to the air flowing through, the deposit must be removed by intermittent shaking, stretching, and beating of the filter by mechanical means. Dust shaken off in this way may be collected below from the casing. Rational arrangement of filtering-plants for poisonous dust is very important, because when improperly constructed and worked the results may be serious to the workmen employed on them.

Worthless dust when combustible may be destroyed by burning. But this is seldom the case with poisonous kinds. It must generally be precipitated by water, the dusty current of air being introduced into water or washed by sprays.

When gases and vapors can be utilized they are condensed and absorbed, or supplied to other industries. But, in any case, the proper condensation and absorption of poisonous gases and vapors is of the utmost importance among protective measures. The more completely and carefully this is done, the more are the workmen protected against the possibility of illness, incapacity, and lowered vitality.

Condensation converts gas into solid or liquid form by means of cooling. In condensing-apparatus the path of the vapor to be condensed is lengthened as much as possible by passing through coiled channels and pipes, artificially chilled, and by enlarging the surface for condensation by means of perforated partitions, curved walls, chambers, boxes, and cylinders. The longer the path the more perfect is the condensation. The chilling is generally accomplished by means of water-sprays.

Poisonous gases and vapors can be absorbed by water or suitable solvents, the impure air rising in bubbles in vessels filled with the liquid. Absorption chambers and vessels are of various construction, and when necessary can be arranged in series. Absorption towers are also sometimes employed to great advantage, the air to be purified or the gas to be absorbed being admitted below, while water trickles down from above on the counter-current principle. The construction and filling of these towers vary with the character of the gas or vapor to be absorbed. There are coke, lime, earthenware, slab, and other kinds of towers.

Materials recovered by condensation and absorption can be employed in various ways. Frequently they supply an intermediate product of the industry or a valuable by-product. Sometimes the gas which is led away can be supplied to another industry, as, for example, when the production of sulphuric acid is connected with the roasting process. Worthless noxious gases should be burned if possible. This may be accomplished in the case of combustible or semi-combustible gases and when relatively harmless waste gases are produced by the combustion. It would, of course, be a mistake to burn poisonous sulphureted hydrogen and allow the product of combustion—injurious sulphurous acid—to escape. Gases are most suitable for combustion which yield carbonic acid and water vapor as the products of combustion. Frequently a very valuable heating-agent, or fuel, can be obtained, as when burning blast-furnace gases and others containing carbon monoxide.

XVII

CHEMICAL INDUSTRIES

A CHEMICAL industry or manufactory driven by power and producing its results by chemical reaction on a large scale has not only to encounter the dangers incident to the use of large mechanical powers, but in addition the possibilities of disaster to the men from the chemical-reaction processes. Against these last they can protect themselves only with difficulty by reason of their ignorance of what is best to do. There are poisonous and explosive compounds to be included in this class, as well as strong acids, alkalies, gases, and liquids corrosive to living tissues. There are dangers in the manufacture of such compounds as soap, gas-charged waters, fertilizers, japan and varnish, poisonous materials, explosives, ammunition and fulminates, powder, picric acid, percussion caps, fireworks, and compressed and liquid gases.

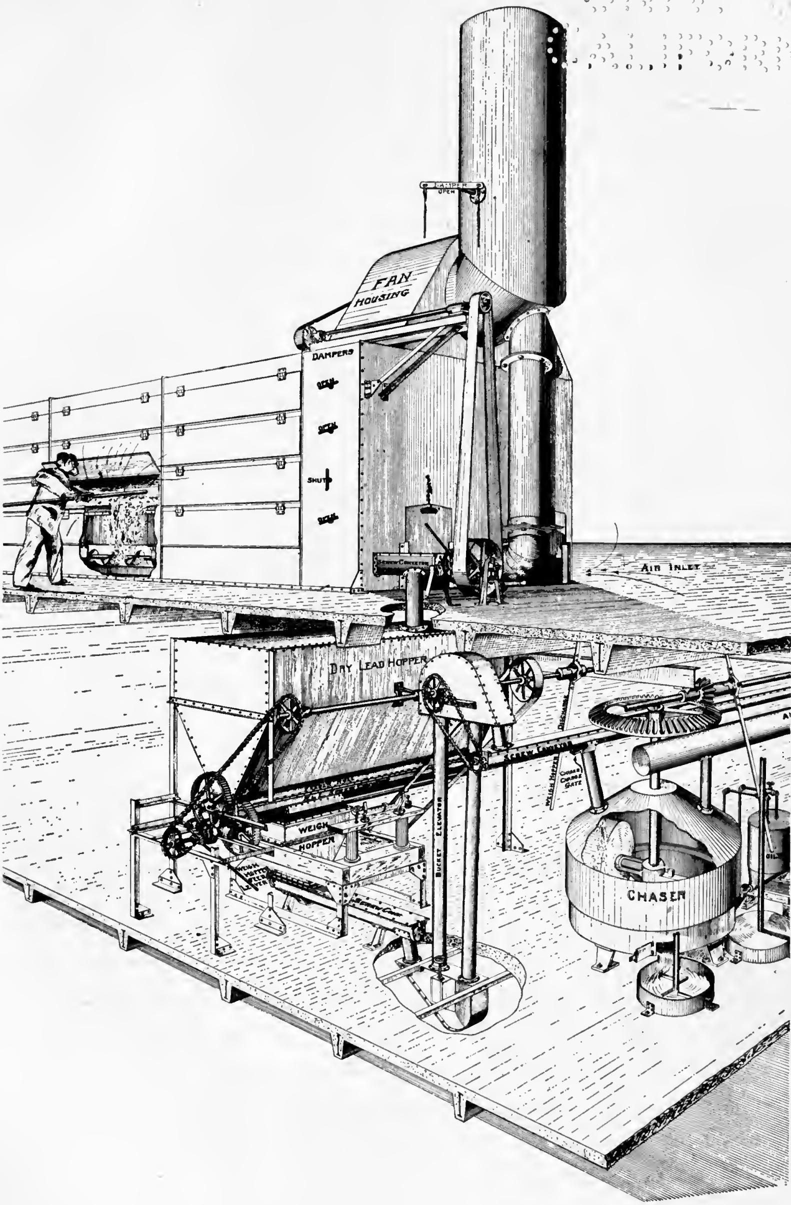
While many companies have found certain protective measures to be effective, they illustrate but scattered attempts at solution of the problems, and unless collected are not of much value to the student or technician.

Inasmuch as whole treatises could be written on health promotion in each one of these various lines of activity, it is, of course, necessary to condense the treatment to a discussion of the methods successfully applied in one particular industry. Perhaps the manufacture of lead offers as good an example of the problems to be solved and the methods applied to their solution as could be mentioned.

In this industry as well as in almost all others the management is well aware that the first step in the elimination of danger incident to the manufacture of lead concerns mechanical improvements—for example, the substitution of metal for woodwork in the housing of apparatus wherever possible and insistence upon closed mechanical joints throughout the system. Equally important is the substitution of closed mechanical conveyors in place of trucks for handling materials and mechanical operation for hand labor wherever possible. Then, too, there must be the connection of all apparatus of whatever description handling lead products in the dry state, to an effective air-exhaust system, the air suction being maintained at all times, to the end that there shall be an indraught of air into each opening or crevice from which dust might otherwise escape.

Regarding mechanical improvements to prevent exposure of the employee to lead dust and by the use of machinery to reduce the number of employees exposed, it may be interesting to know that in this respect the United States has always been in advance of foreign practice. But even so, prior to five years ago the improvements made came more as a matter of general mechanical betterment. Up to that time it was generally recognized by lead-manufacturers that the operation of dumping lead from corroding-pots when stripping a stack and the operation of removing lead when dry from the drying-pans, were especially dangerous features of white-lead manufacture and mechanical ingenuity had so far been unable to conceive remedial measures. The extent of the operations of a large organized company like the National Lead Company is such that there is a large field from which to draw suggestions for improvement and a large force of men competent to give them expert consideration. The successful improvements are in most instances combinations of a number of ideas, and often it has been a minor suggestion which has made a large plan feasible. Before attempting a proposed mechanical improvement, preliminary study and experiment must be made with such thoroughness that the installation when made shall be practically free from breakdown and from the need of adjustments which involve the opening of the system, because the dust developed during repairs or adjustments cannot be disposed of by the regular exhaust equipment and may in the aggregate offer more danger than that incidental to the routine operations which the machinery is intended to replace.

In 1907 the reconstruction of one of their large works afforded the National Lead Company an opportunity to carry into effect certain plans in which hygienic considerations were prominent. The improvements inaugurated have been incorporated at other factories as rapidly as opportunity afforded, in every case extensive and important additions to the original plan being made. The magnitude of the work is such that in most instances the prudent practice has been followed of giving a thoroughly practical test of each improvement at a single factory before attempting to incorporate it in the others. By this method of growth there has now been perfected, and is in regular operation, a complete system of safe handling of dry white lead from the drying-pans until it leaves the chaser as lead in oil paste. This is without question the most notable improvement made in lead manufacturing, from a sanitary standpoint, since the early



DUSTLESS HANDLING OF WHITE LEAD BY THE NATIONAL LEAD COMPANY

days of white-lead manufacture in America, when inclosed machinery was substituted for hand labor in separating the uncorroded from the white lead.

The perspective view herewith illustrates this mechanical system. A battery of inclosed drying-pans is shown on the upper floor, and on the lower floor the balance of the equipment, including an inclosed chaser. In the upper corner is a cross-section view of the inclosed drying-pans, showing a battery of four pans, one above the other. Each pan has a double bottom through which steam passes, supplying the heat for drying. As to the inclosure, it will be noted that the front comprises two vertical partitions, both provided with doors to give access to the pans; one of these partitions being placed close to the front of the pans, and the other at a sufficient distance to provide for the installation of a screw conveyor at the bottom of the space thus formed. The front of each pan, instead of being vertical, has a gradual slope, permitting the removal of the contents with a hoe instead of a shovel. In the cross-section view a hoe is shown drawing lead off the pan, and the lead falling between the two partitions and into the screw conveyor. The same operation is illustrated in the perspective view at the point where a portion of the front is shown broken away. The lead thus removed from the pans is delivered by the screw conveyor into the inclosed dry lead storage-hopper on the floor below.

Regarding dust control and the circulation of air for drying purposes: At one end of the inclosure a suction fan is mounted, suitably inclosed, the suction chamber connecting through dampers with the space above each pan. The continuous operation of the fan maintains a partial vacuum throughout the pan inclosure. Through the openings marked "air inlet" a current of air is admitted which flows between the bottom of the lowest pan and the floor along the entire length of the pan battery. On its way it absorbs heat from the bottom of the lowest pan, and thus increases its power to take up moisture. When the air reaches the chamber at the far end of the inclosure it divides and passes back over the tops of the four pans to the chamber beneath the fan-housing at the end whence it started, and the fan sends the moisture-laden air out into the atmosphere. This is the regular course of operation. But when the lead on a pan has become thoroughly dry, and it is necessary to unload the pan, the damper connecting the space above that particular pan with the fan chamber is shut. The outer and inner doors of a section of the pan are then opened to give access to the lead. Immediately on opening the doors there is an indraught of air. This current of air picks up such dust as arises when the lead hoed off the pan falls between the partitions to the screw conveyor. The air, bearing dust in suspension, flows to the air-distributing chamber at the remote end of the inclosure. From the distributing-chamber the air-current divides and passes over the three other pans of the battery at such a reduction in velocity, owing to the larger area of passages, that practically all of the suspended dust is deposited on the surfaces of the other three pans. Reaching the fan-suction chamber, the currents unite and pass out through the fan.

The operation of removing the dry white lead from the pans has by this apparatus been rendered absolutely safe. It makes the panroom and the discharging operation practically free from dust. The normal temperature of the panroom, instead of being in the neighborhood of 100 degrees Fahrenheit, is within one or two degrees of the temperature of the rest of the factory. From the dry white-lead storage-hopper the dry lead is fed into the weigh-hopper below in such amounts as it is desired to mix.

When the beam of the scales registers the correct weight, the feed is cut off. By the movement of a lever the contents of the weigh-hopper are fed into a short screw conveyor underneath, and by it are delivered into the boot of a bucket-elevator. By this the lead is taken up and redeposited into another screw conveyor which connects with a number of chasers, one of which is shown in the immediate foreground of the picture. By opening a damper in the pipe, connecting the screw conveyor with the chaser, the lead is allowed to fall within the inclosed hood of the chaser. There it is mixed with oil in the proper proportion, and after the lead and oil are thoroughly incorporated a small gate at the bottom is opened, and the mixture discharged in the form of white-lead paste into the receiver of mills on the floor beneath, which give the final grinding and deliver the white lead in the form of the oil paste of commerce. While all the joints through this system are made as air-tight as possible, it will be noticed that an air-suction tube is connected to the apparatus as a further precaution. The danger of poisoning from dust has been eliminated.

To protect the men who are taking the corroded lead out of the stacks, two successful experiments, using apparatus of two distinct types, have just been concluded by the National Lead Company, and are being reduced to a practical form for use in its stack-yards. The dust which endangers these men arises when the pots containing the corroded buckles are dumped into the box placed in the stack for that purpose. Both systems utilize a hood (which can be readily attached to the box) and a long, flexible but not collapsible pipe from six to eight inches in diameter, connecting the hood with an exhaust-fan and dust-collector. One type of equipment experimented with uses a portable dust-collecting unit; and the other a stationary dust-collecting unit with a pipe system extending throughout the stack-yard, provision being made at each stack for connecting thereto the flexible pipe above mentioned. These experiments were conducted under practical working conditions, and were successful to such an extent that the use of the experimental apparatus is being continued pending the perfection of plans for permanent installation.

Complementing the mechanical improvements are the provisions made for personal hygiene, such as the installation of complete washing and bathing facilities, with hot and cold water, a free supply of towels and soap, and an allowance of company time twice daily for washing; the installation of double sets of lockers, one set for working and the other for street clothes. Every possible effort is made on the part of superintendents and foremen to influence employees to make effective use of the facilities provided. The lunchrooms are commodious, well lighted, heated and ventilated, clean and attractive; they are all separated from the workrooms in the factory.

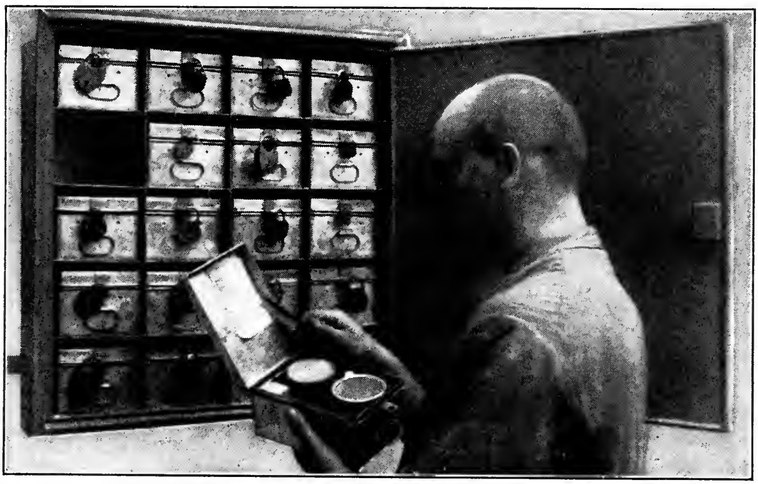
To enforce the application of this preventive work placards are posted throughout the factory:

1. Respirators must always be worn where there is dust. KEEP THEM CLEAN. Shave frequently so that respirator fits snugly.

2. Washing. Before eating and before leaving factory at night employees must thoroughly scrub their hands, clean their fingernails, and brush their teeth.

3. Clothes. Employees must make a complete change of clothing, including hat and shoes, upon coming to work and again at the close

ONE OF THE LUNCH-ROOMS WHICH THE NATIONAL LEAD COMPANY PROVIDES FOR ITS EMPLOYEES



OUTFIT FURNISHED BY THE ALLGEMEINE ELEKTRICITAETS GESELLSCHAFT FOR ENCOURAGING PERSONAL CLEANLINESS ON THE PART OF WORKERS IN POISONOUS SUBSTANCES

of the day's work. WORKING-CLOTHES MUST NOT BE WORN OUTSIDE THE FACTORY GROUNDS.

4. Baths shall be taken daily (on company's time) before changing into street-clothes.

5. Complaints. The company furnishes, free of charge, respirators, sponges, tooth and nail brushes, soap, towels, and individual lockers, and has equipped the plant with bathing facilities and sanitary devices. Any failure to furnish the above supplies, and any defect in the operation or sanitary condition of the machinery or equipment of the factory observed by any employee shall be called at once to the attention of the foreman in charge, and if not remedied in 24 hours COMPLAINT SHALL BE MADE DIRECTLY TO THE SUPERINTENDENT.

6. Company's doctor. Employees shall report to the company's doctor every ailment, no matter how slight, as soon as discovered, and shall be present at the weekly examination. The company's doctor will attend to employees for all ailments without charge.

IT IS FORBIDDEN

To eat in any part of the factory except the lunchroom.
To bring beer or alcoholic liquors on the premises.
To smoke in or about any factory building.

RECOMMENDATIONS

Eat a hearty breakfast before coming to work.
Milk, eggs, and onions are the best food for workers in lead.
Whisky, gin, wine, beer, and other alcoholic drinks are especially harmful.
Do not get lead in your mouth from dirty hands or dusty clothes.
Never carry chewing-tobacco in your working-clothes or touch it with dirty hands.
Keep clean.

By obeying the above rules and keeping lead, which is a poison, from entering the mouth and nose, employees can keep well and lessen the risk of lead-poisoning, which they assume in entering the employ of this company.

XVIII

SHOP SANITATION

ALREADY American industrialists are complaining of the lack of skilled mechanics and capable workmen. It is a serious problem, and here and there the employers are trying spasmodically to seek a solution, well knowing that if they are to hold their own in the keen competition for the world's trade skilled workers are essential. Health is a fundamental for skill. The next generation of workers are now in the public schools: in a few years they will be at the bench and in the shop. Will they be prepared in health and skill? In this connection a recent report from the United States Bureau of Education is of startling import and deserves the serious consideration of every employer.

It cannot be taken for granted that school-children are healthy. The majority of them are not as healthy as they should or may be.

There are in the schools of the United States to-day approximately 20,000,000 pupils. Extensive observations of child health for 20 years and careful study of statistics and estimation of all conditions lead to the following conclusions:

From 300,000 to 400,000 (one and one-half to two per cent.) have now, or have had, tubercular disease of the lungs.

About 1,000,000 (five per cent.) have spinal curvature, flat-foot, or some other moderate deformity serious enough to interfere to some degree with health.

Over 1,000,000 (five per cent.) have defective hearing.

About 5,000,000 (twenty-five per cent.) have defective vision.

Over 6,000,000 (thirty per cent.) have enlarged tonsils, adenoids, or enlarged cervical glands which need attention.

Over 10,000,000 (fifty per cent., in some schools as high as ninety-eight per cent.) have defective teeth, which are potentially, if not actually, detrimental to health.

Several millions of the children possess each two or more of the handicapping defects.

About 15,000,000 (seventy-five per cent.) of the school-children in this country need attention to-day for physical defects which are partially or completely remediable.

If 75 per cent. of the coming generation of workers enter upon their industrial life thus handicapped the employer must do what the public schools and the home both failed to do—namely, provide the best conditions under which labor may be carried on. If he is wise he will concern himself closely with the public-school system of his community to see that those physical defects in his coming employees are remedied before they have crystallized into partial or complete wage-earning incapacity.

Among the enemies which affect the credit side of the management's ledger is the dust from dressing grindstones and working on dry emery-wheels. This consists of very fine, hard particles of metal, sandstone, or emery, with sharp edges and pointed corners. As the inhalation of this dust causes at first only a slight tickling or dryness of the throat, the workmen have a tendency to underestimate the dangers to which they are exposed and to disregard protective measures.

The formation of dust in grinding can be prevented by the process of wet grinding; or if it is necessary to grind dry, then an adequate exhaust system should be provided.

The grinder should never breathe through his mouth while at work, but always through his nose. If the nasal passages are obstructed or stopped the worker requires the attention of a physician.

Equipment which prevents a stooping position while at work is advantageous in that it permits full expansion of the lungs.

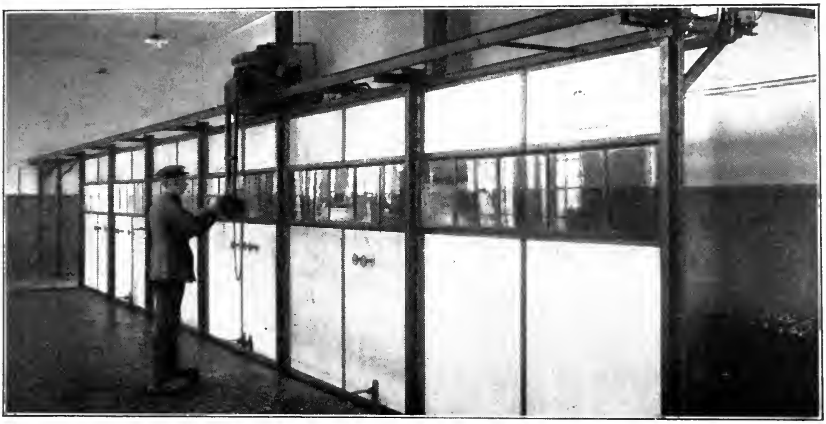
All grinding-machines should be equipped with dust-hoods connected with an exhaust system to carry away the dust and small particles, serving both to protect the workman and prevent wear and tear on machinery and belts.

In spite of precautions it is found that in some of the best grinding-rooms of the country, where natural grindstones are used, the labor problem is a difficult one, mainly because of the prevalence of disease and sickness. It is interesting to follow what is being done to displace the natural grindstone by artificial stones made of alundum, the particles of which have been found to be much less injurious to the worker.

The problem of grinding table cutlery has been solved by certain large firms with artificial wheels. The surfacing of steel plows in the United States is now largely done on artificial wheels. Skates, axes, and hatchets are being ground successfully on these wheels. In fact, it is the opinion of those who are in a position to know that all work done on grindstones can be done on artificial wheels made of modern electric-furnace abrasives.

The artificial stone does not need to be raced into shape. It is at once apparent that there is less volume of dust to handle than if a natural wheel of the same dimensions is used. The application of the modern wheel permits the use of a relatively small wheel, consequently it is more practical to give the operator better protection by means of dust-exhausters and water-hoods.

Dust from the abrasives of which these modern wheels are made does not readily affect the lungs or cause bronchial troubles. A most thorough medical examination of more than six hundred employees of one large com-



AUTOMATIC ACID-DIPPING PROCESS IN USE AT THE ALLGEMEINE ELEKTRICITAETS GESELLSCHAFT. NO INHALATION OF FUMES OR CONTACT WITH THE ACID

ONE WEEK'S ACCUMULATION OF DUST WHICH DID NOT GO INTO THE LUNGS OF WORKERS AT THE NATIONAL CASH REGISTER COMPANY

pany manufacturing these wheels revealed only four cases of tuberculosis. The history of these cases showed that the disease was contracted outside the works and among men who had been in the employ of the company but a comparatively short time. This percentage is remarkably low, and compares favorably with that of the most healthful community.

It is fair to note that an advance has been made toward stopping the death-toll of a trade, the mention of which had made those familiar with its statistics shudder, and it can be truly said that the grinder of the future in the well heated and ventilated workroom and with the modern grinding-wheel will be in a healthful environment.

