# Metals Section

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H. H. Henry, Otis Steel Co., Cleveland, Ohio.
H. G. Hensel, The Youngstown Sheet and Tube Co., Chicago, Ill.
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F. A. Lauerman, Republic Steel Corp., South Chicago, Ill.
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D. V. Medalie, Interlake Iron Corp., Chicago, Ill.
John O'Rourk, Bethlehem Steel Co., Sparrows Point, Md.
C. E. Ralston, Pittsburgh Plate Glass Co., Pittsburgh, Pa.
Frank Rowe, Wheeling Steel Corp., Portsmouth, Ohio.
Herman Spoerer, The Youngstown Sheet and Tube Co., Evanston, Ill.
J. K. Stafford, Mississippi Valley Structural Steel Co., Decatur, Ill.
J. A. Voss, Republic Steel Corp., Cleveland, Ohio.

* Deceased.

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*Slides and Safety Kinks Committee Chairman*—J. A. OARTEL, Carnegie-Illinois Steel Co., Pittsburgh, Pa.
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B. T. DYE, Republic Steel Corp., Warren, O.
JOHN P. EIB, Carnegie-Illinois Steel Corp., Joliet, Ill.
E. A. ELLIS, Wheeling Steel Corp., Wheeling, W. Va.
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A. C. GIBSON, Spang Chalfant Co., Inc., Pittsburgh, Pa.
O. F. HARVEY, American Car and Foundry Co., New York, N. Y.
S. E. HAWKES, Macwhyte Company, Kenosha, Wis.
H. G. HENSEL, The Youngstown Sheet and Tube Co., Chicago, Ill.
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FRANK ROWE, Wheeling Steel Corp., Portsmouth, O.
A. C. SCHULTZ, Bucyrus-Erie Co., So. Milwaukee, Wis.
H. J. SPOERER, The Youngstown Sheet and Tube Co., East Chicago, Ind.
E. J. STERNER, Bethlehem Steel Co., Bethlehem, Pa.
J. A. VOSS, Republic Steel Corp., Cleveland, O.

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## MONDAY AFTERNOON SESSION

### October 5, 1936

The opening session was called to order by General Chairman H. W. Darr, Bethlehem Steel Co., Johnstown, Pa., who presided. Chairman Darr welcomed the delegates, pointed to the excellent progress made by the Section during the year, and commended the various committees on their work.

# Industrial Relations and Accident Prevention

**By J. A. VOSS**

**Director of Industrial Relations, Republic Steel Corporation, Cleveland, Ohio**

Industrial relations of the right kind are essential to the success of business. Men are no longer regarded as commodities, to be purchased at the lowest possible rate and discharged when no longer needed. Employees must be as contented as ambitious men can be; deserving ones must have opportunities for advancement; wages, hours, and working conditions must be favorable. There must be an earnest, sincere effort to work with men, to appreciate their needs, and as far as possible, to meet them.

As intelligent labor relations are essential to modern industrial management, so intelligent safety work is essential to a worth while industrial relations program. The Employee Representation Plan, which has proved so successful during past years, is an excellent medium for carrying out both programs.

This plan, with its representatives elected directly by the men from among their fellow-workers, gives employees and management every opportunity to meet together and discuss all phases of industrial relations, which should include a discussion of unsafe practices and conditions. By holding regular meetings, these problems are promptly settled before serious misunderstandings develop and accidents occur. The safety man has an outstanding opportunity to carry on his work in cooperation with a safety committee from among the representatives.

That safety and welfare represent an important part of the discussions between men and management under this plan is indicated by the fact that during 1935 more than 25 per cent of all the cases handled by the representatives in our corporation dealt with these subjects.

No safety program is really effective if it fails to use the many opportunities that an enlightened industrial relations policy presents to keep safety and accident prevention constantly before the worker. Safety deserves a place of importance in the industrial relations program because of the good will it engenders among workers.

Through a constructive, well designed accident prevention program the management can get closer to the men and at the same time bring them more real good than through any other single medium. Such a program has one great advantage. Whether it's the president of the company or the newest laborer on the payroll, there is a unanimity of opinion about the value of safety.

A sound safety program also provides, through proper organization, a logical system of liaison between management and men. The safety man, who should be, and frequently is, an integral part of the industrial relations program, meets with the superintendents. The superintendents, in turn, pass on the information they have gained to the foremen. Finally, the foremen hold meetings directly with the men working under them. This completes a chain that can, as need manifests itself, be used to pass along other information with equal effectiveness.

Such a relationship is invaluable. It should be fostered and developed, for in this relationship will frequently lie the method which will place a restraining hand on trouble and discord.

In our corporation the safety department is a part of the industrial relations department. The office of the safety manager adjoins my office, and he is familiar with the questions and problems which confront us in carrying out the broad program of industrial relations.

Safety, to us, is distinctly a sales job, judiciously mixed with a bit of crusading spirit.

There can be no laying down on the job—no hoping that the lesson has soaked through permanently. New men are being hired who must be taught, and, being human, older men too frequently get careless and forget. So we use a lot of selling, backed up with advertising and combined with a dash of sales promotion.

It is in connection with this constant selling job that the employee Representation Plan is most effective. Among the representatives are men from every department. The very fact that they are representatives is proof that they are leaders, that the men listen to and respect them and their judgment. If, therefore, we can sell the representatives on the value of safety, we have a number of influential proponents who are unofficial safety representatives, and whose efforts supplement the instruction which has been passed down through the superintendents and foremen.

These representatives, whose duty it is to be interested in everything that affects the welfare of their constituents, will, without making the formal inspections that are the duty of the safety department, bring to attention unsafe practices that might, for a time at least, elude the eye of the most vigilant safety inspector. We encourage our representatives to report such practices, and when they are reported we make haste to correct them.