Grinding-dust, once inhaled, slowly collects in the lungs, where it eventually causes stubborn catarrhs and slow inflammations, developing into coughs and excretions, pains in the chest, loss of appetite, drowsiness, and short breath, known as "grinder's asthma." If the disease is not checked, general destruction of the lungs takes place, resulting in death. "Grinder's rot," "grinder's asthma," and, "grinder's consumption" are very familiar terms among the industries using grindstones.

In statistics from the recently closed International Hygiene Exhibition in Dresden showing the mortality in the grinding trades of Sheffield, England, during the years 1901 to 1909 it was noted that the death rate among grinders due to phthisis, or tuberculosis, and respiratory diseases runs as high as 35 per cent. in some trades, and that the average for all males in this district in these diseases runs about 6 per cent.

When a large plant like the National Tube Company considers it sufficiently important to supply cooled, filtered drinking-water for upward of one thousand men in all parts of the plant during twenty-four hours in every day it stands as expert testimony on the value of pure water.

The system just mentioned includes a compressor and circulating-pump, both engine-driven, ammonia receiver and condenser, cooling-tank, filters, and distributing-lines. Water received from a city main is passed into filters, which are connected in series and provided with a coagulant tank, introducing a trace of alum into the water before it is filtered. The filtering agents are silicate, sand, and charcoal, and their capacity is from 540 to 720 gallons per hour.

From the filters the water is received into a cork-insulated steel tank, where it is cooled by contact with ammonia expansion coils from a temperature of about 80 degrees in summer to an even temperature of 45 degrees. The temperature can be regulated as desired. Refined, anhydrous liquid ammonia, from which every impurity has been eliminated, is the refrigerating agent used.

The cooling-tank has a capacity of two thousand gallons, and its inner surface as well as the outside of the coils is coated with black enamel paint so as not to impart a taste to the water.

From the cooling-tank the water is passed into the circulating-pump and forced through the distributing-lines at a pressure of about twenty pounds.

The capacity of the circulating-pump at average speed is three thousand gallons per hour. All gears, fly-wheels, and couplings are provided with safeguards.

The ammonia-compressor is a combined suction and pressure pump which aspirates the gas from the expansion coils as fast as it is formed. The compressor, engine, and fly-wheel are all equipped with safeguards.

The ammonia-condenser is located directly over the engine and compressor and receives the gas as it is discharged. The office of the condenser in conjunction with the compressor is to reconvert the gas into a liquid after evaporation, thus making the original charge of ammonia available for use in the same apparatus over and over again.

The compressor-pump, circulating-pump, cooling-tanks, and filters are mounted on concrete foundations.

There are approximately 7,000 feet of distributing-lines consisting of a two-inch main and five branching circuits of one-inch galvanized pipe, with which fifty-five sanitary drinking-fountains are connected. The longest circuit in the rolling-mill is 1,790 feet, with sixteen fountains; the shortest circuit through the offices and pattern shop is 825 feet in length, with eight fountains.

All the lines are constructed so that the water is kept in rapid circulation through them and returned to the cooling-tank at a temperature of about 48 degrees. The pipes are covered with pressed cork insulation, glued and wired in place and coated with black shellac.

The sanitary drinking-fountains are located at convenient places about the plant, and are provided with self-closing valves. The bowl is so designed that it is impossible for a man to put his mouth on the water outlet. All waste water is carried directly to the sewer.

The average consumption per individual, including the water that is wasted, is about 25 gallons per hour, or a total of about 275 gallons per hour for the plant.

The mill restaurant at the Gary Works of the American Sheet and Tin Plate Company is a neat, one-story building about 61 feet in length, 38 feet wide, and 11 feet high to the ceiling. It is constructed of brick, with concrete floors, corrugated steel peaked roof, and plaster ceiling. The interior is divided into three rooms—namely, the dining-room, kitchen, and storeroom.

The dining-room is almost square, and contains 144 lineal feet of opalite counter, built in the form of a huge "M," around which are ranged 72 seats for the accommodation of patrons; three urns; two glass showcases; a cream and butter cooler; and a cigar case.

The kitchen is fitted up with a steam warming-table, a cooking-range, a cook's table, a pot-sink, a two-compartment glass and silver sink, a steam dish-washer, two other tables, and all necessary cooking and eating utensils.

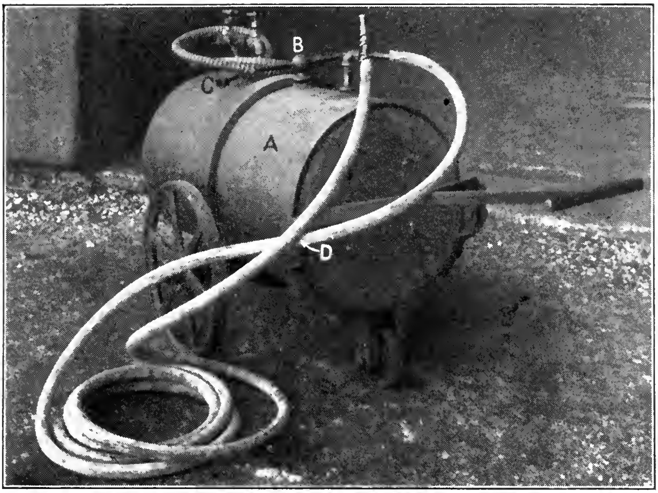
The storeroom is equipped with a refrigerator, a meat-block, and shelves for the storage of commodities.

The restaurant is not leased to the keeper, and he is not obliged to pay any rental; but he must pay about $20 a month to cover the cost of heat, light, and water. Permission to continue the business is based entirely upon the proper conduct of the restaurant, the serving of wholesome food, and keeping the premises in a neat and sanitary condition.

The floors and counters must be scrubbed at least once a day, the ice-box and windows thoroughly cleaned once a week, and the urns washed out daily. The sewage-lines are flushed once a week with lye and water.

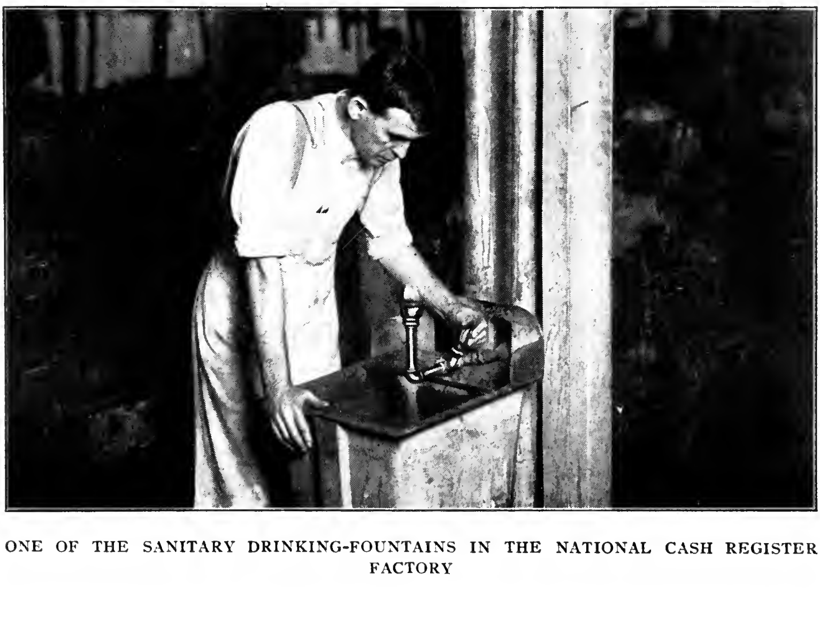
The drinking-water is cool and of excellent quality, being furnished by the general water system of the plant.

Most of the unskilled laborers carry their luncheons with them, as do many of the skilled workers also; but about 186 regular meals—breakfasts, luncheons, and sup-



CONVENIENT DISINFECTING APPARATUS FOR USE IN MILLS AND SHOPS

A—Steel tank.
B—Hole for introducing disinfectant.
C—Air connection.
D—Spray-pipe hose for disinfectant.



ONE OF THE SANITARY DRINKING-FOUNTAINS IN THE NATIONAL CASH REGISTER FACTORY

pers—are served here daily. The total transactions, including luncheons and supplies, number about 400 daily.

The regular noonday meal is a very substantial one, consisting of soup, a choice of meats, vegetables and dessert, and costs only twenty-five cents. Nourishing food is also furnished *à la carte* at very reasonable prices. To name a few articles: Hot soup may be had for five cents per plate; roast beef, lamb, or pork sandwiches with potatoes and coffee for fifteen cents; and fruits, pie, and other desserts for five cents a portion.

A very subtle test of the efficiency of an industrial establishment is the equipment of the water-closets and the condition in which they are kept. In one pipe-mill there are 176 men to use the lavatory night and day. The walls and floors are tiled, toilet-bowls are flushed automatically, and individual porcelain wash-bowls and a shower-bath provided. On the day turn the room will accommodate about 100 men. In addition to the above, the furnishings include a slop-sink and a heater.

With the utmost care on the part of the management, and closest co-operation from the men in observing the proprieties of lavatories, it is possible to go a step farther in the provision of an appliance for properly disinfecting latrine-buildings, mill and shop floors, and heating-coils, to make conditions more sanitary for men while working.

The illustration shows a traveling steel tank, with compressed-air connection for the necessary pressure to the liquid, and a spray-pipe hose for disinfectant. A good disinfectant solution is one gallon of creosote preparation to sixty gallons of water, though among the patent disinfectants that have been brought out lately there is one at least having many times the strength of pure carbolic and at the same time is non-poisonous and non-caustic.

The common type of wardrobe in the working-place is a row of hooks or pegs, on which hats and wraps are hung. It requires no stretch of the imagination to predict what the consequences of such an arrangement may be when a worker comes from a home where there is sickness of communicable character. Each shopmate is in danger of infection. The solution of this problem is the individual locker, which each person controls by means of the lock and key. A coil of steam-pipe at the bottom will dry the worker's clothing in wet weather.

Good ventilation is imperative; but, as it merely introduces the outside air, which in many places, and especially in great cities, is of poor quality and lacking in energy, ventilation must be reinforced by some agent to vitalize the indoor air and destroy its impurities.

One such agent is the Vohr Ozone Maker, a portable instrument contained in a wooden case and operated simply by inserting a plug in an electric-light socket and turning on a switch.

Such appliances act on stale, poisonous indoor air in the same manner as a thunderstorm acts on the air out of doors, burning up the impurities and making the air fresh and invigorating.

One characteristic of the new industrialism is the provision of a medical department wherever the number of employees is sufficient to warrant it. The philosophy of this department is to protect the workers in the plant, maintain their wage-earning capacity, and, wherever possible, to increase it. "Whatever will help my men to earn more wages I will approve," said a successful employer, recognizing that self-help means an extra advance for the business.

The Norton Company, in establishing their medical department, laid stress on these four points:

1. Complete physical examination of all employees.
2. Immediate attention to all defects found at examination, with an effort to rectify the same.
3. Re-examination at regular intervals of employees having physical defects, to see that they are in the best condition possible.
4. Immediate attention to all employees incapacitated by injury or illness, so as to restore them to normal condition in the shortest time.

The wisdom of this policy is apparent in the interest the men take in their personal condition and their appreciation of the remedial measures. In the course of six hundred examinations only one man objected.

Specific benefits resulting from this system include:

> Immediate elimination of those absolutely unfit for work.
>
> An increase in the capacity of the partially unfit by slight changes in work, medicine, and mode of life.
>
> An exact knowledge of those who may become partially or wholly unfit, and a continued effort to keep these conditions from recurring.
>
> A prevention of sickness by advice given to well employees, and by immediate attention to slight ailments.
>
> A reduction in the time of recovery from accidents. Wounds and injuries properly treated at once heal very much more quickly than if treatment is delayed.
>
> The elimination of so-called blood-poisoning by proper treatment of wounds.
>
> The elimination of active tuberculosis, syphilis, or any condition dangerous to other employees.

After examining a man the doctor discusses his physical defects with him, and strongly urges him to attend to any weakness.

Thus men having ruptures are advised to wear trusses. Those with poor teeth are advised to go to a dentist, and are instructed in the importance of the care of the teeth.

If any minor disease exists, advice is given, with prescriptions if necessary. The employee is told to report again in two or three days, as the case requires. When there is reason to suspect pulmonary tuberculosis, a sputum examination is made, and where the kidneys are involved a urinalysis. This company expects soon to make a complete urinalysis on all employees over forty years of age.

If the employee examined is too sick to work he is sent at once to his family physician.

It will be seen from this that every attempt is made to get the men in perfect physical condition at the start. But this is not all. When an employee is found to have a weak heart and is doing work injurious to such a condition his work is changed; when a man has a double rupture he is not allowed to do heavy lifting; men with organic disease are required to report at varying lengths of time for examination and advice. In this way the weak spots of the human machinery are kept under close supervision and any rapid degeneration is prevented. When a man has once been examined he is pretty sure to return for advice at his first subsequent sickness.

By examinations and subsequent intercourse with the employees the doctor is able to get in very close sympathy with his patients, and they will discuss many things with him freely. He is thus able to use his influence to modify minor vices such as over-smoking and late hours among the younger men. In several cases this practice has had very gratifying results in keeping at steady work valuable men who have a tendency toward "sprees." Working-men will listen to advice from a doctor and, what is more, follow it, when from any one else it would prove of no avail whatever.

One large transportation company has just completed a physical examination of some six hundred waiters in its restaurant and dining-car service. Fifty-nine of these were discharged on account of venereal diseases, showing how the public benefits by a management's care. These points, when brought out, prove valuable in enlisting the co-operation of the public.

In a large factory in the West the employment bureau reported that as a result of the physical examination of applicants for work a considerable number were refused because of venereal diseases, thus warning and protecting workers already employed. The management provides illustrated lectures fully covering every phase of these diseases. A lecture of this character, given on the opening day of the company's annual convention of a week's duration, resulted in closing up the "red-light" section of the district.

At the Wanamaker stores, where there is a sanitary department directly under medical supervision, not only the employees and the management but also the general public are directly benefited. The principal advantages of this medical direction can be enumerated under six heads:

1. Protection against sickness and accident.
   - (*a*) By examination of new employees, and exclusion of those with contagious diseases.
   - (*b*) By discovery of contagious diseases which may arise in the store, by immediate removal of the patient, and by use of antiseptic precautions.
   - (*c*) By sanitary surroundings, elimination of dusts, proper ventilation, and supervision of food.
   - (*d*) By making occupations as free from danger as possible through the use of safety devices.
2. Immediate treatment in case of injury or sickness. Inasmuch as about one-third of the injuries are minor surgical cases, prompt attention causes these cases to progress quickly and favorably.

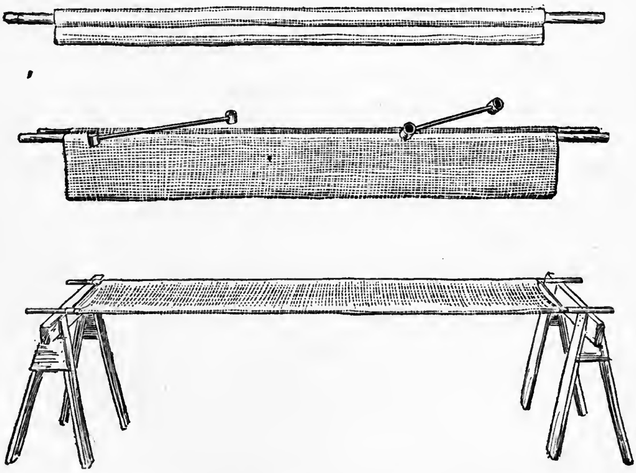
3. Raised standard of health and energy through treatment for the nose, throat, and ear, and prophylactic dental work.

4. Advice and instruction to each individual upon questions of personal hygiene, particularly in respect to diet, sleep, exercise, clothing, bathing, care of stomach and bowels.

5. Ability to remain at work, reducing absence and loss of wages.

6. The creation in the minds of the employees of a sense of security; a confidence that they are working under best possible conditions, that their physical welfare is being provided for, that in case of accident or sickness immediate attention will be provided until they can consult their family physician, if necessary, and if they so desire; a happier, healthier, saner body of workers, of higher individual earning power.

When it is impossible to have a fully organized medical service in a plant, there should be an emergency-room



AN INEXPENSIVE BUT SERVICEABLE TYPE OF FACTORY STRETCHER

equipped with the proper appliances and remedies where first-aid treatment can be given to injuries and minor ailments. Until quite recently it was the policy of both management and force to scout the idea of the necessity for immediate treatment of what were considered slight injuries, but to-day it is realized that even the slightest injury should have treatment at once to prevent the possibility of serious developments and the consequent loss of time and wages.

As a feature of first-aid equipment and emergency-rooms stretcher-boxes located at convenient points throughout the plant are effective. It is well to have a distinguishing mark on the box, thus enabling them to be seen from a considerable distance. For instance, the Carnegie Steel Company paints a green cross on a white background of the box. Lists of the locations of these boxes are issued, so that they may easily be found. Each box contains a Reeves Army Stretcher, woolen blanket, tourniquet, and gauze bandages for use in stopping a flow of blood.

An important feature of this work is inspection. Each box should be inspected daily with a view toward keeping everything in order. As soon as stretchers and blankets are used they should be immediately replaced by others.

For a quickly made stretcher, cheap but serving fully the purpose, the National Tube Company utilizes a framework of light pipe-iron. A transverse section, keeping the canvas taut, makes it perfectly strong.

A good type of emergency stretcher for use in mines is that of the H. C. Frick Coal and Coke Company. It is made with springs to absorb shock and jar as the injured man is being taken from the mine to the emergency-room.

For rapid and comfortable conveyance of an injured man to the works emergency hospital the Allgemeine Elektricitaets Gesellschaft, of Berlin, uses a double bicycle ambulance. The injured man rests comfortably on the stretcher, which can be quickly lifted on and off.

The expense of building and equipping a hospital within or near a plant for its exclusive use is often prohibitive. When the plant is located in or near a city where there are one or two hospitals it is perfectly possible for it to rent a part or the whole of one floor with the plant's own surgeons and nurses in attendance. At the same time, in case of necessity, the regular staff of the hospital can be drawn upon. Such co-operation lessens the charge on the plant and at the same time insures a fixed income for the hospital.

PART IV

SOCIAL WELFARE

XIX

INDUSTRIAL EDUCATION

THE question of industrial education is constantly attracting more and more attention in the great industrial countries of the world. Not only manufacturers, who are perhaps most directly interested, but educators, legislators, labor leaders, and the general public are becoming more and more alive to the necessity of giving growing boys and girls useful and practical preparation in the public schools for their future careers. It is worth while to consider certain phases of this admirable work, which should in all cases include direct instruction in good practice as regards safety.

Not long ago the National Education Association of the United States pointed out the responsibility of the public-school system in training the youth of the United States along vocational lines, and declared against the waste—in unprofitable courses of study—of the intelligence of the future factors in our industrial life.

The efforts of the National Society for the Promotion of Industrial Education should be mentioned in arousing public opinion to a realization of the importance of industrial education and of turning out workers who are prepared.

The committee on Industrial Education of the American Foundrymen's Association has been one of the most active forces in making this subject a matter of national importance. As the chairman of this committee has pointed out: "The fundamental aim of industrial education should, however, be supplemented by the training of the worker in understanding the relation of his work to the welfare of the community he lives in, as well as to the nation at large.

"In the industrial school to come the prospective industrial worker, as well as the prospective engineer, should be made to see that mere manual dexterity, scientific knowledge, and the mathematical perfection of mechanical processes are one-sided possessions in the struggle with keen competition if not reinforced by an additional training in civic duty which tells the industrial worker, be his station in life ever so humble, that as a man and a citizen he is morally bound to see to it that his fellow-men are not curtailed in their enjoyment of life as he himself expects to enjoy life. If the mechanic, be he ever so skilful, or the laborer, be he ever so strong and quick, carelessly or ignorantly wastes time and material or slights his work, then he increases thereby the cost of the product in various ways unnecessarily, and lessens the chance of its sale through higher cost in competition with other more prudent concerns or industrial nations. Hence he does himself and others more or less harm by lowering wages or loss of work, or both. On the other hand, the diminishing of our resources of raw materials by careless waste makes living harder and more difficult for those who come after us. In either case it is an immoral act of the mechanic as a man to injure others in one way or another if he can avoid doing so by learning how.

"Whatever differences there may be between capital and labor, the latter will not improve conditions by neglecting the opportunity to become skilful to earn more; but using that skill in a more economic manner will tend toward a more scientific use of our mental and material resources, more economic municipal housekeeping and the exercise of a greater co-operative spirit. For the same reasons, as well as for self-preservation, this duty likewise devolves upon capital. Lavish waste of time and material enriches a few. Judicious economy without penuriousness secures greater permanency of raw materials and continued prosperity to the many.

"If this broader industrial education, all too meagerly outlined above, has any right to be heard in the councils of our industries, it is for reason of the present waste of talent, intelligence, and mental and moral discipline in the years after leaving school."

Maintaining the supply of intelligent, capable mechanics is a matter of concern to the managements of all manufacturing plants. The pattern shop and foundry are no exceptions in this regard, as skill and diversified knowledge are demanded in the production of castings. In recent years the perfection of the molding-machine has evolved new ideas in pattern-making, or a varied application of old principles to meet new conditions. While many labor-saving tools and devices have been introduced, they have not made an automaton of the pattern-man. His value to his employers depends upon his skill as an artisan and his intelligence.

The reason why most manufacturers feel the need of more efficient workmen may be ascribed to the system of apprenticeship in force in most shops.

Under existing conditions the foreman is too busy in attending to the work that must be put out and in giving orders to the men, to devote much time to the instruction of apprentices beyond the general information conveyed in giving them their work.

One practical foundryman has described the situation fairly: "To teach a boy how to run a lathe, a planer, or any other machine-tool does not make him a machinist; nor does teaching a boy how to grind, sharpen, and handle his tools so that he can successfully make a glued joint, turn a piece accurately in the lathe, or carve a block of wood to given lines make him a pattern-maker. There is other information that he must acquire. In addition to such knowledge of mechanical drawing as he may be able to gather in the course of his shop practice he should be taught the principles of projection and enough plane geometry to enable him to carry on his work with a saving of labor and material. He should also have some knowledge of mathematics, and the more of this the better. It is also essential that he have a knowledge of foundry methods and molding practice. This of itself covers a wide range to-day. He should have other general information pertaining to the trade, such as a partial knowledge, at least, of modern machine-shop practice, of the nature and properties of materials that are used not only in the pattern, but in the finished casting. He should be taught his duties not only as a workman, but as a citizen. This would tend toward the making of the finished mechanic, the betterment of conditions in the shop, and an increase in the output."

The apprenticeship plan of the Cleveland Punch and Shear Works Company is pronounced by many foundrymen as the best system of turning out skilled pattern-makers in this country. This apprentice system requires a probationary period of three months, during which time the boy helps wherever possible in lending a hand at sandpapering, varnishing, and other duties, while he familiarizes himself with his surroundings, the nature of the work and the discipline of the shop. He is given ample opportunity to show what is in him, and to make up his mind whether he wants to be a pattern-maker or not. On the other hand, the manager of the shop has time to decide whether the boy is fitted for the work. At the end of this period the parent or guardian of the boy is called in and a contract entered into covering a period of four years, during which time the boy is to be taught the trade. The contract stipulates the boy's duties, payments at stated periods, and the amount of increase in wages. The shop practice, briefly stated, is to start the apprentice at circular work, simple lathe work, blank gear work, and similar machine work. He is given a bench and is expected to provide himself with the necessary tools. This class of work familiarizes him with the use of machinery and different shop tools, which he has been carefully instructed how to handle, and with the peculiar dangers of which he has been warned. Having become proficient in this class of work, he is given simple patterns to make, requiring bench work, and is advanced to better and more intricate work as he shows himself capable of performing it. It has been found that advancing the apprentice as rapidly as is consistent with the thoroughness of his work makes him ambitious to learn, and is, in the end, more profitable than keeping him on a class of work that he has learned to perform quickly. This is justice to the boy and is of value to the firm. Throughout this period of instruction the foundry methods are given due weight, and this knowledge is essential to success, as the pattern made is but a means to an end, and not the end itself.

The same need for trained workers is felt in the molding-rooms of foundries. In a few thousand shops there are turned out annually one or two molders apiece. Many of the workers never advance beyond the stage of laborers or "handy men." Those who do become valuable to the foundry in which they have received their first training are very prone to travel and to give other employers the benefit of their experience.

A few of the larger establishments, recognizing the situation, have gone about the systematic training of their young men through foundry trade-schools and special courses of instruction. But the up-to-date system of training apprentices by means of a school in connection with the shop is possible only in some of the largest plants of the country. To expect the small manufacturer to maintain an apprentice-school with special instruction is not feasible.

The real solution lies in the public school, where, after the ordinary and elementary studies have been passed, special studies should be taken up bearing upon the chosen vocation. For instance, if a boy decides upon molding as his life-work, he should receive, in addition to practical manual training, instruction in chemistry, mechanics and other collateral studies which will give him an intelligent grasp of the science of his work when he enters a shop after leaving school.

The National Metal Trades Association has also realized that the question of industrial education is a serious one, and that it will continue to grow in importance. One of the early efforts in this line was made through a committee of the association in connection with equipping with machinery certain buildings in the Winona Technical Institute of Indianapolis, and the furnishing of scholarships to the value of one hundred dollars each for prospective students. The committee did very effective work in soliciting the contributions of equipment and scholarships which were made to the Institute by individual members of the Metal Trades Association. Later, the association in conjunction with Indianapolis members voted financial support to the Institute for the maintenance of a Metal Trades Department, and appointed a committee to co-operate with the officers of the institution in the management of that department.

In co-operation with the University of Cincinnati, under Professor Herman Schneider, members of the National Metal Trades Association opened their shops in 1906 to the students in the university's "co-operative course in engineering," with the result that young men are now getting a practical and technical training that was impossible under the old order. It is interesting to note that the products of this course are eagerly sought after and are being absorbed by the trade faster in some cases than the finishing-processes are completed, and that the number of applicants for enrolment is reported many times greater than the facilities at the university will accommodate.

It is well known that the manufacturer in the metal trades is always glad to secure the services of a German machinist because of his better technical and theoretical training. The only drawback to this type, as voiced by one employer, is that after a while these men seem to appreciate their superiority over the other workmen and develop a more or less annoying case of self-importance. When it is pointed out that these men are the fruit of a system which we in America are trying to inaugurate, the employer readily sees the point and is more than ever willing to help along this type of education. The complaint has been made that the graduates of some of the higher grades of educational institutions are afraid of soiling their hands and clothes or of donning a suit of overalls, indicating the advisability of extending the field of the purely trade school and providing industrial training and education for the boy who, for reasons wholly beyond his own or his parents' control, is obliged to fare forth and assist in providing the necessaries of life for the family. The need for the education of such boys has been provided for in some instances by the organization on the part of members of the National Metal Trades Association of apprentice-schools in the plant or factory of the association member. Arrangements are made for a teacher, and the boys are alternated in small groups between the schoolroom and the shop. In one instance in Cleveland, where the demand was great and no one manufacturer would undertake such a work alone, the Y. M. C. A. was induced to take up the work of organizing and teaching while the manufacturers, members of the National Metal Trades Association, and others furnished scholarships of a certain value and agreed to allow the boys opportunity in the daytime to attend the classes on certain days each week. The great avidity with which the boys grasped the opportunities is the most eloquent testimonial to the merits of this plan.

The great economic, social and industrial gain by the continuance of these measures can hardly be estimated. Better mechanics, better workmen, better citizens, and better men in every conceivable respect are being produced than if this same material had been allowed to drift into the unskilled occupations or to grow up on the street.

Realizing, after some time, that the spread of industrial education should be in the hands of specialists, and appreciating the work of the National Association for the Promotion of Industrial Education to this end, the National Metal Trades Association, at its annual convention in 1911, appropriated money to be used at the discretion of its administrative council for advancing the work undertaken by the former. Of this amount a part was paid to the National Association for the Promotion of Industrial Education in the autumn of 1911, and the disposition of the balance was left with the administrative council by the convention of 1912.

The National Metal Trades Association has identified itself with this movement both as a national body and through its branches, and in addition to the instances above noted members of the National Metal Trades Association in branch territory have lent their support to institutions which are teaching students along industrial lines.

In Chicago the Lewis Institute receives the co-operation of the association; Cincinnati's Continuation School and Co-operative High School, in addition to the University, are training mechanics in many trades and have the members' hearty approval; Cleveland has its Technical High School in the public-school system in addition to the work being done by the Young Men's Christian Association mentioned; members in Hartford, Conn., have induced the public-school authorities to inaugurate a continuation school to which they will send their apprentices; New Haven, Conn., members have co-operated with the Boardman School, and are trying to induce the Board of Education to take up the matter of industrial training for the apprentices in their shops;

St. Louis members are working with the Rankin Trade School in that city, and report very gratifying progress. The members of the National Metal Trades Association are alive to the necessity of education for the American boy of a sort to fit him for his life-work, thus increasing our national industrial efficiency and enabling our country to hold its own in the markets of the world with those nations who long since saw the advantages of such an educational system, and who are now reaping the fruits of their wisdom and foresight.

Well-trained apprentices are already going from the shops and factories of members of the National Metal Trades Association into the ranks of the mechanics of the country, making for the industrial betterment of the whole nation.

The object of the school for apprentices of the Pennsylvania Railroad Company is to give apprentices of the road a knowledge of the fundamentals of mathematics, mechanics, and drawing, with a view to making them more useful in their chosen trades. The work is very practical, the problems in the various courses being drawn directly from the shop practice.

Attendance at the school on the part of the apprentices enrolled is compulsory for all exercises scheduled. When new apprentices are taken on they attend the apprentice-school promptly after they take up their apprenticeship, and they complete the course in the term in which their third year of apprenticeship ends. Vacations, when granted, fall without the school-year. If for any reason an apprentice must be absent, he must obtain permission from his foreman and he must advise the authorities at the school, giving the cause of absence. A weekly report of attendance is issued by the instructor to the master mechanic or general foreman of each shop, and through their co-operation a very close account is kept of each apprentice.

The work as outlined is arranged to cover three years of forty-two weeks each. Each apprentice receives four hours of instruction per week, making a total of five hundred and four hours for the three years. The work is given in periods of two hours, so that the apprentice reports two days per week. Each year is divided into two terms of twenty-one weeks each. It is intended that the apprentice shall have two hours of recitation work per week and two hours of drawing and laboratory work. The recitation work requires outside preparation, and it is intended that the apprentice shall devote one hour of study for every hour of recitation work. The drawing and laboratory work require no outside preparation.

Those reporting at the school consist of the apprentices in the first, second, and third years of their apprenticeship, and for purposes of instruction are divided into seven sections, lettered from A to G inclusive; A, B, and C are sections of the upper class, and D, E, and F sections of the lower class, while G is a preparatory section or class provided for such apprentices as may enter after the beginning of the term. The work of the preparatory class is analogous in a general way to that of the other classes, but it is the effort here to give closer instruction in order that such apprentices may join the regular classes as early as their qualifications will permit.

Apprentices showing a special aptitude for their work may be formed at any time into a class which moves faster and takes more advanced work than the others.

Each of the sections from A to F inclusive is composed of a maximum of thirty men. The number of apprentices in section G may vary considerably, according to the rate at which new apprentices are taken on by the company, and according as promotions and demotions are made among the young men already registered.

The courses of study include mathematics, mechanics, and drawing, with as much of English and science as is warranted in a school whose object is primarily specific trade education.

The work in English covers instruction in the proper spelling and meaning of words, parts of speech, formation and structure of sentences, and composition-writing. Some attention is given to instruction in the correct method of writing business letters, making out order-blanks, time and other reports.

The work in mathematics is at the beginning very elementary, eventually leading to the study of such portions of higher mathematics as are especially useful in the solution of shop problems. The lower class takes up applied arithmetic, beginning with the elementary processes of addition, subtraction, multiplication, and division. The upper class begins its work with algebra and continues into applied geometry and the study of the more simple trigonometric formulæ. This is taught largely by means of shop problems.

The course in physics is made up of two parts—recitations and lectures, and laboratory work. The recitations and lectures are intended to familiarize the apprentice with fundamental physical principles. The laboratory work is intended to develop powers of observation and demonstrate physical principles through experiment. Considerable time is given to the study of elementary electricity and electrical applications.

The study of mechanical drawing begins with plates enabling the student to become familiar with drawing-instruments and with standard forms of lettering, dimensioning, and conventional signs. Drawing from models and plates is then taken up and some time is devoted to the completion of partially finished drawings. Free-hand sketches of shop pieces and parts of machines are made by the apprentice and reproduced in the drawing-room as finished drawings. The apprentice is also given a little practice in tracing and blue-printing. Many of the problems involving principles of geometry and mechanics are worked out on the drawing-board under the head of geometric drawing and graphics.

The work in mechanics is elementary, and deals only with those problems which relate to machine parts. The work includes a study of forces and motion, and resistance, and work and problems relating to simple machines.

The work in mechanism is similar to that in mechanics, and includes problems having to do with motion, velocity, and acceleration; a study of general machine parts and the different modes of transmission is included under this subject.

The processes of manufacture and properties of materials used in machine construction are considered. This is followed by a study of testing-machines and of the results obtained from these, showing the value of such work as related to the subject of machine design.

The work in mechanics, mechanism, and strength of materials affords the apprentice sufficient preparation to enable him to take up the partial problems of elementary machine design. In this work simple problems are given in the five elementary stresses, with applications to machine parts. A short study also is made of machine members, with regard to power transmission.

The course in chemistry is divided into two parts, general and commercial chemistry. The general chemistry includes only enough of the subject to enable the apprentice to appreciate some of the problems which follow in commercial chemistry. In commercial chemistry a study is made of water and fuels as regards their composition and use. The combustion of fuels, including their economical use, and a short study of iron and steel manufacture are also included in this work.

Steam practice deals with descriptive matter more than design problems. The power-plant as a whole is first considered. Each part is then studied in detail; the steam engine receives chief consideration.

The work in experimental tests deals with descriptions and methods of testing pieces of apparatus in any manufacturing plant. This is followed by simple friction and efficiency tests of engines and boilers.

There is also a course in shop-management consisting of a series of lectures designed to familiarize the apprentice with shop arrangement and management, departmental and stockroom reports, cost and time-keeping systems, and economic methods of handling work. This course is intended to enable the apprentice to understand better his duties and responsibilities with reference to the general organization in which he is working.

In order to provide a basis upon which to establish his records the following system of credits is employed. One credit is allowed for each hour of theory taken per week throughout a term, and one-half credit for each hour of drawing or laboratory work per week for a term; thus an apprentice taking, for a term and according to the schedule, two hours of theory per week receives two credits, and for drawing or laboratory work of two hours each week for a term receives one credit, making a total of three credits for the term. On this basis for completing the entire course of three years, or six terms, the apprentice receives eighteen credits. This system of credits establishes for each term the relation of the subjects covered by the apprentice to those of the entire course. In order to have proper credits those who for any reason miss a regular exercise make up the work without interference with the regular exercises, but through excessive absence or gross inability the apprentice may forfeit the credits of the course he is pursuing either entirely or in part and be demoted or dropped from the school. Apprentices in the advanced class may cover their ground more rapidly than the other classes, and therefore may at the end of three years have more than eighteen credits.

A monthly report of grades is made by the head instructor and submitted to the general office of the Pennsylvania Railroad Company, as well as to the Pennsylvania State College. In determining these grades the deportment and aptitude of the apprentice are considered as well as the work actually done. The monthly records are based on daily recitations, occasional written lessons, and monthly examinations. Only those apprentices whose records are unsatisfactory are reported to the parent or guardian, although a complete report of all apprentices attending the school is maintained at the school and on file at the offices of the railroad company. In the month of July there is submitted an annual report, which gives a summary of the monthly reports and contains a statement by the head instructor expressing his judgment of the ability, character, and special aptitude of each apprentice.

The monthly and annual detailed reports of the instructor concerning each member of the classes and the natural sifting out of those lacking in suitable ability or character, when taken in connection with the regular records of the shop foremen, form excellent and accurate bases upon which to select and use the men to the best advantage in the shops. The apprentices of much more than ordinary ability and character are easily discernible by their work, and at the same time the specially prominent attributes of each individual class member are apt to be marked.

The educational work of the National Cash Register Company among their employees is interesting. In addition to lectures and pamphlets on subjects connected with the operation of the factory and designed to assist the employees in their work, special lectures have been prepared on digestion, respiration, and general diseases. Illustrations have been secured from every known source, and each subject is presented so logically and clearly that the most thoughtless and careless cannot fail to be impressed.

For these and other lectures, not only on health, personal hygiene, sales and efficiency, but also on progress, science, travel, landscape gardening, civic improvement, and many other subjects, some thirty thousand slides have been collected. Nearly all of these slides were made and colored in the slide department, located on the eleventh floor of the office - building. This department employs twelve persons, including two photographers, ten artists and assistants, and has specially equipped darkrooms and studios for this work. Kinemacolor motion pictures are also used to illustrate certain subjects, such as the functioning of various organs of the body, when through the education of their eyes the classes receive such information regarding the physical organism as they would never gain from the printed text-book or academic lectures on these subjects.

The educational center for this work is known as the Hall of Industrial Education, a beautiful building designed by McKim, Mead & White, of New York. There is nothing unusual in the appearance of its exterior; the architecture is simple and graceful. Within, the hall seems like any other of similar size and use, but its appearance is misleading. The walls are lined with felt an inch thick, every inch of the floor space is deadened by thick linoleum, and the ventilation is at least four times superior to the usual standard maintained in public halls.

Back of the stage are twin squares of ground glass, each twelve feet square, for the projection of lantern slides; but all this machinery is hidden and works from behind so that there is absolutely nothing to distract the eye, brain, or nerves of the audience. For possibilities in holding the attention of an audience this hall stands in the very first rank.

The importance of an apprenticeship system to the development of a highly organized engineering department was recognized by the Westinghouse Electric and Manufacturing Company very shortly after the establishment of its works at East Pittsburg, Pa. The apprenticeship course as first organized in 1896 was established to keep track of the young men who presented no special qualifications along electrical lines and who entered the organization with only the assurance that as opportunities afforded they would be advanced. Technical graduates and others were treated alike as far as the course of shop training was concerned. This arrangement was, of course, rather unsatisfactory to the company and to the men.

In 1902 the apprenticeship course was put on a more systematic basis. It is now known as the engineering apprenticeship course, and admits graduates of technical schools and universities. The course is of two years' duration, or 5,480 hours, 18 cents per hour being paid the first year, 20 cents for the next six months, and 22 cents for the remainder of the second year. The man is put on trial for 685 hours before he is admitted fully to the course. Application for the engineering apprenticeship course must be made by letter in the handwriting of the applicant, stating date of birth, course pursued, degrees received, any practical experience which he may have had, and the name and address of father, or mother if father is deceased, or guardian. A recent photograph of the applicant must be submitted with his application together with references.

The apprentice is given an opportunity to become familiar with the manufacturing operations, the general construction and working of the apparatus produced, and actual shop and engineering experience to supplement the work he has done in college. Sometimes apprentices are taken from the course to fill regular positions in the company's engineering or sales organization before the expiration of the full apprenticeship service; in this case the compensation is increased in accordance with the position that the apprentice has been called upon to fill.

The apprentice devotes somewhat over one-half of his time to the shops and the rest of the time to the engineering, construction, testing, and correspondence departments. The large scope of the work in which he is permitted to engage gives him an excellent opportunity to become familiar with up-to-date engineering practice and to decide what branch of the work he will pursue. The time is divided between the different departments, depending upon the relative values of the experience to be gained in these departments. The testing department comes last, since it is desired that the apprentice should have a thorough understanding of the apparatus and its parts before he is permitted to operate it.

Engineering apprentices can avail themselves of the advantages of the Westinghouse Club, a club that inculcates among its members a spirit closely akin to the feeling that exists among the undergraduates of a college. It affords an opportunity of becoming acquainted with other young men whom the member should know in his future career, as well as older and more experienced men in his field of work. The club provides for educational, social, and athletic activity among its members, and is governed by a board of thirteen directors, chosen for the most part from the younger men, who are thus responsible for the direction and success of the club. Incidentally, an important advantage of membership to these younger men is the experience gained in conducting such an organization. The predominant feature of the club is, however, its educational work. Sections of technical or engineering classes are organized to deal with the application and construction of various types of apparatus or to consider other subjects of importance in industrial organization and management. These classes supplement the daily engineering work of the apprentice in the factory.

The apprenticeship courses of the Westinghouse Machine Company are conducted along the same general lines and the requirements for admission are practically the same. These apprentices come from universities and colleges all over the country.

The two years' course for the engineering apprentices is divided as follows: Eight months, turbine department; two months, condenser department; four months, gas and steam department; two months, producer department; three months, field erecting; three months, drafting; and two months, miscellaneous work.

The wages paid are the same in both companies, and give an average monthly pay of $40 to $45 the first year and from $45 to $55 the second year. An apprentice's expenses average about $35 a month. Although the remuneration does not provide for the indulgence of any expensive habits, still it is ample to provide the essentials.

With few exceptions all of the men who graduate in the machine company's course are taken into the company's sales or engineering organizations. Some of these exceptions are men who are sent by the company's customers to take the course. Sometimes a company that is operating a great many Westinghouse machines desires to have some man in its organization familiarize himself thoroughly with their design and operation by taking the apprenticeship course.

The apprentices with the machine company are also eligible to membership in the Westinghouse Club. This affords them social, physical, and educational advantages.

Recently the New York Central lines put into operation at the larger shops a school system for the benefit of the shop apprentices, in various trades. The purposes of these schools are:

1. To improve the quality of mechanical skill available in shop work.

2. To make apprenticeship attractive to intelligent boys.
3. To make it possible for the right kind of boys to rise from the ranks to positions as foremen and master mechanics.

School work is done in regular shop time under pay, and in the morning when the boys are at their best. The work is done under drawing and shop instructors appointed from the local shops, these instructors being under the direction of the officers of the company in charge of the local shop operations. The whole work is under the supervision of a superintendent of motive power.

The boys who apply for apprenticeships in the shops of the company are of various grades of education, some having practically no schooling while others are high-school graduates. The instruction is therefore somewhat varied in character, but is mainly of two general types—drawing and numerical calculations, and shop work. The drawing instruction is given in rooms or small buildings especially devoted to this work. These rooms are fitted up in a simple style with drafting-tables, blackboards, cabinets for storing boards and supplies, and models. The courses, which are laid out for all shops by the superintendent of apprentices, are of a nature to appeal to apprentice boys. Early experience with the work showed that school methods and especially college methods are not applicable to this class of instruction. Academic, numerical, geometrical, and graphical problems make no appeal to the shop apprentice. He must be instructed in terms of his environment. Hence the objects which he is expected to draw are the familiar things with which he works in the shops. Small locomotive parts, parts of shop tools, wrenches, and nuts form the drawing-exercises. Very simple subjects are assigned at the start, leading up to rather complicated ones toward the close of the four-year course. The work includes tracing, so that the student finally leaves his work as if for use in actual construction. In many cases the apprentices actually prepare drawings for foremen, supplementing the work of the regular draftsmen.

The drafting-room periods afford an opportunity also for testing the ability of the students to think for themselves. A large number of problems are assigned for home work, these problems being all of a simple and practical character. Solutions to the problems are handed in from time to time, and by means of blackboard exercises the real ability of the pupils in solving problems is tested.

Most of the time of the apprentices is put in at actual shop work under the direction of the shop instructor. The instructor is a practical mechanic who is familiar with all branches of shop work. His duty is to see that the pupil is taught thoroughly all branches of the selected trade. The instructor shifts the pupil from one line of work to another, giving him sufficient time to permit a thorough mastery of each part. For example: if a boy elects to learn the trade of machinist, which requires four years, his time will be divided roughly as follows: helping in shop, 0–3 months; bench work, 6–12 months; light tool work, 3–6 months; heavy tool work, 3–12 months; in air-brake department, toolroom, or brass tool work, 3–6 months; in erecting-shop, 16–24 months. The instructor shows the apprentice how to perform each operation assigned to him, and sees that the work is done thoroughly. He thus relieves the foreman from the necessity of instructing apprentices, and, as he is a specialist in this line, the work is much better done than formerly. It is understood that while the shop course is going on the apprentice is also working in the drafting-room, as before mentioned.

The instruction of apprentices is quite different from school work of any kind, and the primary function of the course is to teach the apprentice to "do things." Mental development is, of course, aimed at, and comes as a result of the continual exercise of the constructive faculty. Practically no text-books can be used in such a course, as the needs of the pupils are so varied. Lectures, examinations, and recitations as used in school have little place.

The results of the system have been highly gratifying to the company, and, although the experiment has been in operation but a short time, the benefits have been evident in an increase in shop output, a reduction in the amount of spoiled work, and increased desire on the part of the boys to prepare themselves for trades (including even some branches which a few years ago did not attract boys at all), and a general improvement of the spirit in the shops. The shop instructors meet from time to time to discuss their problems; and, as they work through a central organization, their efforts are marked by unity of plan and purpose.

The Committee on Education of the American Electric Railway Association is now formulating an apprenticeship system to be adopted by the electric railways, as has been done by the leading steam roads.

The New York Edison Company offers educational facilities through an Educational Bureau and the Educational Committee of the Association of Employees. The company has prepared technical and accounting courses, in both of which attendance is voluntary. The commercial courses prepared by the Educational Bureau, however, are recognized as part of the routine work of the commercial department, and instruction is given on the company's time. Employees enrolled in these courses are required to attend each session unless excused.

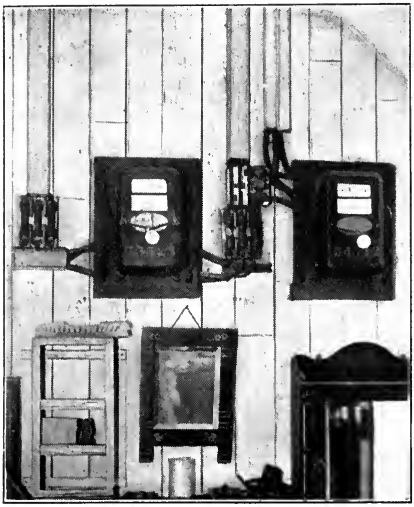
The purpose of the commercial courses is to render to the public the best possible service, and to increase the individual efficiency of the company's employees. The company recognizes that employees, particularly those who meet the public, must be able to answer questions and qualified to give advice on any reasonable matter within the scope of the company's business.

The instruction in the Edison Company's school resolves itself into three parts. First, the employee is taught something about himself through instruction on hygiene, health, and recreation; second, he is taught the basic principles of salesmanship; third, he is fully instructed in what he should know about the company's organization, the elements of central-station business-getting, and the fundamental principles of electricity.

The executive staff of the school consists of a manager, instructor-in-charge, and a secretary. All school sessions are held at the Edison Auditorium, 44 West 27th Street, New York.

The school term lasts a little over six months. The first-year course is held on Mondays and Fridays, from 4 to 5.30 P.M. The second-year courses are held on Wednesdays, from 4 to 5.30 P.M. Inspection tours of the central stations, typical sub-stations, and meter-testing laboratory are made during the school-year.

Under the auspices of the Association of Employees of the New York Edison Company technical courses in electricity have been offered to the employees of the company for the past six years. The scope of this educa-



OLD-STYLE INSTALLATION—WIRING AND CUT-OUTS EXPOSED AND MOUNTED ON A WOODEN PARTITION

SEALED CUT-OUT; FUSES AND WIRES INCASED IN PORCELAIN OR METAL

SAFETY DEVICES FOR CONTACT WITH LIVE METAL CONDUCTORS

tional work has been very carefully considered, and as a result somewhat special courses have been prepared to bear directly on the work of the company. This specialization was decided upon in order to avoid duplication of the educational facilities available through the public and private evening technical schools.

A careful study of the available methods of instruction led the Educational Committee of the Employees' Association to select laboratory work, with a very small amount of classroom exercise, in preference to regular lectures or lectures illustrated with experiments. For the past three years, therefore, these courses have been presented in the form of laboratory exercises, preceded at each session by a talk by the instructor, in which he briefly indicates the object of the evening's experiments and outlines the conduct of the work.

This plan has worked very satisfactorily, as the students' interest is held by the experimental nature of the work, while the assistant instructors in charge of the squads are expected to round out the discussion of the evening's experiment by running comment during the progress of the test and while assisting the students in the preparation of their reports.

Attendance at these courses is entirely voluntary, but students are rated only when they attend the entire course and submit complete sets of reports. These reports are marked and criticized by the instructor, and the standing of the rated students is published at the end of the term. In addition, prizes are offered for the students having the highest standing in the various courses.

These experiments are scheduled for a season of fifteen weeks, and the students are assigned in such order that they conduct one experiment a week. The course is given on five evenings, and in addition an afternoon class is held once each week for the benefit of night workers. The time of the chief instructor is entirely devoted to this work, while the assistants are obtained among the junior engineers or other qualified employees of the company.

The laboratory work is divided into three graded courses as follows:

Course 1. An elementary course of experiments illustrating the fundamental laws and principles of electricity and magnetism.

Course 2. An intermediate course, with experiments mainly illustrating the principles and operation of continuous-current machines and apparatus.

Course 3. A more advanced course, with experiments designed to illustrate the laws of alternating-current circuits, and their application to alternating-current machines and apparatus.

A course of instruction, prepared for the accounting and clerical employees of the company, was presented under the auspices of the Association of Employees, for the first time during the season 1912–13. This course offers instruction in the theory of accounts and on the methods employed in the company's accounting department. It includes lectures on the work of the other important departments of the company, with the object of acquainting the clerical employees with the technical and commercial activities of the company.

A complete system of registration and attendance records will be in force, and examinations will be held, with carefully prepared examination papers, at the end of each of the shorter parts and at intervals during the longer parts of the course.

As in the other course of instruction, attendance will be open to all employees of the company, but only those who are regularly enrolled will be examined and rated. These regularly enrolled students will be rated in accordance with their attendance and the marks obtained on their examination papers. The course is conducted in the evening, and attendance is not compulsory.

It is expected that this course will provide instruction in accounting well suited to the needs of men already engaged in work of that character, as well as information in regard to the departments of the company's business with which the clerical employees are not generally well acquainted. Thus, it is not proposed to offer instruction in electrical engineering, but to illustrate for non-technical employees the functions of the generating station, the sub-station, the mains and meters, with the object of increasing their efficiency and promoting an intelligent interest in their work.

The company maintains a valuable library, in addition to the fully equipped school laboratory, in which are to be found the most recent publications on technical and commercial subjects, with reference and text books compiled by leading authorities.

The library is open from 10 A.M. to 10 P.M. to accommodate employees who are seeking information or assistance in their special lines. The company subscribes for many important American and foreign technical journals. A file of daily city papers and a large number of popular magazines are other features. Comfortable seats and excellent light are provided, giving great attractiveness to the room, which is well patronized, especially in the evening hours, by employees who are making the most of their opportunities.

The New York Edison Company congratulates itself upon being the first electrical company to undertake a work of this kind among its employees. The results accomplished are in every way satisfactory, and worthy of the effort which the undertaking required.

XX

MEETING THE PUBLIC

GENERALLY the head of an industrial business can surround his factory or plant with a high fence and thus keep out the unwary public, but there are certain fields of industry, such as transportation, building construction, underground work, and the distribution of electrical energy, which by the very nature of their operations must come into contact with the general public.

It becomes, therefore, part of the daily experience of the average citizen, but especially of one who dwells in a great city, to face alarms and dangers with which those of the battle-field pale into insignificance. He may meet with accidents in front of moving cars, within them, or through some obstruction of the right of way; he may receive injuries due to overcrowded cars or to some failure of electrical equipment, frequently resulting in fire and panic; he may forfeit his life to automobiles and heavy motor trucks through the criminal recklessness of licensed chauffeurs; whenever he passes a sky-scraper in course of construction he runs the risk of having his life crushed out by the failure of hoisting-apparatus or the fall of materials from great heights; he may suffer injury from the careless use of explosives in excavating work, or he may tumble into an excavation that has been left unguarded; and he may be instantly killed by the violent blowing off of a manhole cover.

In 1911 in the Borough of Manhattan, New York City, 72 persons were killed by surface cars; 139 persons were killed by horse-drawn vehicles; 10 persons were killed on elevated railways; 10 persons were killed by subway trains; 63 persons were killed by elevators in the buildings of the borough. From the evidence brought forth at the inquests it was shown that at least 75 per cent. of the deaths might have been avoided if the elevators had been equipped with safety devices and proper care exercised in operating them. Five hundred and ninety-five deaths were caused by falling downstairs, from windows, roofs, and on sidewalks. One hundred and sixty-one deaths resulted from fires.

The Public Service Commission for the First District of the state of New York in its report for the year ending December 31, 1911, gives a long list of accidents and injuries in connection with the surface and elevated railways and subways of New York City, including all the boroughs of the greater city. Of 26,209 persons injured in connection with the operation of the city's surface lines 3,590 were employees and 22,619 were passengers or pedestrians. Out of this total number of injured persons 143 were killed, 48 had their skulls fractured, 27 sustained injuries to their limbs requiring amputation, 261 had one or more of their limbs broken, and 1,268 other persons suffered injuries that were classed as serious.

On the elevated and subway lines 70 persons were killed, 7 received fractured skulls, 7 sustained injuries to their limbs requiring amputation, 54 had one or more of their limbs broken, and 101 other persons suffered "serious" injuries, in a total list of 9,890 accidents to passengers, employees of these railways, and pedestrians.

An applicant for street-railway service, having passed the preliminary mental and physical requirements demanded by the employment office of every up-to-date electric-railway company, should be put through a course of training that will prepare him in advance to meet the difficulties to be encountered in the actual operation of cars.

It is not enough that men selected for car service have satisfactorily passed the prescribed mental and physical examinations, but they should be required to present themselves at stated intervals for further examination to prove that they are still mentally and physically fit to perform their work. In all cases where men are found to be deficient they should be removed at once to some other department of the road where the safety of its passengers does not depend upon the physical fitness or mental alertness of the employee.

The motorman should be required not only to know the rules, but also to understand the machinery and apparatus that are placed in his care—that is, he must understand why a switch contacts firmly, why a fuse blows out, why a brush-holder spring should not be left up. He should be thoroughly drilled in the meaning of every step in car operation by having demonstrated to him the various electrical parts found in the classroom in addition to the regular service work. Sufficient time should be allowed the future motorman to comprehend and assimilate the knowledge imparted to him.

The selection of competent instructors is of the greatest importance because of their responsibility in forming the habits of the student.

The learner should not be permitted to form any bad habits in handling a car, for if a bad habit is once formed it is very difficult to correct it. Neither can a motorman afford to become mechanical in the operation of his car.

Great stress should be laid by the chief instructor and by motorman instructors upon the rules as to spacing, the speed in approaching and passing standing cars and vehicles, obstructions, excavations, travelers in the highway, track-junction points, and other rules looking to the prevention of accidents.

The supervision of the instruction department should not end when a man is turned out to work by himself. On the contrary, each man should be followed up daily by traveling instructors until he gives evidence that he has formed the habit of doing his work well and carefully.

It is the narrow margin by motormen, too frequently measured by fractions of an inch, that causes many avoidable accidents.

The motorman should know during what periods of the day and at what places on his route the major number of accidents occur, and he should exercise the greatest possible care at such times and places to avoid accidents.

It is also very important and necessary that the new motorman should understand that failure to operate his controller properly is very apt to cause electrical troubles with his motors, controller, circuit-breaker, or main-motor switches, and cause those blow-outs that are usually followed by panic and injury to passengers, to say nothing of the damage resulting to the equipment.

In addition to the careful selection and proper instruction of men who are mentally and physically fit to represent the company there is a third step equally important—namely, the duty of sustaining the interest of conductors and motormen in their work. In few industries do intelligence, stability, skill, zealous interest, and fidelity on the part of employees count for so much as they do in street-railway work. Therefore, it should be the aim of every street-car company to awaken in its car crews a greater responsiveness to the necessity of preventing accidents as well as to the welfare of the road as a whole.

Many accidents point to the necessity of introducing some means of keeping the mind of the employee alert, as it should be in the case of a man operating a car.

To secure this combination of interest, alertness, reliability, and intelligence is the question which must be solved by the management if the road is to be immune from accidents due to the failure of employees. It is human for one who has exercised caution day after day and met with no occurrences requiring such caution to relax his vigilance, but the tendency emphasizes the necessity of repeatedly impressing caution upon the minds of men, and especially those of the older men, in car service.

To be sure that the men thoroughly understand the rules it has been suggested by the claims attorney of an electric railway in one of the large Eastern cities that an instructor be appointed whose sole duty would be the instruction of men in the rules and regulations of the company. Too little attention has been given this subject in the past. Superintendents may feel that they are able to judge whether or not the men are fully conversant with the rules, but in general there is no way by which the men's knowledge of the rules and of what they should do in emergencies can be so well gaged as by oral and written examinations at frequent intervals. In many cases the rules were adequate to have prevented the accident or trouble on the cars had they been intelligently observed by the employee involved. The plan of

22

having frequent examinations on the rules trains the car crews to respond quickly in cases of emergency or where decisive action is necessary.

It has been recommended that the leading operating rules of a company be periodically published in the form of a special notice delivered to each employee affected by them, illustrating the importance of the rules and calling attention to some accident or operating trouble that resulted from non-observance. Employees taking examinations in rules should be paid for the time so employed, unless they exhibit such ignorance as would seem to demand stern action by the company.

A good way to sustain interest in the rules is to place from time to time in each car vestibule a printed card showing some of the leading operating rules and to require each conductor and motorman when changing ends to carry his list to the other end of the car. In this way his mind is impressed with the importance of these rules.

A rule which stands to the fore in all books of regulations issued by the street-car companies concerns the avoidance of accidents. In one case this rule reads as follows:

> *The first consideration under all conditions must be the exercise of care and caution in the discharge of duties;* next, the regularity of the service, always having in mind the comfort and convenience of passengers and the interests of the company.

Another rule reads:

> Avoid accidents. Always take the safe course in case of doubt.

Still another company enjoins:

> It takes less time and trouble to avoid accidents than to report them after they have occurred.

The rule against alcoholism stands in close proximity to that for safety:

> Drinking or carrying intoxicating liquor in or about the premises of the company, or entering any place where liquor is sold as a beverage while in the uniform of the company, is strictly forbidden. No one will be employed or continued in employment who is known to be in the habit of using intoxicating liquor.

Experience has shown that car crews, when personally appealed to, will try to please their superintendent. Frequent meetings between the superintendent and the men will tend to develop personal dignity among the latter. The superintendent should talk to them about the rules and about the causes of the accidents which happen every day. Each man should be made to feel that he is a safety committee all by himself, delegated to prevent some one accident.

When an accident happens in a city street the crowd gathers around the unfortunate victim lying in helpless agony. Vague suggestions are offered, but seldom is anything done until a policeman arrives. Then he telephones for an ambulance. Twenty minutes to an hour may elapse before the ambulance arrives, and unless a doctor happens to be passing and volunteers his services nothing is done to relieve the sufferer. As a result of this delay he may die in the ambulance or shortly after reaching the hospital. Many people have lost their lives from injuries that would not have proved fatal if properly treated a short time after they were sustained.

It is ignorance of what should be done in emergencies that renders the by-standers apparently so helpless, although ignorance sometimes makes the efforts of well-meaning individuals who rush to do the wrong thing even more harmful.

To protect passengers as well as employees in the event of an accident the street railways should maintain an efficient first-aid service. First of all it is essential to have a medical man as lecturer to demonstrate the proper methods of treating common accidents, such as fractures, cuts, burns, and electric shock. A pamphlet containing a concise summary of emergency essentials should follow up the personal training. The following serve as examples of the printed instructions:

1. Keep cool.
2. Send for a physician.
3. Keep the crowd away to insure plenty of fresh air.
4. Examine the injuries carefully before doing anything.
5. Don't touch open wounds with the hands; don't attempt to remove dirt or apply unclean dressings of any kind, as infection may be introduced by so doing.

Explanation should be made of the stretcher and the proper way to lift an injured person onto it, of adjusting a sling with a triangular bandage, emergency treatment of injuries to the scalp, and methods of bandaging. A description should also be given of the various articles in the first-aid packet and directions for their use.

It is important that the men be shown how to use a newspaper, a piece of scantling, or even a cushion from a car, for splints, as it is recognized that in many cases there will be few facilities at hand for caring for the injured.

The result of such instruction is to make the men responsible, as they realize that they may be called on at any time to minister to an injured passenger or fellow-employee.

Employees of street-car lines have the same chance to rise as employees in general have in every large corporation. The average railway company keeps a record of its motormen and conductors, and in the event of a vacancy in a position higher up preference is given to the individual who has faithfully and conscientiously adhered to the rules of the company and shown ability in his line of work.

The successive grades of promotion in force on one large Eastern street railway are as follows: from motorman or conductor to starter, inspector, general inspector, car-house superintendent, chief clerk of transportation office, superintendent of transportation, general manager, vice-president, president.

All of the men at the present time holding positions with one large street-railway company as starters, inspectors, and up to the office of chief clerk of transportation have risen from the ranks. The present superintendent of transportation was promoted from an office position to his present place, and one of the vice-presidents started in as a horse-car driver. This street-railway company also has a pension system in force among its employees.

While applicants between the ages of twenty-one and thirty-five are received for the position of motormen, as far as possible the company endeavors to fill this position with men who have reached the age of twenty-five, believing them at that age to be more inclined to regard the seriousness and responsibility of their position.

Another large railroad company, employing more than four thousand employees in the classes of motormen, conductors, inspectors, starters, and despatchers, advances the wages of its men on a sliding scale, in recognition of more efficient service from experienced men, the efficiency being almost entirely a matter of freedom from accidents.

Conductors and motormen are promoted as vacancies occur in the operating grades, as it has been the policy of this company to adhere as closely as possible to civil-service promotion within the ranks in filling vacancies rather than to obtain employees from outside sources. The grades of promotion are about as follows: from either conductor or motorman to despatcher, to inspector, to assistant superintendent, and from that to superintendent; at the present time a number of superintendents are men who have come up from the lower ranks.

Permanency of its force is an asset that every operating department earnestly desires. A permanent force of workers is of necessity a well-trained force. To demonstrate the relation of experience and training to accident prevention the Public Service Railway Company of New Jersey recently made a unique and valuable study of the accident records of the men in their employ. The result of this investigation showed that 34.5 per cent. of their men had been in the employ of the company less than one year, and that 61 per cent. of the accidents for 1911 were chargeable to these first-year men.

The cost to the company of accident settlements, exclusive of the cost of maintaining the claim department, for the first-year men was found to be $202.98 each, while the cost per man of over one year of service was $66.82—just about one-third as much.

The average accident cost per man for 1911 for periods of one to four years was $209.98 for the first year, $135.57 for the second year, $83.23 for the third year, and $47.35 for the fourth year.

The custom of paying pensions to old employees in recognition of faithful service for many years has a stimulating effect upon younger employees, tending to make them more careful and insuring steady and continuous employment.

The Philadelphia Rapid Transit Company maintains for the benefit of its employees an insurance and pension fund, from which the sum of five hundred dollars is payable at death to the beneficiaries of any employee who has been in the service of the company continuously for a period of two years prior to his or her death and whose compensation from the company at that time does not exceed two hundred dollars a month. Under the operation of the pension system any employee who has been in the service of the company continuously for twenty-five years, who has reached the age of sixty-five, and whose compensation from the company does not exceed two hundred dollars a month, is entitled to retire from active service and receive thereafter from the company a pension of twenty dollars per month.

With all these precautions and encouragements for the prevention of accidents on the part of the management it does not seem reasonable to conclude that the street-car company is always at fault, as the general public is so ready to believe. The public itself must bear a large share of the responsibility for accidents which happen daily in connection with street traffic.

Some means for preventing passengers from remaining on the platform, thus restraining them from jumping on or off, is a problem awaiting solution. There are technical considerations of management and traffic involved, as well as the safety of the passengers; for example, more time is needed to open and close the doors, and as the stops, especially in large cities, are short, every hindrance to free exit or entrance at stops causes delay and interference with the running-schedule.

The vicious habit of jumping on and off cars in motion will continue until the passenger meets with an accident—then the victim realizes too late that it was his own fault. For an accident of this character the injured cannot justly claim compensation.

The constantly growing development and use of automobiles and motor trucks have resulted in increased fatalities to pedestrians. This is especially true in the larger cities. According to the annual report of the coroner of New York for 1912, in the Borough of Manhattan there were one hundred and forty-six deaths due to automobiles, an increase of fifty-six over the preceding year. From the evidence brought forth in the majority of these cases it was clearly shown that the killings were principally due to carelessness of chauffeurs, excessive speed, and the failure to give proper warning to pedestrians.

The relation between police activity and the public safety is a close one; many timid persons depend entirely upon the traffic policeman for protection against the perils of a dangerous street-crossing. Greater vigilance on the part of the police and the prompt arrest of reckless drivers who wantonly violate the ordinances made for their guidance and the safety of the public would undoubtedly result in a marked lessening of street accidents.

The ordinances in force in the large cities of the United States for the regulation of street traffic point out clearly the respective rights and duties of street cars, vehicles, and pedestrians. The pedestrian is too often the transgressor and needs to have a deeper sense of his personal responsibility while on the streets.

The city of Newark, New Jersey, recently adopted ordinances having in view the elimination of a class of street accidents due entirely to individual carelessness. Any one who jumps on a moving vehicle, or a driver who permits any one to jump on behind with the feet hanging out over the tailboard, is now subject to arrest and fine.

The police department of the city of Philadelphia has also recently issued a general order relating to the danger of stealing rides on cars and vehicles. The order reads as follows:

> The numerous accidents on the city streets resulting from children riding on the sides and the rear of cars, trucks, and other vehicles are such as demand the attention of this bureau.
>
> Lieutenants are, therefore, hereby instructed to at once issue orders to the men under their respective commands to immediately stop vehicles whereon children and young people are in the habit of stealing rides. This practice must be broken up, and patrolmen will be held accountable for any dereliction in this connection.
>
> Arrests shall be made on sight, and those arrested (if under sixteen years of age) shall be sent to the House of Detention for a hearing, in order that they may be brought before the Juvenile Court.

The safety problems of building management, including the housing and daily transportation—through the elevator service—of a population equaling that of a small town are of great importance to the city dweller. While it may not be at once apparent to the building superintendent confronted with the problem of profitably filling all his space that the elimination of such minor perils as insufficient hand-rails, worn floor surfaces, slippery steps, too few lights by day and night, and inadequate illumination of elevator entrances is good business, nevertheless a consideration of these matters always pays.

In the keen competition for securing and keeping tenants the building manager with a reputation for freedom from accidents even of the minor sort will win and hold his tenants.

Every building manager is only too familiar with the claims for compensation following severe storms and due to the collapse of swinging signs and awnings, the slipping down of slate or other roof coverings, the breaking loose of cornices, and other accidents. The results are sometimes fatal to the public within the danger zone, and the management of the building suffers a money loss in the cost of repairs. The main point is that through inspection and precautions for safety the building superintendent should know how to prevent these accidents.

Even if the outlay for inspectors and precautionary measures does not produce immediate and visible cash returns it must be borne in mind that any company, in building up its business through the ordinary advertising mediums, is presumably paying for a good reputation with the general public. One minor accident, to say nothing of a catastrophe, will destroy much of the favorable opinion that years of applied engineering skill, backed by carefully worked and high-priced publicity, may have helped to create.

One ordinarily thinks of transportation as moving along horizontal lines, but a moment's reflection will show that the ordinary city dweller travels many miles up and down daily, especially if his office be located in the upper floors of a Woolworth or Singer building.

The problem of the elevator concerns almost every building superintendent in the modern city. It is the part of wisdom to be sure that the doors are made to slide and are provided with a lock so arranged that they cannot be opened from the outside of the shaft without a key. A door-locking device prevents the opening of the entrance-doors when the elevator is away from a landing, and also makes it impossible for the elevator to move away from a landing before the door is closed. An elevator not provided with an attendant should have a locking device for the operating-cable, so that when the elevator is being used at any landing it may be locked in order to prevent its being moved by any person at another floor.

The careful building superintendent insists that the hoistways of his freight elevators shall be inclosed on all floors by a substantial framework, with self-closing gates, made, wherever practicable, to slide vertically.

Where there are projections in the hoistway—such as floor headers—apron or toe guards should be placed under them so as to prevent injury to any one whose foot or any other part of his body extends beyond the elevator platform. All elevators should be roofed over to protect persons in the elevator from being injured by falling material.

Elevators in constant use should never be operated indiscriminately. It frequently happens that, without the knowledge of the person last running the car, it is set in motion by persons on another floor, with the result that the former operator, returning to the car with the expectation of finding it still in the position in which he left it, falls down the elevator-shaft and is killed. It is always well to remember that heavy cases, hampers, and other goods are often placed in the elevator by persons walking backward and pulling the goods in after them. Similar accidents may occur with hydraulic elevators when, owing to a leaky valve or piston, the car creeps away from the floor or landing at which it has been left.

While loading or unloading exceptionally heavy articles the car should be provided with a device to support it independently of the cables or plunger. Otherwise the car may jump up when the load is partially removed and cause it to fall forward on the men handling it. Similarly, the car, if not supported, may jump down while it is being loaded.

After the physical safety of the elevator has been assured the human factor must be given equal consideration. The manager must feel that the selection of an elevator-operator is a matter of great importance. Whenever it is evident that an operator is incompetent or untrustworthy he should at once be replaced by one qualified to perform his duties.

Every new operator should be thoroughly instructed by some competent person and impressed with the responsibility of his position. Eighteen is the minimum age prescribed in most places, and no person below the age specified by law should be employed under any circumstances.

The manner of installing and operating the boilers in a large building should also be a matter of vital concern to the owner or manager.

In discussing this point with Mr. George W. Martin, the general manager of the New York Service Company, which has for its object scientific building management, he gave as his opinion:

> The American business man seems to be accustomed to take some rather long chances in the development of his business; the risk he runs equals his indifference.
>
> It frequently appears that the boiler-room is placed in some out-of-the-way corner of the basement for which no other use can be found. This makes inspection difficult and cleaning a task to be dreaded.
>
> A favorite place for installing boilers for moderate-sized plants is under the sidewalk. The object, of course, is to save space in the basement of the building, but if the building owner realized that in many cases a small amount of space is saved at the expense of economical operation, and if the public realized the great danger of this manner of installation, fewer boilers would be thus installed.

Apart from the danger to pedestrians overhead, the chief objection to the location of a boiler under the sidewalk is that the space available is often sufficient only for the boiler-setting, without adequate space for cleaning and inspection. The task of firing a steam-boiler is usually no sinecure, and when the further burden of keeping inaccessible parts clean is placed upon the fireman the wonder is that more boilers do not explode.

As is well known, in a boiler under steam the larger part of the boiler is filled with water at a high temperature, the steam generated being stored in a proportionately small space between the surface of the water and the top of the boiler. To the lay mind it may seem that the explosive energy is contained only in the steam generated, but if the pressure on the water should be suddenly released by a failure of the boiler the water would flash into steam as quickly as gunpowder is transformed into explosive gases, and destruction would follow in the wake of the expanding force.

The following newspaper account of a typical boiler explosion in New York illustrates the destructive force of a boiler exploding under working conditions. Quoting from the *Evening Post:*

> A boiler explosion wrecked the basement of a seven-story brick building. Although the estimate of the damage was placed at only thirty thousand dollars, the fire-department representative who examined the building said it was by the merest chance that the boiler did not effect the destruction of a great deal more property, not to speak of many lives. Had it turned aside in its course it would have penetrated the foundation of a warehouse and brought down the front wall and most of the floors up to the roof.
>
> As it was, the boiler, situated in the vault beneath the sidewalk in front of the building, shot forward like a gigantic projectile under the pavement, crashing its way through gas and ammonia pipes, water mains, and high-pressure mains, for a distance of half a block to the intersection of Greenwich and Hubert streets, where it came to rest

after thrusting half of its length above the sidewalk and discharging a volley of tubes into a tenement on the opposite side of Hubert Street.

Its destructive track could be traced by a long straight mass of upheaved flagging, broken pipes and mains and debris of the roadway. Flames were already rising from the gas-pipes as the frightened residents of the neighborhood ran out into the street believing that an earthquake had struck them and half-suffocated by the fumes of the ammonia that filled the air.

A boiler may become unfit for use in a few years if it has been abused, but there comes a time when even a boiler in apparently good condition should be retired upon general principles.

There are doubtless many boilers of questionable age in operation in every large city which should be condemned.

It is poor practice to pass a law compelling engineers to pay for a license to operate steam-boilers in order that the public shall be protected against accidents, and then to permit old, decrepit boilers to be operated.

In addition to steam-heating apparatus many office-buildings are equipped with hydraulic elevators receiving their power from steam-driven pumping-engines. Many office-buildings also contain cafés or restaurants where high-pressure steam is needed for cooking.

Of course for a building now standing where steam is required for purposes other than generating electricity, the problem is more difficult of solution, for the steam-driven hydraulic pumps must be replaced by electric-driven hydraulic pumps, and the steam-cooking appliances must be replaced by gas-heated appliances. In a new building, however, the installation of the latest type of electric-traction elevators and cooking appliances using gas together with current purchased from a central station will eliminate the necessity of using steam for any purpose other than heating the building.

The question then resolves itself to the advisability of installing boilers to generate low-pressure steam or the purchasing of steam from the outside for heating the building.

From a safety standpoint there appears to be little choice between the use of low-pressure steam generated in a boiler in the building and the purchase of steam from the street mains. Considerations of cost, service, and handling the coal and ashes are usually the determining factors.

In constructional work, especially in the erection of tall buildings, the public must be protected from the dangers of falling materials and obstructions carelessly placed in the highway.

It is the duty of the construction company's engineer or inspector to see that building materials are carefully unloaded and placed where they will usurp no more of the street and sidewalk than they properly should, thereby lessening the chances of proving pitfalls for the unwary pedestrian.

There should be a standard set for scaffoldings, and only the safest and most substantial permitted by the building inspectors in connection with the erection of buildings, or, in fact, all overhead work. This precaution is imperative not only to secure safety for the men obliged to work at dizzy heights, but also to prevent the falling of scaffolds and materials upon pedestrians below.

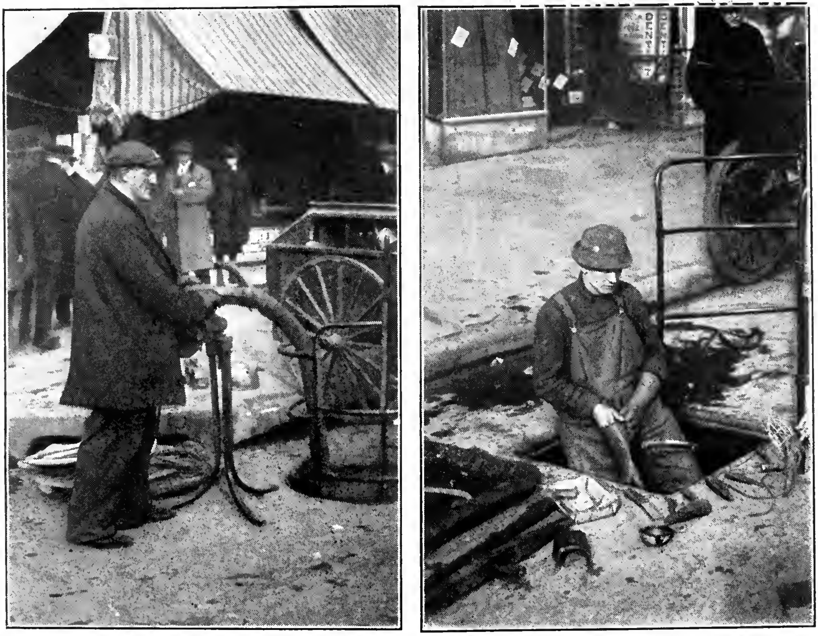
In the Borough of Manhattan, New York, sixty people were killed last year as a result of being struck by falling materials.

The man in the street has often wondered if it was really necessary to install a large boiler in the highway during the construction of a building. The boiler takes up good space in the street, it is unsightly in appearance, and its accessories add to the general untidiness of the building operations. "Why," queries the layman, "in this day of electrical development cannot the builder or contractor make use of electricity to pull up the excavating teams and hoist the building material?" There is always present the risk of a boiler explosion. Then, too, in every city there is a record of casualties due to the frightening of horses by the escaping steam long enough to make the outside steam-boiler a serious menace to the safety of the public.

While excavations are being made great care should be exercised in shoring up the sides adjacent to sidewalks and passageways used by pedestrians. Guard-rails should also be placed at the top along the sidewalk. For the further protection of the public a sufficient number of lights should be placed around street obstructions to prevent teams and pedestrians from running into them at night.

The dangers from open cellar doors through which goods are taken into buildings and ashes, empty barrels, boxes, and other materials removed are apparent to every pedestrian who has stubbed his toes against such obstacles in his way and, in consequence, has almost been precipitated into the cellar beneath his feet. The same conditions are to be found in connection with the delivery of coal into the storage-bins beneath the sidewalk. Not only does the passer-by suffer the inconvenience of being obliged to walk out into the street in order to pass the coal-wagon, but even if the coal-chute has been removed and no longer bars his way he may step into a hole carelessly left unguarded and thereby receive serious injuries.

Manholes should never be left unguarded. A better



THE NEW YORK EDISON COMPANY'S GUARDS FOR MANHOLE IN A CITY STREET

UNSIGHTLY AND DANGEROUS STREET OBSTRUCTIONS

method of guarding these openings in city streets should be evolved, perhaps the use of a trap-cover with guard-rails attached, which rise into place as the cover is raised. Such a type of guard has been used most effectively in the busy yards of certain of the great steel plants of our country.

The covers of manholes should not be retained after they have become worn and slippery, but should be replaced by new covers offering proper resistance to the feet of passers-by. In the Borough of Manhattan last year there were sixty-nine deaths due to falls on the streets and sidewalks, a large percentage of which were caused by slipping on manhole covers worn dangerously smooth by the feet of the passing crowds.

The general public is also greatly interested in the protection afforded it in connection with electrical service. The increasing use of electrical energy has accentuated the menace of fires and bodily injuries due to exposed switches, fuses, and open service wiring. Not only live wires, but also meters, switches, cut-outs, and other intricacies of the service must be properly safeguarded.

The electrical installation in office-buildings and apartment-houses is frequently found to be very hazardous. Wires have sometimes been left hanging loose, thereby causing injury to persons who have accidentally come in contact with them. Such wires should be entirely covered and placed under seal, so that no unauthorized person may gain access to them.

One dangerous installation discovered by an inspector had its meters with exposed cut-outs and exposed wiring all mounted on a wooden partition in a washroom. In the event of a fuse blowing out or any metallic substance coming in contact with the live parts it is apparent how easily a conflagration could have resulted from such equipment. Fortunately, this installation was removed to a safe corner of the cellar and the meters, cut-outs, and wires protected by porcelain or metal frames.

In connection with this phase of safety for the public Mr. Thomas E. Murray, of the Metropolitan Engineering Company, has pointed out:

> The protection of the watt-hour meter, the service wiring, and the service cut-out is one of the most important questions facing public service companies to-day. With a view to eliminating tampering with the meter, fire hazard, and irregularities in the wiring, each meter and service installation must be fireproof and tamper-proof.
>
> The need was early felt, from a fire-protection standpoint, for a service cut-out and switch as near the service entrance-point as possible, and this was adopted as a fire underwriters' ruling. A cut-out and switch at this point became standard practice, using an ordinary unprotected knife-switch and a non-sealable cut-out. The fuses in the service cut-out are often blown, due to overloads or short circuits on the customers' lines, and are sometimes replaced by customers with copper wire of much greater conductivity, or cross-section, without notification to the company. Such installations are a serious menace to continuity of service, and where the capacity of the network is large they endanger apparatus in the customers' premises.

XXI

TRAINING FUTURE WORKERS

THE complexities of our modern social and industrial organization are demanding a new type of education if the children of the present generation are to become the efficient wage-earners and contented citizens of the next.

There are some twenty million children of school age in the United States to-day who must be educated to the efficient use of hands and brains, and in this education there should be included some understanding of simple laws of safety.

It is the duty of the state to see that there is given to these children an education which will enable them successfully to meet the problems of life that will confront them. Yet it is safe to say that not one-half of the children of the United States are receiving this kind of training. It has been authoritatively stated that one-half of the school-children of the United States leave school at the age of fourteen years, and that 85 per cent. of this number, lacking training and direction, helplessly drift into unprofitable positions in which they have few opportunities for advancement. In many industries there are minor positions demanding no education and little skill which are held usually by boys and girls just out of school and which never pay more than a child's wages. Those young people who do not possess the initiative to make efforts at self-improvement, become discontented with the low pay and unsatisfactory conditions of work and frequently leave their employment to become members of that restless, unhappy army of the unemployed which preys, directly or indirectly, upon the more fortunate classes of society.

From all over the land industrialists are calling for capable, prepared workers. Industry wants skilled workers just as badly as men and women want positions.

In Germany when a child leaves school at the end of his fourteenth year his education is by no means completed. On the contrary, he begins a course of training designed to meet his practical needs, develop his special abilities, and make of him a useful and contented citizen. In this way Germany effects, as she effects in so many of her wise institutions, a great saving in her national life and efficiency. It has been stated that 66 per cent. of the children leaving school in Germany go into occupations that progressively advance them in skill and, consequently, wage-earning ability. They go from school directly into apprenticeship, thence to their chosen trades.

To meet the growing industrial need of our country the leading business men, legislators, and prominent educators of the United States are to-day indorsing the plan of vocational or continuation schools, the value of which has been so successfully demonstrated by the experience of Germany and other European countries.

In Wisconsin the development of a practical plan for continuation schools has been placed in the hands of a special State Board of Industrial Education working in co-operation with local boards in the various communities. The state board is composed of employers, manufacturers, and educators, one-third of each class being represented; the local boards are made up of two employers, two employees, and the city superintendent. The plan gives at least five hours' instruction each week to children in employment, the wages being continued during the hours spent in school.

Wisconsin's new apprenticeship law requires that the apprenticeship agreement must be signed by the legal representative of the young person and by the employer. The agreement must state the amount of compensation to be paid the apprentice and must also provide that the whole trade, as carried on by the employer, will be taught.

The number of hours to be spent in work must be definitely stated, as well as the number of hours to be spent in instruction, the total number of hours not to exceed fifty-five in any one week. Of these fifty-five hours not less than five must be devoted to instruction in English, citizenship, business practice, physiology, and such other branches as may be approved by the State Board of Industrial Education. The apprentice is not required to attend school during periods of the year when the public schools are not in session, but for failure to attend school during the regular terms the apprentice is punished by losing three hours' compensation for every hour he is absent without cause.

Many of the manufacturers in Wisconsin have gladly brought their apprenticeship systems within the requirements of the new law and are establishing apprenticeship schools in their own shops, or sending their apprentices to the public industrial schools in their communities.

A recent law of the state of Ohio authorizes the local boards of education to open continuation schools and to require the attendance of all between the ages of fourteen and sixteen having working-papers, unless they have completed the eighth grade of school work. The attendance must be in the daytime and must not exceed eight hours in any one week. The Board of Education of the city of Cincinnati was the first to put the continuation-school plan in operation under the Ohio law.

In other states part-time schools are being conducted with much success. In many of the industrial centers of these states local employers are co-operating with the public schools by alternately sending half of their apprentices to school one week and keeping the other half at work in the shop.

Still other cities have developed trade schools in connection with the regular school system. In these schools, of course, the students are without income, while in the part-time schools they earn wages every other week, and in the continuation schools are paid for five or five and a half days' work each week. In this respect, as in many others, the continuation school seems to be most practically adapted to the needs of the young workers who have left school because their assistance as wage-earners is needed in the home.

By means of vocational and manual-training courses the school systems of the principal cities in the United States are beginning to demonstrate that many children formerly considered backward or defective may be developed along practical lines of self-expression to intelligent and useful citizenship.

Under the New York law authorizing vocational schools the increase in the quantity of instruction in the manual, household, and agricultural branches has been remarkable.

According to the last annual report of the Board of Education of New York City, besides the manual and home-making courses in the day elementary and high schools, there are two day schools devoted to vocational training and six evening trade-schools, three of high school and three of elementary rank.

In the state outside of New York City 17,113 girls are now receiving instruction in domestic science and 13,320 pupils instruction in the manual arts.

At present there are 35 industrial and trade schools in the state of New York employing 145 teachers and having a combined day and evening enrolment of 6,303 pupils.

The New York law specifies certain conditions which a vocational school must meet in order to be considered as entitled to special state aid. (1) It must be independently organized—not necessarily a separate building, but established with a distinct vocational purpose in mind; (2) it must have an enrolment of at least twenty-five; (3) it must employ the full time of a teacher; and (4) it must have a course of study meeting the approval of the commissioner of education. The fourth condition allows of considerable latitude and discretion. The course of study is not defined by the law; it may vary in different localities to connect with local industries, which vary in different parts of the state.

When the question of establishing an agricultural-school course in accordance with the provision of the New York education law was under discussion in the educational department there was called a meeting of the prominent men in the varied agricultural interests of the state, such as the State Department of Agriculture, the State College of Agriculture, the State Grange, various agricultural societies, the State Agricultural Experiment Station, and the state schools of agriculture.

For the girls the course substitutes household economics for some of the agricultural subjects to be elected by the boys and at the same time provides for some agricultural elective.

Girls as well as boys may be admitted to the regular agricultural courses, but are specially advised to elect the work in poultry-raising, fruit-growing, and the home work.

Already this type of education is appealing to young people who cannot attend school every day or for the full school term, and there is every reason to believe that these special schools may become the centers of agricultural interest.

New York is the first state to undertake the training of teachers for vocational work. At present there are three state normal institutions, two universities, and two technical institutes which are training teachers for one or more of the proposed types of vocational schools. The last two classes of institutions have had courses for some years in the training of teachers for the manual, household, and decorative arts, but have modified and enlarged the scope of their instruction to meet the more specific and practical requirements of the vocational-school movement.

The next generation of wage-earners must receive physical training now if they are to withstand the wear and tear of industry and if they are to know how to protect themselves against occupational dangers. To this end the curriculum in many schools includes courses in physical training as a part of the regular school work; and through setting-up exercises, light calisthenics, games, and dances, as well as more advanced work in the school gymnasium, the bodies of boys and girls are being developed in fitness and powers of endurance.

Special attention must be given to those children whose physical condition is below normal and who, in consequence of their physical defects, fall below the average in intelligence and good conduct.

Of the 258,784 school-children examined by the physicians of the Department of Health of the city of New York in the year 1911–12 only 74,452 were found to have no physical defects. The number examined represents about one-third of the total enrolment of pupils, but the total number of children suffering from defects that impede their progress in school was probably in the same proportion.

Dr. William Martin Richards, an eminent eye specialist, in making a report to the Board of Education of the city of New York in December, 1912, pointed out that 78,000 children in the public schools of the city had failed of promotion because of defective eyesight.

In forty difficult cases that had been sent to him for examination and treatment Dr. Richards found that more than half of the children were ungraded, and the other half were "backward" children who had spent two or three terms in each grade, or "delinquents" who could not be disciplined. Thirty-two of these children were far-sighted, three near-sighted, and the others affected by both far sight and near sight. After these children had been fitted with proper glasses the reports from their principals showed in each case a remarkable improvement in study and conduct.

One hundred and thirty-nine thousand two hundred and sixty-six of the children examined by the Board of Health physicians in the same year were found to have defective teeth.

The importance of a clean mouth and sound teeth as fundamentals of good health cannot be overemphasized if a child is to have good digestion and good blood and be free from the diseases of the throat and nose resulting from a dirty and uncared-for mouth.

In some cities the care of the teeth of school-children is given over to skilled dentists selected by the board of education; in other places much of this work is done at free dental dispensaries, as in the city of Rochester, New York, where the dental dispensaries are chartered and regularly inspected by the New York State Board of Charities.

A large proportion of school-children are found to be suffering from malnutrition, due to a lack of food or to the poor quality and preparation of their food. Children suffering from malnutrition are unable to pay attention to their studies, hence arises the need of providing these children with wholesome food at slight cost or, in the case of the very poor, free of charge.

A few years ago the New York School Lunch Committee was organized by philanthropic persons to supply wholesome lunches at cost price to school-children in congested sections of the city. These lunches are inspected by the regular cooking-teachers. The quality of the food is good, and it is well cooked.

Nourishing soups are served at a cost of one cent. The soup is compulsory, but if a child wishes to make further purchases he may select what he wishes from a variety of other foods, principally desserts, on the penny-table. Lunches are served free of charge to those who are too poor to pay for them.

In each school certain pupils assist in serving the lunches, receiving their own lunches free in payment for their services.

The benefits of a nourishing lunch are given by the director of this work as follows:

1. Improvement in physical condition and manners.

2. Alertness of mind.

3. Less indifference and laziness.

4. Better afternoon work under the stimulation of the food.

In New York, as in other large cities, open-air classes are maintained for children suffering from tuberculosis and anemia. The tubercular children are cared for on ferryboats and on the roofs of hospitals, while the anemic children receive their instruction in special classrooms, the windows of which are kept wide open. While the results attending the open-air classes are fairly satisfactory, it is felt that the children should have better opportunities for exercise and play out-of-doors, and that the time spent in the open air during the school terms is too short to effect speedy recovery. It has been suggested that a better plan would be to secure land in the suburbs where shelters could be erected and the children kept at work and play at least seven hours every day.

Open-air schools are now being successfully maintained in the suburbs of London and Berlin.

Twenty minutes' ride by an electric car from the heart of Berlin brings the visitor to one of the newest pedagogic and prophylactic institutions in Germany. On leaving the train, winding paths leading through the woods bring the visitor to the Grunewald Forest School in Charlottenburg, situated on the high ground near the Capital Villa Colony, West End.

Children arrive on foot or by special train in the morning. With their teachers they assemble for breakfast. One-half of the children have lessons from eight to ten and the other half from ten-thirty to twelve-thirty. There are twelve classes composed of twenty children each. Each lesson lasts twenty-five minutes, with five and ten minute intervals for recess. Boys and girls are together in the classes. During the free morning hours the children do their lessons or play out-of-doors. When dinner comes the main part of their daily school work is finished. The upper classes have lessons from three to four in the afternoon, but on some days this period is devoted to gymnastics and baths. The children have a light luncheon at four o'clock, and after this the time is their own, until supper, for play. They are given five meals a day; all the plates, cups, rest-chairs, blankets, extra shoes and stockings are marked by numbers, so that each child may always have his own.

The Forest School covers about two acres of ground, separated from the rest of the forest by wire fences. There are dwelling-rooms for the housekeeper, servants' quarters, and two open halls where the children have their rest and sometimes lessons, but whenever possible the classes are held out-of-doors.

There is a school garden where each child has his own little patch for flowers for which he is responsible; in addition there are larger beds for flowers and vegetables used for demonstration purposes. Each child has a warm shower-bath two or three times a week, and those children needing them have special baths prescribed by the physician.

This school in the open is controlled by the School Board of Charlottenburg. The women's patriotic league supplies the household barracks free of expense and the food and household supplies at cost. The housekeeper is a trained nurse who looks after the bathing and other physical needs of the children. A regular physician is attached to the school, together with a regular staff of teachers.

A FOREST SCHOOL FOR WEAKLY GERMAN CHILDREN

MUNICH MUSEUM OF SAFETY

The pupils are selected from the public schools by their class-teachers and principals and recommended to the Board of Education. The physician of the Forest School then decides whether the pupils so selected shall be received.

The school in the forest is open from the beginning of April to late autumn; one year it was open until the twenty-second of December. The children are allowed to come to the Forest School on Sundays also and during vacation.

Realizing that the accidents to the general public, but especially to children, on our city streets were increasing at an alarming rate, the American Museum of Safety, in the summer of 1912, decided that an educational campaign among the children themselves would be the best means of preventing these accidents and of reducing the waste of human lives and limbs.

Accident prevention is primarily a matter of education, and the hope for sound and efficient citizens in the future lies in training the children of the present generation to think and act along lines of safety and caution on the streets and in their homes.

In this matter it was felt that America could profit by the example of Germany, which is educating her school-children in safety and hygiene and preparing them for the actual conditions they must meet when they have exchanged the classroom for the shop and factory. The educational methods adopted by Germany include special loan exhibits to the schools from the great German museums of safety; school visits to the museums, where the life-saving and health-promoting devices are carefully demonstrated and explained to the children; and by instruction in safety and hygiene as a part of the regular school curriculum.

With the consent of Dr. Maxwell, superintendent of schools of the city of New York, several classes of vacation-school children, accompanied by their teachers, visited the museum during the summer. The responsiveness of the children and the indorsement by their teachers of the short talks on safety and caution and the demonstrations of devices clearly indicated the success of the experiment. The children eagerly absorbed the instruction given them and answered with intelligence the questions asked them with a view to determining their understanding of the uses and purposes of the various devices explained to them.

In the fall of 1912 the American Museum of Safety offered to carry its work into the schools, that all of the seven hundred and eighty-five thousand public-school children might receive the benefits of this special instruction. The Board of Superintendents of the public schools of New York City were heartily in favor of the plan, and after formal deliberation submitted a resolution to the Committee on Elementary Schools, asking permission of the Board of Education to co-operate with the museum for the purpose of reducing accidents among the school-children.

This resolution was promptly indorsed by the committee, and by it submitted to the Board of Education with the recommendation that the request of the Board of Superintendents be granted. The resolution, as formally adopted by the Board of Education on November 13, 1912, reads as follows:

Resolved, That permission be, and it is hereby, granted to the Board of Superintendents to make arrangements with the American Museum of Safety for co-operation between the schools and said museum, for the purpose of reducing the yearly loss of life and limb among the children attending the schools of the city of New York.

In connection with this resolution Associate City Superintendent Straubenmüller presented a special report:

In the year 1911 423 persons in this city were killed by vehicles. The death-toll was 13 per cent. higher than in 1910. During the same period 2,004 persons were injured by vehicles. For the nine months ending September 1, 1912, there were killed on the streets of New York City by vehicles 339 persons. Of this number 117 deaths were due to wagons, 86 to street-cars, and 136 to automobiles. Of those killed the greater number were children.

The very rapid growth of the modern large city, unexpected and unprovided for, has deprived the children of yards and playgrounds. The street of the city is in many sections the only available play place. To this fact as much as to anything else is due the great daily sacrifice in life and limb. The great industrial and commercial development within the confines of the modern large city has reduced to a minimum the moral dangers of the street, and increased to an alarming extent the physical dangers. The rapid growth of the modern large city has forced many problems onto us which call for solution, but probably none calls more urgently nor more immediately for solution than the problem of the protection of life and limb of children as well as of adults.

It is right that the child should be trained to think and act along lines of safety and caution on the street, in the shop, and at home. At any rate, the dangers of the street, the shop, and the home should be brought to its notice so that it may at least be forewarned.

European countries have taken up in their schools the subject of safety to life and limb, and the work of caution has been successfully introduced in California, Washington, Oregon, Pennsylvania, Massachusetts, and New Jersey. Our country has acquired a bad name for its slight estimate of human life. Here as elsewhere the enactment of proper laws and the enforcement of the same are slow processes. It is possible while awaiting state action to save some lives by school action. Thus, since instruction in this subject by lecture was introduced in New Jersey, the accidents to school-children for the six months ending September 1, 1912, were 44 per cent. less than during the same period last year.

The American Museum of Safety has trained lecturers in the field who visit the schools and speak to the assembled children on the subject of caution and how to avoid the dangers that lie in wait for them in the street and elsewhere.

The museum is also ready to inaugurate a system of traveling exhibits illustrative of dangers to eye, ear, throat, etc., to welcome teachers and pupils at the museum, and to do all in its power to co-operate with the Board of Education in reducing the casualties to children. It furthermore proposes to furnish the lecturers and traveling exhibits without any expense to the Board of Education.

December 10, 1912, the museum commenced the work of instructing the school-children in the importance of safety and the need for caution on the streets. Their representatives visit the various schools according to carefully planned schedules. The little stories of accidents and brief talks on safety are illustrated by charts and models of safety devices specially prepared for this educational work.

The pupils meet in the assembly-room. Sometimes these audiences are very large, numbering as many as twenty-five hundred boys and girls. At the close of each safety talk neat and attractive buttons bearing the insignium of the American Museum of Safety are left with the principal of the school for distribution among the children. The wearing of this button makes the child a member of the museum's Safety League and serves to keep the lessons of the talk fresh in mind. Badges of a little better quality and of more artistic design are presented to the teachers and to the pupils of the higher grades.

The buttons are followed at intervals by safety leaflets, or stories, on the special dangers of street-cars, electricity, gas, automobiles, and matches. Both text and illustrations are adapted to the comprehension of the children, who appear to be delighted with them.

Not only are the public schools included in this educational campaign for safety, but also the parochial and private schools, adding at least one hundred and fifty thousand boys and girls to the seven hundred and eighty-five thousand children in the regular public-school system. To date the museum's lectures have reached two hundred thousand children in the public schools, parochial schools, and the schools maintained by the Children's Aid Society. It is interesting to note here that the children in the last-mentioned schools offer a most fertile field for this educational work. They are the children of foreigners, mostly Italians, and some of them of foreign birth themselves. It is the aim of the officers and teachers of the Children's Aid Society to instil American ideas of personal cleanliness and morality into these children, in addition to teaching them the English language and preparing them for the regular public schools. These schools are charitable as well as educational centers, and carry relief into the homes of pupils where there is sickness or great poverty. Believing that well-nourished bodies are essential to the success of educational methods, these schools furnish the children with food during the school-day, the first meal consisting of a glass of milk, and the second, served at eleven o'clock, consisting of a bowl of hot soup accompanied by a generous portion of bread.

It was while working in one of the most congested sections of the city, where the Children's Aid Schools are principally conducted, that one of the museum's lecturers became more than ever convinced of the necessity for the educational work in which the museum is now engaged if the modern city is to produce law-abiding, public-spirited citizens, and not a race of hoodlums and desperadoes. As the automobile in which she was proceeding to the next school on the schedule made its way slowly through the tide of humanity and traffic filling the narrow street, she saw the children spinning their tops, playing tag, and chasing each other, or wrestling in groups and tumbling down in squirming heaps—all in the middle of the street, and apparently unmindful of the constantly passing automobiles and heavy wagons. When the automobile stopped for a minute, a horde of small boys swarmed over it, hanging on wherever they could lay their grimy little hands, and some of them deliberately scratching the brightly painted body of the car with their finger-nails for the pleasure of making marks upon it. When the chauffeur spoke to one boy and bade him step back, the lad struck the driver on the knee and then drew away with a great air of bravado. As the car proceeded, dodging in behind other vehicles and out of the way of the children playing in the street, another boy threw a stick at the chauffeur, hitting him across the knuckles. Throughout that trip, as on subsequent trips, it was observed that the children made the crowded streets their playgrounds, and the wonder is that the daily toll of accidents is not greater.

In some of the densely populated sections conversation with the principals of schools has disclosed the fact that many accident cases are "faked" by parents, who deliberately expose their children to danger or swear that the children have been injured, securing the assistance of false witnesses and of shyster lawyers to substantiate their claims for "damages" upon the public-service corporations. In some instances teachers have been approached by these "lawyers" for testimony to strengthen the claims, even when the testimony desired bears not the slightest relation to the facts as the teacher knows them.

In the talks given by the museum lecturers honesty and integrity of character are strongly impressed upon the children in connection with their actions upon the streets. Thus far every principal has been found to be in heartiest accord with the work, believing that it will have beneficial results, not only with the children, but upon the neighborhoods from which they are drawn.

The following letter is typical of the communications from educators received at the museum:

MR. ARTHUR WILLIAMS, March 7, 1913.
President.

DEAR SIR,—I believe your safety work is valuable, especially in crowded neighborhoods such as this. We are constantly warning the children of the dangers in the street; but, in spite of our efforts, distressing accidents occur, and I feel that any organized effort which brings the realization of the danger closer to the children is a good thing. I think, too, you have adopted a good method. The use of charts and other objective material greatly strengthens the impression made by the speaker, and the wearing of the button is a constant reminder.

Wishing you all success in your campaign of mercy, I am,

Very truly yours,

JESSIE B. COLBURN,
Principal, P. S. 106, Manhattan.

The following selections from letters written by the children themselves testify eloquently to the manner in which the safety instruction has been received by them:

I thank you for all that you told us about the cars. I look both ways before crossing the street. I am forever thinking about it. I always look on my button. I wish you would come again.

Your little friend,

MATILDA PANSKY.

All the girls like the button. Thank you also for the story-books that you sent us. I told my mother to be careful using the gas-range—to open it before lighting the oven.

Your little friend,

REBECCA LINSKY.

I told my brother not to hitch on the wagons. I never thought so much about the dangers before. Whenever I cross the streets my button reminds me of the cars. SOPHIE SASONKIN.

All the girls in my class wear their buttons. We never thought before of the danger you told us about.

Your little friend,

HELEN YOUNGER.

I enjoyed the lecture you gave us. I learned a great deal from it. I told my brother about hitching on automobiles, wagons, and cars, and my mother about the stove.

Your loving friend,

YETTA LUSCHINSKY.

I learned something from your lecture and told my mother about the stove. I wear the button every day. I told my friend to be careful. I never thought of so much danger before.

Your little friend,

GUSSIE SKOUREINSKY.

The same afternoon as I went home I tried to study the lesson you have taught us, and I succeeded. I will never jump on moving cars, and never touch any wires again.

Yours respectfully,

ISADORE NUSKIN.

The red button will help me remember to set the safety example. I told my parents all about it. They will try to set the safety example too.

Gratefully yours,

LILLIAN RICHMAN.

When I came home from school on Tuesday I looked at the fire-escape, I saw boxes on it, so I told my mother about it, and she cleaned it off. I also remember what you said about rolling on the floor when your clothes are on fire.

Yours respectfully,

AARON FELDHERR.

For the cumulative effect of a concerted effort to drive home a lesson of safety and caution to every child in the greater New York the suggestion was made by Mr. Arthur Williams that every school-teacher in the city should deliver a safety talk on the same day and at the same hour, in the classrooms. The practical result of this concentration will be that 18,000 teachers will reach 785,000 children. Mr. A. A. Anderson, chairman of the museum's educational section, has had a reading lecture prepared, entitled "Safety and Caution"—a suggestion which the teacher can read to the class, or, preferably, assimilate as the basis for a talk to the pupils. No particular anecdotes have been added, as each teacher will recall many an illustrative fact which can be used in reinforcing a special point in the text.

Mr. Williams's idea met with cordial response from the Board of Education, as attested by this letter from its superintendent:

DEPARTMENT OF EDUCATION
THE CITY OF NEW YORK
Office of
THE CITY SUPERINTENDENT OF SCHOOLS

500 PARK AVENUE, March 7, 1913.

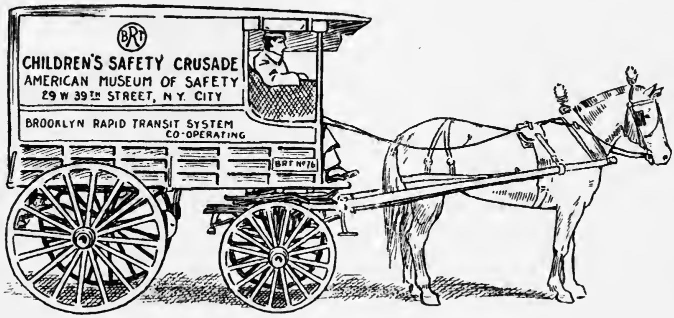
MR. ARTHUR WILLIAMS,
President, American Museum of Safety,
29 West 39th Street, Manhattan.

DEAR SIR,—The Committee on Elementary Schools and the Board of Superintendents have approved your suggestion that on the same day and at the same hour in every public school in this city each teacher shall give a talk on "Safety."

The Board of Superintendents has selected April 4th at two o'clock as the time when these lectures shall be delivered, and I have been requested to notify the principals of the schools to this effect, and to transmit with the letter of notification the text of the lecture.

Yours very truly,
WM. H. MAXWELL,
Chairman, Board of Superintendents.

The Brooklyn Rapid Transit Company is rendering valuable co-operation in this effort to instil in the minds of the children the necessity of exercising caution on the streets, and in boarding and alighting from surface-cars, by furnishing the museum with model cars to be used in the lectures, and by placing its delivery service at the disposal of the lecturers in conveying the exhibits from school to school.



A "SAFETY" WAGON THAT HAS BECOME A FAMILIAR SIGHT TO THE SCHOOL CHILDREN OF BROOKLYN

Posters describing this safety work are conspicuously displayed in the cars on all the surface-lines operated by the Brooklyn Rapid Transit Company.

In its editorial columns the Philadelphia *Inquirer* recently commented on this safety campaign as follows:

> This plan must appeal to one as a scientific method of dealing with the subject of avoidable accidents. There is little doubt that it will make a lasting impression on the young, which will be of vast benefit in a precautionary way, and the beauty of it is that it is calculated to prove not only temporary or limited to the young. For, after all, persons of maturer age than school-children seem also in need of such instruction, and these may get it from their little ones, if the idea of home discussions is carried out.

The educational plan of this children's safety crusade includes the placing of loan collections of exhibits in the schools, to remain in each school one or two weeks, thus affording every child in that school an opportunity to study the object-lessons and become familiar with them;

also, class visits of school-children accompanied by their teachers to the museum itself.

In co-operation with the school authorities the museum expects to extend this instruction, by means of evening courses in safety and sanitation, to the forty thousand pupils who annually leave the public schools of New York City to go to work, thus preparing them to meet the new industrial conditions. Every young worker will be given a certificate based on examination. This certificate will be helpful in securing the first position, as the employer will realize that he will have a worker trained in caution and self-control. In this way it is hoped to refute the contention of so many employers that workmen will not make use of the safeguards furnished them. An employment bureau may be a future feature of this branch of the educational work.

XXII

SOMETHING MORE THAN WAGES

WHILE the humanitarian side of a provision for safety is obvious there is also much to be said for the social and economic safety which some employers aim to provide.

This is illustrated in the welfare work of three great industrialists of the Old World who have brought their undertakings to successful issues. Each one felt that he owed labor something more than wages; each was governed by high ideals; each worked out his philosophy in his individual way, based on his own attitude and personality; but we must not lose sight of the fact that their success meant years of perseverance, of unselfish devotion, and labor.

These facts are instanced in refutation of the arguments of those who claim that such undertakings can only be perfected by the few, and that it is more of a discouragement than an inspiration to the many, especially those of small business undertakings, who are hard pressed by keen competition in our country. While this is true, Lever and Cadbury, of England, and Krupp, of Germany, made their start under very similar conditions and in a very small way. A man's sincerity and his stability of purpose will determine the degree of success attending his endeavor to promote mutuality. With this guiding principle there is no reason for discouragement on the part of any one desirous of doing his share in bringing about industrial peace.

Early in 1909 Sir William H. Lever, one of the best known of English industrialists, laid before a meeting of some twelve hundred of his employees what he called his partnership scheme, whereby he intended to take into partnership eleven hundred and thirty members of his staff, from directors down. In his opening speech he commented on the fact that it was just twenty-one years before that the first sod was cut at the industrial community of Port Sunlight. He also stated that it had taken an equal length of time for him to perfect the scheme which he was about to unfold, although it had been his aim and desire from the very first.

At the outset of his career as a manufacturer, in 1886, he had made a study of various profit-sharing plans, with a view to arriving at closer relations with his working family than those ordinarily existing between employer and employee. He was not in sympathy with profit-sharing, so called, believing firmly that *profit* without *loss* sharing was unsound in business relationships. He did believe, however, that whatever produces a more kindly and friendly bond between employer and employee cannot fail to be beneficial. His first effort, accordingly, was the building of the village of Port Sunlight, where his factory was located, in Cheshire.

Port Sunlight is an idyl, created through the largeness of a great man's mind, one who has conscientiously endeavored to meet every contingency as far as is humanly possible.

The undertaking was the result of a well-matured, scientific plan for city-building. Necessarily, the problem was difficult, inasmuch as homes had to be provided for people of moderate means.

The total acreage of the works and the village is two hundred and thirty acres, representing an expenditure of upward of two and a half million dollars, exclusive of the business. From the very first the management of the village has been in the hands of the citizens, who control its affairs through a village council, elected by the householders' association.

Not only is Port Sunlight a most beautiful city of homes, with comfortable firesides and delightful surroundings, but its completeness in every detail has made it possible for the dweller to enjoy all the privileges of free citizenship, the joys of culture, music, recreation, and healthfulness in a greater degree than would be possible in many larger centers.

A workman's cottage, containing parlor, kitchen, scullery, pantry, four bedrooms and a bath, rents for $1.25 a week. Each house is beautified by a garden in the foreground, serving also as a screen from the road. Every year a certain amount has been set aside from the profits of the business for the building of more cottages and the maintenance of the village. The houses are let to the workers without any regard to the return on the capital invested, with rentals so arranged as to cover taxes, repairs, and maintenance. No one on the staff is compelled, however, to dwell in the village.

Everywhere in Port Sunlight there is diversity of architecture, winding roadways, adornment of yards with flowers and lines of trees; in fact, all the externals have been planned with an eye to beauty. The general width of the roadways has been fixed at forty feet, allowing eight feet for sidewalks. A considerable part of the tract is indented with ravines; wherever possible the ravines have been filled in and graded, affording pleasing sweeps and curves to the roadways which, in general, have been planned to afford the most direct routes to important points, such as the factory, ferry, railroad station, and tram terminus.

Sir William found it imperative to keep the gardens in order, so that the obtrusion of neglected or ill-kept plots might not mar the symmetry of the ensemble. The extra cost amounts to about six cents a week for each yard, which is added to the tenant's rent. Other houses, larger and more elaborate, have been built to meet the needs of the chemists, mechanical engineers, architects, superintendents and the resident pastor; their dwellings are more expensive. Architects come to Port Sunlight from all over the United Kingdom to study the treatment of house and land, and the relation of both to the block on which they are located.

A bit of slum property, bought in 1900, by an irony of fate bore the name of Primrose Hill. It was pathetic that property containing such ramshackle dwellings should be associated with suggestions of flowers and fields; under such conditions of life it was no wonder that all sorts of industrial complications existed. Certainly only a poor specimen of mankind could have been content to live in such rookeries. To-day, those hovels have been torn down and replaced by true homes, now justifying Primrose Hill and re-establishing the old traditions and memories of a happy outdoor life.

A decorative feature of Port Sunlight is the graceful bridge spanning the park and ravine near the schools, which were built on the most scientific principle, as it is here believed that nothing is too good for the children, who start in the kindergarten and pass through the various grades of elementary schooling. The scholars are offered supplementary work in science, languages, shorthand, wood-carving, designing, and other technical branches. A system of scholarships makes a college course possible anywhere in Great Britain for those winning them. This opportunity for a scholarship gives a young man or woman a chance to see the world, which might never have been possible if their lot had been cast in a less favored community. No partiality is shown; all have an equal chance.

Fresh air, clean houses, good food, moral surroundings, and wholesome recreation are equipping the Port Sunlight children for any struggle in life. The birth-rate is much higher than elsewhere in the Kingdom; the death-rate between eight and nine in one thousand, as opposed to thirty-five in the congested slum districts.

The church built to meet the religious sentiment of the community is a simple but dignified piece of architecture worthy of the purpose for which it is intended, with every detail speaking of thoroughness and truth, and only such ornament as adds dignity to the building.

The young women have a social center for entertainments as well as useful pursuits; not only do they meet for good times, for dancing, singing, lectures, discussions, and other forms of self-culture, but they receive lessons in various trades and domestic science.

For a nominal rental of $1.25 a year, gardens are allotted to each family, whose members are stimulated by this outdoor education and encouraged by a series of prizes at the annual flower and vegetable shows. Incidentally, these little garden-plots are a commendable saloon substitute, creating an interest outside of working-hours.

The inn, with its two great wings and its unconfined court offering a fine approach, carries one back to olden days, when coaches dashed up to the door with blowing of horns and cracking of whips, and lends a charm and picturesqueness to the fancy. Besides the small dining-rooms for cozy parties there are larger rooms for the social reunions of the clubs and organizations. One floor of a side wing was built for dancing, dramatics, concerts, and other forms of entertainment. Billiard-tables have also been installed, so that all the citizens may share in the attractions provided by the inn. For the exclusive use of the men athletic headquarters are maintained in another part of the village, and, near by, one of the most beautiful bowling-greens in England.

A ravine with sloping banks offered a suggestion for an open-air theater, along the lines of those in classic Greece. It was an experiment, but has met with a fair degree of success. The village also boasts of a swimming-pool with adjoining shower-baths—a pastime greatly appreciated by Englishmen.

In every European community, with its rootage going back many centuries, there is much of the quaint and curious; for the sake of conserving interest in the past and stimulating any desire to delve into the historic and scientific, a free library and museum are maintained at Port Sunlight.

In summarizing the effect of this village of light it is not exaggeration to say that it is a convincing object-lesson of the principle that good food, healthy occupation, pleasant surroundings, and reasonable recreation are better than any legislation for making a happy and prosperous community.

After the successful establishment of Port Sunlight Sir William Lever felt that its benefits did not include his staff in other parts of Great Britain and in other countries. To remedy this he organized the Employees' Benefit Fund, which provided-old age annuities of eighteen pounds to one hundred and eighty pounds a year. He considered this as simple justice to the men who had been devoting their best years to his business. Then came the committee system, through which the managers and heads of departments were made to take a more personal interest in the business and the men in their immediate charge. Finally, it was proposed to the council — the court of final appeal, composed of the chairmen of each committee — that they seek some method for saving expenditure, avoiding waste, and promoting efficiency, and whereby each could share in the saving effected. In commenting on this last stage of his work Sir William Lever has said:

"I finally came to the conclusion, in view of these repeated attempts, founded on a basis of records and impossible statistics, that I was trying to solve the insoluble; and, as I did not agree with profit-sharing without loss-sharing, and as the system of payments by results in the various departments of our particular type of manufacturing business was impossible of realization, I had to attempt to evolve an entirely different system."

Again, in a public address, he remarked:

In business there is no room, nor is it desirable that there should be room, for benevolence, but a partnership founded on sound lines seems to me to be elevating, encouraging, and stimulating; if we could only here, in Port Sunlight, solve this problem so that every employee, after having served an apprenticeship to the business and after having arrived at a mature age, may be taken into partnership in this business, and may share equally in proportion to position and contributions to the success of the business with myself and those who will follow me, then do I feel that we shall have established our more perfect relationship as people engaged in one common sense, and fighting for a common interest.

Believing that the employer should "get back again, in office, factory, and work-shop, to that close family brotherhood that existed in the good old days of hand labor," Sir William laid down what he considers as elemental conditions necessary to the success of a partnership plan:

1. It must not degenerate into charity or philanthropy.
2. Its object must be the increased success of the undertaking, with increased prosperity for all connected with it.
3. It must not place management in the position of servant to labor through liability to criticism and censure.
4. It must insure to labor freedom from control of management in the enjoyment of the benefits derived from prosperity-sharing.
5. It must possess greater stability than a mere system of bonus checks varying in amount from year to year and ceasing altogether in years of bad trade.
6. Its benefits must be felt by wives and children.
7. It must have a distinctly elevating tendency on labor, raising it in the social and intellectual scale, and increasing its power for its own enjoyment and happiness, as well as its power of usefulness.
8. The benefit must be reserved to employees and pensioners at the discretion of the firm.

In discussing his plan at the meeting, in 1909, he stated that its corner-stone would be confidence in those qualified to participate. Paying a beautiful tribute to those assembled, he said:

I have never found my confidence misplaced when I have reposed it in you, and I know it is not going to be misplaced this time. But apart from that there is another factor that, in my opinion, enters into business relationships, and that is happiness. I have a great strain of veneration for that which has gone before, and whether it is in architecture, paintings, or old furniture, I believe firmly that which has survived the test of time is the best. Now, I have looked for my model in this new arrangement to the oldest working arrangement that has ever existed in business, and that is the ordinary partnership.

It was then announced that he proposed to create five hundred thousand pounds, par value, of partnership certificates—for allotment among those eligible, namely, all employees of twenty-five years of age and over who had been with the firm at least five years. Most generously he dated back to January 1, 1900, the first allotments, under this ruling. The basis of the annual allotment is about ten per cent. of a man's salary. It was impressed upon the men that there would be no liability for money, and no one would be called upon to pay a single penny. The holders of the partnership certificates are on the same basis as the ordinary share-holders, and receive dividends after the share-holders have received theirs. If any holder of the partnership certificates wishes to acquire preference shares, he is at perfect liberty to do so, but he must buy them in the open market; however, he can never buy more than an amount equal to his partnership certificates.

Each employee who is eligible requests, in writing, from the trustees of the partnership scheme a certificate; in return for this he agrees that "I will not waste time, labor, materials, or money in the discharge of my duties, but will loyally and faithfully further the interests of Lever Brothers, Limited, its associated companies and my co-partners, to the best of my skill and ability, and I hand you herewith a statement in writing of the ground upon which I base this application."

There are two conditions upon which the partnership certificate may be canceled: flagrant misconduct and leaving the firm's employ. The amount of partnership certificates that any one man may hold is based on the following scale:

A VIEW IN PORT SUNLIGHT, CHESHIRE, AN INDUSTRIAL COMMONWEALTH

PLAYGROUNDS FOR THE NEXT GENERATION OF WORKERS AT KRUPP'S, ESSEN

Annual salary of seven hundred and fifty pounds and upward				3,000	of	certificates
Between	750	and	500 pounds	2,000	"	"
"	500	"	300 "	1,200	"	"
"	300	"	200 "	800	"	"
"	200	"	100 "	400	"	"
Less than			100 "	400	"	"

If a man's health breaks down, or he reaches the age of sixty-five and wishes to retire, or the firm wish him to retire, then his partnership certificates are exchanged for preference certificates, on the basis of ten years' purchase on average dividends. These preferential certificates will be continued in favor of a man's widow as long as she remains unmarried. This generous pension for the widow recognizes the help which a wife who is interested heart and soul in her husband's success can render—a further extension of the partnership idea. The plan includes only the man himself, or his widow, and not his mother, sisters, or any other relatives dependent upon him.

"Waste not, want not" is the motto of the deed of trust for carrying out the provisions of the partnership scheme, which covers four classes—management, salesmen, employees, and preference-certificate holders; each class chooses three members to constitute a committee working under the trustees, who are the directors of Lever Brothers. Out of the total five hundred thousand pounds not more than one-fourth can be distributed among the directors, management, salesmen, and employees; the certificates being issued in unit values of sovereigns.

Finally, preference certificates can be granted to the social institutions of Port Sunlight—the churches, schools, scholarships, and recreation gymnasium—so that they may be put on an independent foundation.

Sir William Lever is a hard-headed business man, with a preponderating sense of justice to all his workers. He considers philanthropy in business a misconception of business relationships, and will have none of it.

He has worked his way up from the ranks and has acquired his education in the hard school of practical experience. This development has given him a keen grasp on all business problems. Only a man of the keenest intellect, swayed by a great sense of justice and a desire to overcome difficulties which would have discouraged an ordinary man, could have struck out so boldly, neither fearing nor caring for criticism from the whole world of commerce and business and holding himself true to the course he feels is right.

When Mr. Edward Cadbury was recently asked what influence had determined him to introduce a new social order in the conduct of his business, he made answer: "I am firmly convinced that the principle of brotherhood should be applied in the daily conduct and routine of a business. This principle has led me to the provision of perfect sanitation in my factory, good air, cleanliness, and wholesome food-stuffs; furthermore, for the contentment and happiness of my employees these clubhouses, athletic centers, swimming-pools, recreation fields for cricket, tennis, and football; and a communal boarding-house for my girls who come from a distance, under the care and supervision of a matron, whose duty it is to look after their comfort and pleasure. I can assure you that this house is not only a haven of rest but a true home, where one sees only bright and cheerful faces. Gradually, as my business increased, I took up the question of better housing and surroundings for my people; later, extending our sphere of influence by including those living in the slums of Birmingham and by making the rents so low that the occupancy of a model home would not be prohibitive."

When Mr. Cadbury began business his staff consisted of twelve; now his employees number nearly four thousand. The social side of the work kept pace with the business. Having acquired a large tract of land in Bournville, some five miles from Birmingham, one of Mr. Cadbury's first achievements in 1879 was the building of cottages for his employees. Some two hundred houses were built in 1895, the lowest rental being $1.25 a week.

Having demonstrated that the village community of Bournville was financially practicable, that there was a demand for houses with gardens and rural surroundings, that the health of the community was greatly above the average, and that the population would develop communal interests and corporate action, Mr. Cadbury decided to make a gift to the nation of the village and the estate consisting of five hundred and two acres, six hundred and sixty-nine houses, with a population of 3,170. This was done by means of a trust, to administer the property of the estate according to the conditions in the deed of foundation. The revenue in 1906 was approximately $28,000 and the total value of this gift to the nation $1,125,000. It is an absolute gift, no part of the capital or the revenue returning to Mr. Cadbury, but all the income to be used for continual expansion and extension of the idea.

December 14, 1900, the trust was transferred to the trustees, who were apprised of its object in the opening sentences:

> The founder is desirous of alleviating the evils which arise from the insanitary and insufficient accommodation supplied to large numbers of the working classes, and of securing to workers in factories some of the advantages of outdoor village life, with opportunities for the natural and healthful occupation of cultivating the soil.
>
> The object is declared to be the amelioration of the condition of the working class and laboring population in and around Birmingham, and elsewhere in Great Britain, by the provision of improved dwellings, with gardens and open spaces to be enjoyed therewith.

It is suggested in the deed of trust that no factories shall occupy more than one-fifteenth of the total area of the estate.

Provision was made that the dwellings should occupy only one-fourth of the site, the remainder of the lot to be used for gardens or open spaces. It was furthermore Mr. Cadbury's strong desire that the rents should, if practicable, be fixed on such a basis as to put them within the reach of the working classes whom he wished to attract from crowded and unsanitary tenements, without, however, placing them in the position of being recipients of charity.

The average garden space for each house is six hundred square yards, and is laid out by the estate gardeners as soon as the house is commenced. Pear, apple, and plum trees are planted at the lower end of each plot, for the purpose of forming a pleasant screen between adjoining premises as well as for the fruit. The estate maintains two professional gardeners, with assistants, who are ever ready to aid the tenant with information and advice, but he is responsible for the cultivation of his own garden. Further interest in gardening is stimulated by two classes for boys and young men.

The catholicity of the trust is evidenced in this:

> The administration of the trust shall be wholly unsectarian and non-political, and there shall always be a rigid exclusion of all in-

fluences calculated or tending to impart to it a character sectarian as regards religion or belief, or exclusive as regards politics, and it will be a violation of the intention of the founder if participation in its benefits should be excluded on the ground of religious belief or political bias.

The democracy of Bournville is shown by the fact that only forty-one and two-tenths per cent. of the villagers work for Mr. Cadbury, while forty and two-tenths per cent. come from Birmingham, a distance of five miles.

It was the intention of the founder that the sale, distribution, and consumption of intoxicating liquors should be entirely suppressed, unless such suppression, in the opinion of the trustees, should lead to greater evils. The unanimous consent of the trustees, in writing, is a prerequisite for the use of any house where liquor may be sold; the trustees also may rigidly prescribe all the conditions under which a license is granted. All net profits shall also be used for further recreations in the village and counter-attractions to the liquor traffic as ordinarily conducted.

A recent census showed that fifty and seven-tenths per cent. of the villagers were employed in indoor factory work; thirteen and three-tenths per cent. were clerks and travelers; thirty-six per cent., mechanics, carpenters, bricklayers, and other trades not capable of exact classification. The affairs of Bournville are administered by a village council, elected by the ballots of the householders and serving voluntarily for one year. Two of the council serve on the school committee; they manage the flower shows and village fêtes, bath-house, playgrounds, and parks.

For the six years ending 1906 the death-rate in the village was 7.4 in 1,000, as opposed to 10.7 for the city district and 15.9 for England and Wales. The infant mortality per thousand live births for the five years ending 1906 was: Bournville, 78.8; the city district, 104; England and Wales, 134.4.

Mr. Cadbury has built better than he knew; his social trust is continuing its success and widening its sphere of influence, inasmuch as it has served as a model for the Garden City Association of England, which is developing a tract of thirty-eight hundred acres within an hour's ride of London with the direct object of lessening the city congestion and becoming a self-contained community, combining the social attractions of the city with the healthfulness of the country.

Both Mr. Cadbury and Mr. Lever are generous contributors to this association and are members of its board of trustees.

Last, but not least, in this trilogy enters the work and influence of a personality who, more than the others, went through the depths. Notwithstanding all the hardships, trials, and discouragements, this man became the founder of a work, colossal in importance, known all over the world, and which must ever serve as a lesson to industrialists and men of affairs. Three generations of Krupps have passed away, but the work handed down to posterity has become a memorial, outlasting tablets of brass and monuments of stone.

The establishing of a great business means the development of industry and commerce and the building up of the community. Nowhere can we find this illustrated more forcefully than in our own country. For two hundred years Schenectady was a conservative, self-contained, old Dutch town, but with the advent of the General Electric Works a new force showed itself and has become irresistible. The growth of the works and the progress of the city have kept pace.

If now you have a man of unselfish purpose, democratic sentiments, and real love for his fellows, sincere in his wish to express the idea of mutuality by sharing the prosperity which has come to him with the co-workers who have made it possible through their toil, such a man leaves an indelible imprint on the community in which he lives. The success of the one means the success of the other. Even so Essen is famous for the efforts of one little man who in 1810 founded his works there. The first year there were four on the pay-roll; to-day, nearly seventy thousand.

In looking at the completed picture of this enterprise one should never lose sight of the early struggles and efforts, nor of the humble origin of this mighty business. Living in a city of considerable extent, Krupp's first efforts were to bring the people near the factory for the sake of saving time and money in going to and from their work. Westend, the first colony, was founded in 1863; then came Nordhof, 1871; Baumhof, 1872; Schederhof, 1873; Croneberg, 1874; Alfredshof, 1894; Friedrichshof, the latest colony, was built in 1906, and accommodates over five hundred families. This last is also the best; and the stranger, passing through the streets of Friedrichshof, is impressed by the magnificence of the location, the diversity—yet simplicity—of the architecture, the entrances and archways, resembling the portals of palaces and historic buildings, the loggias and balconies, the small parks, and trees and flowers everywhere. Each family has the use of a grass-plot in front of its dwelling for bleaching or drying clothes, these open spaces being designed for useful as well as ornamental purposes.

Everywhere one meets happy and contented faces of the children who play in the courts, or little parks. They seem anything but the type of children one finds in the ordinary factory neighborhood. Krupp showed his usual foresight in the provision of adequate playgrounds for the children, well knowing that they would be candidates for future positions in his works. It was not a matter of experiment; he knew that he could depend on workmen of sterling worth and character, for they had grown up under the wholesome conditions of the colony life.

In Friedrichshof an apartment of three rooms rents for from $41.25 to $55 a year; of four rooms, $51.25 to $65; five rooms, $63.75 to $68.75, according to location. The rooms are of good size, every one communicating with the outer air.

Krupp's works are not confined to Essen. His shipyards, collieries, mines for iron ore, rolling-mills, and blast-furnaces are located in different parts of the empire. Likewise, his altruism is not confined to Essen, as is instanced by the conditions surrounding his coal-miners near Bochum.

There are one hundred and three supply stores for the sale of meat, bread, manufactured goods, shoes, haberdashery, hardware, clothing, and everything needed in the home. Twenty-five shops are devoted exclusively to the sale of coal, potatoes, and straw. Krupp, solicitous for everything which concerned his workmen and their families, examined closely into the question of food and household supplies. Ascertaining that his people were not receiving pure food-stuffs, just weights or measures, he opened supply stores to meet these requirements, but not to undersell the local dealers in Essen. To encourage patronage of these stores there is a system of profit distribution, each householder receiving 8 per cent. on all the purchases made by her during the year. Over a thousand people are required to run these stores.

A flour-mill and two bakeries supply the colonies with bread-stuffs. A recent monthly record showed a daily product of twelve thousand loaves of bread and forty-seven thousand small pieces. The mill is equipped with the most scientific methods of refining and producing the best food-stuffs. It is one of the model mills in Germany. Two slaughter-houses, a factory for brushes and bags, and a coffee-roasting mill complete the store system. The supply stores furnish the Krupp public-houses, nine in number, with the provisions for warm and cold food, beer, wine, and coffee. In three of these the large hall is at the service of the men for their festivities and entertainments. At the coffee-houses a bowl of coffee is served for half a cent, with sugar at the rate of three pieces for one-fourth of a cent, and a pint of milk for one and a fourth cents. There is a complete system of restaurants; the one at the entrance to the works accommodates five hundred men at a sitting, and the largest three thousand men, who pay seven and a half cents for the noon meal of soup and a good portion of meat; for five cents a supper is served, with a choice of meat or fish.

In a home-keeping school the daughters of the workmen qualify themselves for the management of future homes. They are first taught the simple principles of marketing, and then the preparation of the food purchased. Economy is the watchword, and the amount of food is carefully calculated for each person. If any food remains after the meal it is saved and tastefully prepared for dishes on the morrow. The whole course of four months is on a scientific basis. Not only are the girls taught the preparation of a wholesome meal, but each has a little garden for raising the vegetables used in the kitchen. They are also taught how to preserve vegetables and fruits for winter use. To make the study practical a midday meal is prepared and served by the young cooks to the workmen whose wives happen to be sick, to those who have no homes of their own, and to invalids. The price of the meal is about nine cents.

For a warm bath the men pay six cents, the women two and a half cents, and the children one and a fourth cents; soap and towels are furnished free.

An average of forty-five thousand people a year use the bathing facilities that are furnished at Friedrichshof. The public-bath building also contains the free library and reading-room. Another house is devoted to medicated baths of all kinds, as well as massage. In all of the new factory buildings baths for the men are installed as a matter of course, while in the washrooms each man has his own locker of perforated metal

In 1890 a social center, known as the Officials' Casino, was opened, where Krupp could meet his staff and freely discuss the affairs of the business. Connected with the casino are a restaurant and garden, clubrooms, bowling-alleys, a gymnasium, fencing-school, baths, and a library. The rooms are so arranged that they can be thrown into one on special occasions. In addition to this recreational center a few years later a boathouse was built on the Ruhr, a lovely stream flowing through the city and admirably adapted for water sports and contests of all kinds. In cold weather this spot is a rendezvous for winter sports. The bicycle clubs also make use of the building. Under the auspices of a mutual improvement society of three thousand members, organized for self-culture and civic betterment, dramatics, concerts, lectures, and various entertainments are given free or at a nominal cost.

Krupp's crowning effort in all this wonderful work was his provision for the old and those incapacitated in his service. It was his wish that these veterans should live their declining years in comfort and free from care. The colony at Altenhof, built for this purpose, contains two hundred and sixty-eight houses where aged employees may live, rent free, during the remainder of their lives.

Each little home is a bower of beauty, treated architecturally different, so as to free it from any institutional taint. To each Krupp attached a small garden, well knowing the joy and diversion which occupation in the open air would give the veterans, keeping them in good health and spirits.

The whole layout of the colony of Altenhof would well serve as a model village; winding streets, shaded by beautiful trees, ever avoiding stiff, straight lines, give a most restful and pleasing effect. Krupp had due regard for open spaces, the grass of which is neatly kept by the old people, who take a communal pride in the village.

In the event of the death of one of an aged couple the survivor is allowed to remain in the old home for a period of six months; after which he or she is transferred to the widowers' or widows' home. In the widowers' home each inmate has a room to himself, so that he can be perfectly independent if he desires. The meals for the men are sent in from the convalescents' home, just opposite, at a cost of twelve cents a day. The dining-room is used in common, and is a social center. Here, with their warm carpet slippers, their long pipes, and their caps, the old men look the picture of solid comfort, remote from the outside world.

The widows have each two rooms, a main room and a tiny kitchen where they prepare their own meals. The dining-room, however, is used in common. Everything is scrupulously clean and free from odors. Connected with these two retreats is a large kitchen.

Two churches, Catholic and Protestant, testify to Krupp's liberality in furnishing houses of worship for each creed. Adjoining the Protestant church, a simple shaft, with a bronze medallion of Krupp, has been erected as a memorial by the old men and women who contributed their pennies. They felt that they had lost their best friend when Krupp passed away.

The convalescents' home stands on a terrace overlooking a deep glen, which merges into a wood on the opposite hillside. The glen and surrounding wood form part of a large park, which is for the enjoyment of all the people. This home is so successful in the complete restoration to health of patients sent there from the hospital that Frau Krupp has built other homes for women and children adjoining.

In 1907 fifty-eight hundred people were treated in the hospital. There are special pavilions for diphtheria and tuberculosis and for medicated baths, while in the suburbs two barracks are always available in case of an epidemic. The medical service is directed by a staff of five, with twelve trained nurses and forty attendants. The description of the hospital naturally suggests mention of the funds for social insurance—that is, insurance for sickness, invalidism, accident, death, and pensions. In addition to the obligatory funds prescribed by law there is a workmen's pension fund of $4,312,500; one for the officials of

$1,925,000 capital; a supplemental workmen's fund of $1,425,000; and the convalescents' home fund of $75,000. Including the revenue from these funds, the firm paid in one year $767,000 for sick and accident insurance, $358,000 for pensions, and $593,000 for industrial betterment; a grand total of $1,717,000 for that year.

The home of the founder, Krupp, who died in 1826, still stands in the center of the great works. His son Alfred wrote in 1873 these memorable words:

> For fifty years our family dwelt in this workman's house. For years a cloud of uncertainty hung over us as to the success of the undertaking. During this time we passed many a sleepless night and many a day of sorrow. I hope that no workman will ever pass through a like experience, and it is my wish that this little house shall ever be kept intact as a memorial to the humble origin of our great works. May it ever serve as a source of encouragement to the faint-hearted and an inspiration to the small beginner.

Concluding, he used the life motto of his father:

> The object of work is the welfare of the community; then is work a blessing and it brings a benediction.

XXIII

AFTER HOURS

IN recent years it has dawned upon the minds of employers that the human machine needs attention, rest, and a favorable environment for achieving the best results in production.

Some employers have improved the conditions under which their operatives work because they feel that something more than wages is due; that recognition of some kind should be given employees for having performed their share in the work of production. Others, again, have done this simply because it paid in actual dollars and cents. But whatever the motive, the result—a higher percentage of return—remains the same.

Whatever may be the benefit to the employer in improving the conditions of life and labor of his personnel, the employee, of course, has also been the gainer. Especially is this true of employees who have the economic foresight to seize opportunities for advancement toward greater commercial worth to the employer. Increase in wage-earning capacity is invariably recognized by promotion.

Every employer wants the best workmen he can get. By the best he understands, of course, those who fully earn the wages he pays, and so improve themselves that he must advance them. "I go over my pay-roll every Saturday night," said a prominent manufacturer, recently, "to see whose salary I can raise. My men are far less anxious for advancement than I am to promote them."

The individual who takes advantage of opportunities for advancement cannot fail to be of greater worth to his employer, to the industry, to his own home, and to the community—facts which are positive assets in industrial, social, and civic stability.

In modern business there is little room for sentiment; the employer demands a cash equivalent for each dollar paid out. The situation is reflected by the commercial proverb, "Business is business." But here and there employers are realizing that investment in manhood pays; that improved men as well as improved machines have economic value, because a more vigorous man can do more work, a more intelligent man will do better work, and a more conscientious man will do more careful work.

It is not fair, however, to expect employers to do all. There is a direct relation between capital, labor, and management, the three elements essential to every enterprise. Capital is useless without management to direct its resources, and in turn capital and management are dependent on labor to execute their will. Capital's chief concern, from commercial as well as humanitarian motives, should be the improvement of the workers' condition. On the other hand, it is to the interest of labor not to view with suspicion the overtures made in its behalf, but to meet them in a friendly spirit, with a mind open and ready to co-operate. It is only in this way that all parties can reap the fullest returns from mutuality.

Not by the churches, not by the universities and colleges, not by the common schools, but by the great captains of industry who are recognizing and providing for an all-round development, is the character of the ordinary man being molded and shaped along lines of civic and social usefulness. Never before in the history of the world have employers had such colossal opportunities for guiding and helping the thousands of men and women who spend at least one-third of each working-day in their employ. When employers realize that they hold within their grasp the possibilities of industrial contentment, social stability, and communal welfare, all direct factors in greater production, they will plan and scheme how to improve the condition of their employees with the same zeal they now devote to promoting the mechanical efficiency of their business, extending its operations and reaching out for the acquisition of new commercial territory.

From a shack consisting merely of a roof and a number of bunks has been developed the modern "rest-house" for the railroad man. If the man who "makes the wheels go round" is not as carefully tended as the wheels, engines, car, or road-bed, no amount of mechanical skill or efficiency will equal the human equation. Perhaps the first essential of this new idea is relaxation in attractive form. The railroad rest-house of to-day is a commodious structure, equipped with a restaurant, private rooms, and dormitories, furnishing accommodations at rates at least 50 per cent. lower than elsewhere, with the free use of gymnasium, baths, library, class and lecture rooms. Some of the lectures are delivered by the heads of departments. In this way those who are managing and those who are operating the road—the generals and the privates of the railroad army—"get together," and come into personal contact, favorable to their own interests and those of the traveling public.

At the New York terminal of the Pennsylvania Railroad billiard and pool tables, bowling-alleys, and a gymnasium offer the employee relaxation and healthful recreation. The clubhouse contains 150 bedrooms for the use of trainmen and crews. Some of the rooms are single, and others are arranged on the dormitory plan; all the furnishings are simple, but thoroughly comfortable. In these surroundings the trainman is safely housed for the night for ten cents.

The Colorado Fuel and Iron Company, wisely recognizing the fact that social intercourse is instinctive and when properly directed is stimulating and wholesome, have attempted to gratify this human need by organizing clubhouses, intended to modify the excessive use of alcohol among the men. Liquor is sold, but under certain well-defined regulations, and various forms of wholesome amusement are provided to take the place of the demoralizing features of the saloon. The bar is located immediately in the rear of the porch, and is furnished in a very plain and unattractive manner, no display of bottles, pictures, or other suggestions to drink being permitted. The furniture and furnishings are plain, and everything is conducted in a quiet and orderly manner.

The clubhouse is for the use of members from 9 A.M. to 10 P.M. daily, except Saturdays, when it is open an hour later.

Playing for small stakes is permitted, but in no event are they allowed to exceed a stated low limit. In order to control the quantity of wine, beer, and liquors which may be sold in the clubhouse, no member or visitor is permitted to buy a drink for any other member or visitor. This "no treating" rule is rigorously enforced.

At the H. C. Frick Coke and Coal Company's mines the sordidness of the usual mining-village has disappeared through the provision of playgrounds and parks, planting of thousands of shade trees, and the conversion of barren hills and unsightly cinder dumps into green lawns and terraces.

Streets and alleys have been graded and made of uniform width. Tons upon tons of cement have been used in the construction of cribbing and retaining walls, of culverts, crossings, and walks.

The dwellings of the Frick employees bear not the slightest resemblance to the ordinary "company houses." Every house is built on a substantial stone foundation, on high ground, is well plastered, has a dry cellar and attic, and front and back porches. Windows and doors are tight and weather-proof. The company sees that the houses are kept well painted, and insists that the tenants keep their fences and cellar walls whitewashed, for which purpose lime is furnished to them free of charge.

There are some four-room houses for the smaller families, but the average house has six rooms. Running water, at least in the kitchen, is to be found in most of the houses, and many of them are provided with bathrooms. In the towns where the company generates its own electricity the houses have been fitted up for electrical lighting. For the light, fuel, and water used by the tenants of the company no charge is made. The average rental of a company house is $7 per month. Many of the smaller houses may be rented for less.

Each house has a front yard or lawn of good size and a large garden. The tenants are encouraged and assisted in the cultivation of their lawns and gardens, for which

A WORKMAN'S GARDEN

PLAYGROUND FOR CHILDREN OF FACTORY EMPLOYEES. NATIONAL TUBE COMPANY

the company furnishes free fertilizer, and its own teams and men to convey the manure from the stables and distribute it. Seeds and implements are supplied at cost. Some of the houses have lots of 80 x 130 feet; others of half that width but equal length. At one large plant, in order to give the tenants more room, whole rows of houses were moved back about thirty feet. The average worth of these gardens is $50 each. Many of them are worth a great deal more than that.

The Frick Company has 63 active plants, with about 5,000 houses all told. With very few exceptions, the tenants of these houses cultivate their gardens and keep up beautiful lawns and flower-beds as well.

If each garden returns at least $50 to its owner, it can be seen that the workers in the Frick towns are enriched each year to the extent of nearly $250,000 through their gardens alone.

But, quite apart from the financial returns and the advantage of having fresh and wholesome vegetables for their tables, these gardens are of inestimable value in cultivating thrift and domesticity, and in making useful citizens of the workmen.

To stimulate interest in gardening the company annually awards six prizes at each plant, three for the best gardens and three for the best-kept lawns and finest beds of flowers. The gardens and lawns are inspected by committees of disinterested citizens, and substantial cash prizes awarded according to their decisions. The keenest rivalry exists between tenants for the garden and lawn prizes. The heads of families who are inclined to be shiftless and lazy are stirred into activity by the industrious, and, once interested in the competition, become enthusiastic.

Waldenburg, in Schlesia, recognized the efficacy of the small garden as a saloon substitute and a means of recreation by establishing, in 1911, 1,409 little plots. Some of the land was given by the Minister of Agriculture, the Society of Mines and Factories, and other tracts were rented from private individuals. There is no rental charge to the workmen for these allotment gardens. Seed and shrubs are given by the society, but with the understanding that the land shall be used for the raising of vegetables, flowers, berries, and fruit. The raising of chickens, rabbits, goats, and bees is not approved. The small tracts come under a garden commission of twenty-two members, who report that of the 1,409 little plots 972 were very good, 231 good, 120 fair, 57 passable, and 29 poor.

"The great value of our garden has not been the fine vegetables it has yielded all summer and the good time the children have had in the open air, but the glasses of absinthe my husband hasn't taken," observed the mother of a French working-man's numerous family.

Of the French railroads the Northern has gardens of from 358 to 598 square yards each for 3,000 of its men; the Eastern offers gardens to 2,800 of its trainmen and 820 station agents; on the Southern some 2,600 shelters are built, each having attached a little plot of 598 square yards, while 650 station agents and clerks have allotments of 717 to 837 square yards each; altogether this one line sets aside 448 acres. The Orleans Railway not only provides 6,062 members of its staff with little gardens, but contributes to this movement at Tours, where 30 gardens are placed at the disposal of the families of the men employed in the stations.

Collections and museums, when properly interpreted, play an important rôle in recreation, particularly when the visiting workman brings with him a fund of knowledge gained in the field in which he has worked.

In this class falls the Royal Museum of Traffic and Construction in Berlin, where engineers, city officials, and technical students are interested and stimulated by exhibits of traffic and construction as they appear to-day. Historical and retrospective exhibits reconstruct and vivify details and processes of the past. The largest number of the exhibits relate to the railway service and include: construction of railway beds and their maintenance; engineering for elevated constructions, viaducts, and tunnels; signaling systems, telegraph and telephone plants; locomotives and cars, electric-power plants; railway workshops and machinery; service and traffic.

There is a large collection of models, drawings, statistical information and graphics in connection with the care of employees, including improved dwellings, sanatoria for the treatment of tubercular diseases, invalids' homes, workmen's sick relief and pension funds, accident insurance, temporary lodgings for employees who may be obliged, when on service, to stay away from their homes overnight, rest and recreation rooms, dining-rooms, cooking and heating appliances, baking establishments, and other forms of efficiency promotion. In the section of hygiene are also found an interesting collection of protective garments. Worthy of note are the models and special arrangements for rescue work, including relief trains and first-aid-to-the-injured equipments.

Two industrialists in Leipsig, Koerting and Mathiesen, after a careful study of the conditions of their employees, reached the conclusion that when the strength of workers is used up it is not enough merely to replenish the depleted store; reserve force must also be built up against future need. This is best accomplished by periods of rest for mind and body. Comparatively few recognize this and have the means to do it.

Koerting and Mathiesen built a vacation home in the mountains near Leipsig, with the object of giving all their employees a free vacation at this holiday home. It is not only a health home, but a place of recreation for the well. There are accommodations for 300, the rest season continuing from May to October. The families of married men or other dependents receive a certain sum from the firm while the head of the house is on his vacation. Any convalescent workman, having been with the company one year, can have the advantage of the home for a period not to exceed four weeks. For this phase of their mutuality work the firm set aside $125,000 to build and maintain the holiday house.

When an employer sees groups of young men, among whom may be some of his own employees, gathered at street corners on Sunday afternoons he might ask himself if it would not be "good business" to initiate some movement for recreation that would send these fellows to bed with clearer heads and heavier pocket-books. One subtle test of the standard of a modern city is the amount of wholesome recreation it affords its citizens.

Dresden well understood this social philosophy in the establishment, twenty-five years ago, of a real People's Club, or what is known as the "Volks Verein," with a membership of some 10,000. The membership fee is fifty cents. In addition to the usual educational and recreational features there is a people's theater. Eighty per cent. of the members are sturdy patrons of this theater; they are deeply rooted in the Verein, having grown up with it from childhood, and by means of its publications are kept fully informed of its various activities.

The theater started in 1894 as a nature theater in one of the parks. This was so successful that the desire for a people's theater in the city was expressed. At first the performers were amateurs. In summer, when the professionals were not engaged, their services also were obtained. There was great difficulty in getting artists from the regular theaters, as they did not know the popular plays. In 1908 the Verein rented a large hall in Dresden, with a seating-capacity of sixteen hundred. The actors were engaged by the day, some of them giving their services. In November of the same year Sunday dramatics for the children were begun and received enthusiastically. Since January, 1900, Mondays are devoted to renditions of the classics, with one opera each month. On Wednesday afternoons classic plays for the children are given.

The attraction of this people's theater is most strong, and the clientele feel that they are members of the same family, so to speak. They tell or write the director just what they think of the plays, for is it not their theater? Whole families attend, places being reserved for them. Between the acts they discuss the play and the players. The management controls the eating and drinking, no service of refreshments being permitted during the play. The popular audiences are the most impressionable; there is always more applause and recognition of merit than in the other playhouses, by clapping or laughing or by stillness. All this has an inspiring effect upon the actors. Demands are put upon the Verein that the best talent shall be engaged. Thus this stage is moralized, and becomes an educational factor in the life of the workers.

Prices for seats are so low that there is no competition with the other theaters; in fact, the taste of many has been so developed for the better presentations that when such are given at other theaters many people attend them also.

Classic poets, modern serious plays, light comedies, and farces are played, and certain days set aside for each. Monday night is for the classic drama, Wednesday for comedy, Thursday for the lighter presentations, while Sunday afternoons are devoted to fairy tales for the children, with comedies and farces in the evening.

Last year some sixteen special performances were given for societies who engaged the theater for one night each; among them were the railwaymen's association, carpenters, soldiers, civil service, and tradesmen.

XXIV

THE AMERICAN MUSEUM OF SAFETY

THE last few years have seen a wonderful awakening of the public mind to the importance of making industry less dangerous. Perhaps the most interesting manifestation of this modern attitude has been in the founding of museums of safety. A museum of safety is an economic necessity. It occupies in its field the same position that public schools do in their field. It has proved itself a necessary part of modern industrialism, and it has come to stay.

It has been said that our country is the greatest commercial and industrial nation in the world. If other countries have demonstrated that a museum of safety is a scientific and practical necessity, the United States more than all others should see to it that her museum of safety covers the needs of every trade and industry throughout the entire nation: an institution with adequate provision for exhibits, lectures, study, experiments, tests, and a specialized library—sufficiently great to meet the needs of all interested in the safety and welfare of workers and, indeed, of all humanity.

There are now twenty-three museums of safety and institutes for the study of industrial hygiene—namely, in Amsterdam, Barcelona, Berlin, Brussels, Budapest, Copenhagen, Dresden, Frankfort-on-the-Main, Gratz, Helsingfors, London, Milan, Montreal, Moscow, Munich, New

York, Paris (safety), Paris (hygiene), St. Petersburg, Stockholm, Vienna, Wurzburg, and Zurich. The American Museum of Safety in New York City is the only institution of this kind in the United States.

Recently the director of the Berlin Museum of Safety asked for eighty-three thousand marks for the enlargement of the building, already overcrowded. This request was instantly granted, and it was intimated that he could have all the money he needed, as the government was only too glad to maintain this life-saving station at its highest efficiency. Other European countries were not slow in realizing the importance of museums of safety, which received their greatest impetus during the last decade.

The labor inspectors of Holland have found their safety museum of the greatest service in meeting objections that safety devices in question will interfere with the proper operation of machinery. If a manufacturer is not satisfied with the photograph of an appliance he can send his superintendent, or go himself, to the museum of safety, where he can study every detail of the operation. Often a visitor to the American Museum of Safety will confess that if he had come earlier and learned of certain safeguards there would not have occurred some recent catastrophe in his factory which killed men and hurt his business. Not only employers but also the workers and the general public may go to a museum of safety to see and study in actual operation, or by means of models and photographs, the simplest and best methods of protecting dangerous machines and processes.

While such a museum is primarily for the education of the employer and the employee, in pointing out to the former what safety devices he should install and showing the latter how to use them when provided, it has also the important function of inculcating safety and caution through the community.

Impairment of the wage-earning efficiency of the individual entails a social obligation through the provision and maintenance of the hospital, with its first aid, ambulance, and other services. No self-respecting workman wishes to be made the recipient of charity; yet, if the earning power of the head of the family or breadwinner is snuffed out by an accident, he and his dependents are made dependents of the community. The mother and children, in most cases unskilled workers, must accept a wage insufficient for their needs, and, consequently, charity must step in to support and educate them.

The stamina of children reared in charity is weakened; their moral fiber is impaired, resulting in lowered standards of morals, education, and citizenship. All this means an increased burden on municipal departments of health, charity, and relief.

One very valuable function of a museum of safety is the prevention of wasted effort and time. Such a permanent exposition of safety devices is a clearing-house for new ideas, where an inventor can quickly prove the success of his invention or be convinced that his further efforts are useless.

The first museum of safety on the Western Hemisphere was incorporated by a special charter from the Legislature, Chapter 152 of the laws of 1911, of the state of New York. According to the chapter:

> The objects of the corporation hereby created are to study and promote means and methods of safety and sanitation and the application thereof to any and all public or private occupations whatsoever, and of advancing knowledge of kindred subjects; and to that end to establish and maintain a museum, library, and laboratories, and their

branches wherein all matters, methods, and means for improving the general condition of the people as to their safety and health may be studied, tested, and promoted, with a view to lessening the number of casualties and avoiding death; and to disseminate the results of such study, researches, and test by lectures, exhibitions, and other publications.

The museum is non-commercial; it is not a showroom for patented safety devices; it does not sell or take orders for any of the devices in its collections; all demonstrations are made by its own staff; and there is no charge for space.

The museum is devoted to the safety, health, and welfare of industrial workers and the technique and science of industry. With this end in view, its operations are divided into three great departments—accident prevention, industrial hygiene, and mutuality.

The exhibits in the department of accident prevention are divided into two groups.

1. GENERAL

Boilers, Containers, Steam-piping	Elevators and Hoists
Power-machines	Fire and Explosions
Transmission	Personal Equipment of Workmen
Electricity	Miscellaneous

2. PARTICULAR

Mining	Quarrying, Excavation
Blast-furnace and Foundry	Metal-working
Wood-working	Chemical Industries
Stone and Clays	Textiles and Clothing
Paper and Printing	Food-stuffs
Agriculture	Building Trades
Transportation by Land	Transportation by Sea

First Aid to the Injured

INDUSTRIAL HYGIENE

- Apparatus and Instruments for the Testing of Air, Light, and Water
- Ventilation
- Infectious Diseases—Tuberculosis
- Water-closets and Lavatories
- Miscellaneous
- Exposition of Substances Detrimental to Health
- Lighting
- Exhaust for Dust and Gases
- Baths, Dining-rooms, and Clothing
- Personal Equipment of the Worker

MUTUALITY OR SOCIAL HYGIENE

- Improved Dwellings
- Service Annuities
- Food-stuffs
- Miscellaneous

A jury of experts in each group will pass on the suitability of all exhibits, which must have safety, hygiene, or welfare as essentials.

The museum provides demonstrators, descriptive circulars, care, and maintenance. All cost of transportation to and from the museum is at the expense of the exhibitor, and all installations must be made by the exhibitor, under the direction of the museum.

The collections are open daily—except on Sundays and holidays—and free to the public; but special visits can be made by arrangement to accommodate groups of students or workmen.

In the museum's iron and steel section, under the chairmanship of Charles Kirchhoff, may be found illustrations of safety devices in actual size, models or photographs, in use in the iron and steel and allied industries: blast-furnaces, open-hearth, bessemer, blooming, rail, skelp, slabbing, galvanizing, pipe, and wire mills; power-stations, yards, shops; electricity and transportation. These collections are constantly being studied by engineers, factory inspectors, and foremen, who make drawings and tracings for use in their own plants.

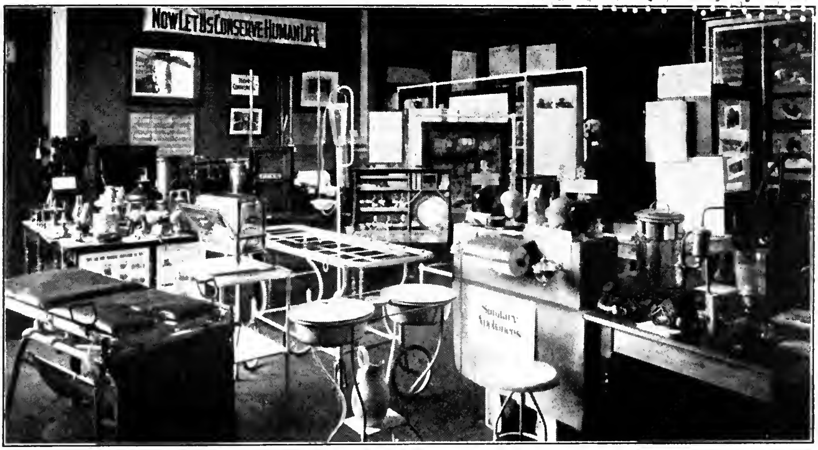
It is proposed to set aside a small portion of the museum space as an inventors' laboratory, where they may work at their devices during such hours as may be recommended by the advisory council. As this help to the inventor is intended only for worthy cases, no charge will be made, although, of course, every inventor must bring his own material and be responsible for all breakage. The fact that an inventor has had the use of this laboratory will be a guarantee that his idea is worth perfecting, and will insure a hearing from the capitalist, whom he may be seeking to interest.

The museum's library contains the most highly specialized collection in this country of books, pamphlets, photographs, lantern slides, and special reports.

These are the facilities that are to be met at the museum's headquarters. On its extension side may be mentioned the free illustrated lectures on accident prevention and industrial hygiene. The iron and steel section alone has conducted an educational campaign at mills and plants, where superintendents, works managers, engineers, and foremen have assembled to learn what has been accomplished through the introduction of safeguards and hygienic measures in their industry. In some instances the meetings have been limited to the personnel of the plant, no men under the grade of foreman being present. These audiences have ranged from 300 to 2,100 men.

Through its lectures, publications, and personal conferences the museum has reached every industrial state in the Union; and it has been the source of inspiration for state commissions of workmen's compensation.

It has also co-operated with the various state depart-



ONE OF THE EXPOSITION-ROOMS AT THE AMERICAN MUSEUM OF SAFETY

THE NORTON COMPANY'S EXHIBIT AT THE AMERICAN MUSEUM OF SAFETY

ments of labor. For example, a week's campaign was conducted in Minnesota, with the Commissioner of Labor, for the purpose of arousing interest in accident prevention in that state. The present activity in Minnesota may be traced directly to the influence of the American Museum of Safety.

Commissioners of labor from other states have made frequent visits to the museum for study and inspiration. The Commissioner of Labor of New Jersey, and his inspectors, have spent much time at the museum taking copious notes and securing working-drawings of the various devices, photographs, and lantern slides. The resources and the personal services of the museum's staff were freely placed at the disposal of the representatives of New Jersey's Department of Labor.

The Department of Labor of the state of New York is using the museum as a training-school for its inspectors, where the latest and best methods for safeguarding machines and dangerous processes may be studied. Candidates for positions as state factory inspectors have made use of the collections of the museum in preparing themselves for the civil-service examinations. Several of these candidates have returned to the museum to report their success and to express their thanks for the practical assistance rendered them. The museum is, in fact, the only training-school in the United States where factory inspectors may prepare themselves for their responsible positions.

Inspectors employed by the great casualty insurance companies have used the museum in like manner. On one occasion the Travelers Insurance Company, at considerable expense, ordered their inspectors from all over the country to assemble for special study of the museum collections.

Many leading industrialists have sent members of their official staffs, managers and superintendents, to the museum for similar investigations. One large iron and steel company in 1912 made four special visits through representative bodies made up of its foremen and selected workmen. So rich were these study visits in results that this company has incorporated them in its policy for the prevention of accidents in its works.

Last year, at the request of the United States Navy Department, the museum made a two-days' inspection of the Philadelphia navy-yard. Upon this investigation was based a report of conditions and suggestions for the introduction of safety devices. This report was then sent to the Secretary of the Navy, by whose direction it was copied and sent to every navy-yard in the country. The practical character of this work of inspection led the Navy Department to request that the museum make special researches abroad in 1912 on the best methods of preventing lead-poisoning and attendant occupational diseases. The second report is now being prepared.

Other inspections have been conducted by the museum in iron and steel mills, gas and electric-light stations, automobile plants, factories, and public institutions in Denver, St. Louis, Pittsburg, Chicago, Altoona, Dayton, New York, and other industrial centers. In many of these plants the management assembled the workmen for illustrated talks on accident prevention. These conferences were in the nature of an executive session, with every opportunity for questions and answers, by which this specialized information was made available for immediate application and use.

The American Museum of Safety is officially related with all the great museums of safety and hygiene in the world. Thus banded together they can readily exchange information, plans, and exhibits. The American Museum of Safety in New York receives the latest authoritative facts relating to the conservation of human life in the Old World.

Last year the museum's resources were greatly enriched by specialized exhibits in the form of models collected by the director and illustrating occupational diseases and industrial poisons. This collection is unique and forms the basis of the section of industrial hygiene, of which our country may be proud.

Sir Arthur Whitelegge, his Majesty's Chief Inspector of Factories for Great Britain, made a special visit to the museum last year. He was so impressed with the practical character of the work that he will use it as a model for the London Museum of Safety, for which a site has already been acquired.

By formal authorization of the New York Board of Education classroom instruction in safety and caution, illustrated by simple models, is now being given to the 785,642 children in the public schools of New York, showing the children how they themselves are largely responsible for the increasing number of street accidents and how they may avoid these perils. The parochial and private schools, an additional 150,000, are also included in this work, which is already showing results. A detailed account of the museum's safety campaign among the school-children will be found elsewhere in this volume, under the heading of "Training Future Workers."

To further stimulate the prevention of accidents and the promotion of industrial hygiene five gold medals are placed at the disposal of the American Museum of Safety for annual award. Three of these are in general fields:

The Scientific American gold medal for the most efficient safety device invented during a certain number of years and exhibited at the museum; *The Travelers Insurance Company's* gold medal, awarded to the American employer who has achieved greatly in protecting the lives and limbs of workmen; and *The Louis Livingston Seaman* gold medal for progress and achievement in the promotion of hygiene and the mitigation of occupational disease. *The E. H. Harriman* memorial medal, founded by Mrs. Harriman, will be competed for by American steam railways, for the best record in accident prevention and hygiene affecting the public and its personnel during the current year. A fifth medal, known as *The Rathenau* gold medal of the Allgemeine Elektricitaets Gesellschaft, of Berlin, is to be awarded for the best device or process in the electrical industry safeguarding industrial life and health. This is one of the very few instances where the bestowal of a high European honor is made through an American institution.

Such an institution as the American Museum of Safety is not coercive, but suggestive. The law says that dangerous parts of machines must be protected. The museum, through its jury of experts, tries to place on view every known safety device, so that the employer may select the one best adapted to his particular needs: in other words, the museum becomes the experimental laboratory for every industrialist in the country. It is therefore obviously to the interest of every American industrialist to lend both his financial and moral support to the movement.

The great organized trade and labor associations could well co-operate with such a museum, helping it to become a storehouse of practical information for accident prevention and workmen's compensation. This material would be of incalculable value for use in factories and workshops, and would offer a foundation for the preparation and enactment of sane and effective industrial legislation.

The elimination of conditions which lead to accidents is undoubtedly the work of a specialist. "Safety Engineering" has become a specialized department of professional activity. But even for the safety engineer there must be a field of training, a place to acquire information, a place where he and all others interested may make comparative studies. Such a training-school is the museum of safety.

The careful elimination of industrial hazards has advantages not confined to the individual worker; they extend to the community at large; they look to the elimination of class differences between capital and labor; they eliminate accidents which diminish the purchasing power of the workers; still further, they prevent these workers and those dependent upon them from changing from the purchasing to the dependent class, from an asset to a liability upon the community.

For these and other reasons the Plan and Scope Committee of the American Museum of Safety looks forward to the time when the city and state of New York shall have a museum comparing not unfavorably with the great institutions in Europe.

It is not the thought that in this only private benevolence should be sought, but rather that here is an obligation resting upon city and state to be met by the same public support that now is given to any other important and necessary educational movement.

There is daily confirmation of the contention that 50 per cent. of accidents in American industries are preventable. This degree of safety is obtainable by educational means; by daily propaganda through museums of safety; by rules and regulations for accident prevention in factories and workshops; popular lectures, and the distribution of easily comprehended pamphlets. This educational movement properly starts with readers placed in the hands of school-children inculcating ideas of safety and caution at the very foundation of the child's life.

Our chase after the dollar has often pushed humanitarian considerations to the rear. We have laid ourselves open to a criticism from one of the most influential German trade associations; after commenting on a statistical report of 35,000 deaths and 2,000,000 accidents in the United States during 1907 it went on to observe that at least one-third of these deaths and accidents could have been avoided if safety devices and measures of prevention already known had been employed. Our system of state factory inspection was criticized in that it did not have sufficient control. Continuing:

> Everywhere in America, in the railways, factories, and building trades, we can see how little regard is paid to human life. It is the cheapest thing in the world. Thousands of times we read in the American papers *human life is as cheap as dirt*. American culture and thought are founded upon a purely capitalistic basis; ours rest on a patriotic foundation. Property and things have the highest value in America, and these, before all, are protected by law. A man must care for his own safety himself.

No wonder that we have the present political unrest, especially among the workers; no wonder that they turn with eagerness to socialism or any other "isms" which seem to offer relief from the present socio-industrial conditions; no wonder that they are inveighing against class distinction and special privileges.

The trustees of the American Museum of Safety feel that their continuous educational work to date has been a large factor in focusing the attention of the country upon the need of a greater adoption of safety devices and provision for industrial hygiene.

The American Museum of Safety stands to-day as the only concerted, organized effort in the United States for demonstrating the use of safeguards; for bringing to industrialists the knowledge of these devices, by means of manuals, leaflets, a special report service, and illustrated lectures; for study visits, not only by employers and employees, technical men and factory inspectors, but also by teachers and the scholars in our public schools in whom, as the coming generation of wage-earners, should be inculcated the principles of safety and caution.

So much reference to this specific center of instruction in safety has been necessary, although this book has been prepared to place broadly before the public the whole subject as illustrated in the experiences and needs of representative industries. Safety is so vital a phase of industrial, economic, and social welfare that the full presentation of its consequence should be sufficient for its general recognition and for larger action than Americans have taken heretofore.

INDEX

C

D

E

F

R

S

T

Y

Z

THE END