Sometimes these practices are reported to the representatives by workmen who cannot help but be impressed with the prompt attention given their complaints or suggestions when they are passed on to the management by the representative.

We should know intimately what the men want, what they are thinking about. We should have a living picture of their mass trouble and tribulations. The industrial relations or safety man who is too indolent to mingle with his men to learn to know them at first-hand is going to fail at his job.

As you get to know the men better, so they in turn get to know you better. A mutual respect and regard is developed which is helpful on both sides when problems of mutual interest are being discussed. You will both be more honest with each other. There will be less beating around the bush and more plain facts.

If demands are being made that are unreasonable, it has been my experience that the best method to use is frankness. Tell the representatives all there is to know about the company's financial condition, its sales problems, its costs of operation, and market conditions. Discuss with them the accident record. If you are honest, and they will know whether you are or not, you will find that they are not only reasonable but sympathetic with the company's problems.

This kind of frankness will also act as a barrier to the disturber from the outside who is attempting to create friction by promising the impossible. The men will know that the disturber's promises are false and impossible of fulfillment. Gradually a feeling of partnership will be generated, and the old idea that men and management must of necessity be enemies will be broken down and swept away.

This new industrial relations policy will do more than anything else to make the safety man's job more effective if he will key his work with that of the industrial relations manager. Working together, they will not only do a real job for the men, but also for the company, and it must be a good job for both.

## Developments in Hoisting Chain Practice

By W. J. BLOOM

Metallurgist, Otis Steel Company, Cleveland, O.

The selection of a suitable quality chain of the best material and workmanship the market affords is of utmost importance. Material which is ductile and sufficiently elastic to recover from the strains produced by shocks should always be used. Though a high tensile strength may be obtained with hard material of low ductility, such material has been found unsuitable, since it is liable to fracture when subjected to sudden loads.

The links of a chain should be designed

as small as is practical, since the greater the number of links in a given length the more flexible is the chain, the smaller the transverse dimensions of the link the less bending action at the ends.

Ordinary short link or close link chains have links with an approximate overall length of four and a half times, and a breadth of three and a quarter times the diameter of the bar. For chains designed to stand severe shocks, links with slightly oval sides instead of straight sides are adopted, as they give the chain greater elasticity.

Every user of chains is familiar with the recommended safe loads for short link wrought iron chains, of the Chain Institute and the National Safety Council, but it may be well to recall that the safe working load for a long link chain should not exceed two-thirds of that for a short-link chain of the same diameter.

Now, as to chain attachments. A ring should be made of material equal to or better than the material of which the chain is made. A ring must be sufficiently strong to carry safely a load equal to the sum of the safe loads of all the attached chains, and, moreover must be capable of standing the total proof loads of these chains without deformation.

There is little variation in the general outline of ordinary hooks; both the inside curved surface and the outside curved surface are usually circular in shape, though not necessarily concentric. The opening or gap of the hook must be sufficiently wide to admit the largest ring which has to be placed on it.

When a hook is loaded, the material in the shank is subjected to a direct tensile stress; this should not exceed three tons per square inch. The material in those sections not in direct line of application of the load is subjected to stresses caused by bending action, in addition to the direct tensile stress caused by the load. These bending stresses increase with the distance of the section from the line of loading, and are tensile at inside, and compressive at the outside of the hook. The stress at the inside is the greater, and a hook, therefore, should be designed so that the maximum stress produced by the working load does not exceed the working stress usually allowed for the material of the hook; and as hooks are subjected to varying loads and shocks, this working stress should be based on an ample margin of safety. We have established the practice of purchasing slings made up completely by the manufacturer. In this way, we are assured of attachments that are correct in material and design.

The kind of sling used depends largely on the nature and shape of the articles to be lifted. The size of the chain is determined by the weight of the article, and also by the angle between the legs of the sling or the position in which it must be used.

In our steel foundries where large castings have to be raised from a mold, it often happens that the whole of the sand is not removed from the sides of the casting, and the actual load upon the lifting gear is augmented by the pressure of the sand, or the "suction" of the sand, as it is termed by the molders. Lifting gear of ample dimensions is therefore always used. Again, in the case of our steel works, the removal of "skulls" (slag containing metal) from furnaces or casting pits entails unknown loads on the crane and sling chains, and special precautions are taken.

The important connection between the actual tension in the leg of a sling and its angle of inclination should never be overlooked. It is often assumed, and at times with disastrous results, that a multiple-legged sling will safely lift a load equal to the safe load of one leg multiplied by the number of legs, whereas this is only strictly true when all the legs are in a vertical position.

Chains and other lifting gear are often exposed to abnormal temperatures in foundries and steel works, and those in the open are subject to variations in atmospheric temperature, including frost. The strength of iron and steel is not seriously impaired at ordinary temperatures, but above 600 degrees F. the strength diminishes rapidly with increase of temperature. Possibly with the exception of lifting appliances attached to ladles for molten metal, few, if any, are exposed to temperature exceeding 600 degrees F.

There has been a consensus of opinion among chain users that chains exposed to frost become brittle and are liable to fracture without warning. Recent research supports this view and shows that, although good quality chain iron does not develop brittleness in the absence of notches at low temperature, there is very grave danger of brittle failure, even at ordinary "frost" temperatures, in chains containing defective welds or links which have become notched or damaged in service.

It is, therefore, necessary to avoid exposure of chains and other lifting gear to extremes of temperatures, as these tend to aggravate the effects of any slight cracks, flaws, bad welds, or similar defects.

Although annealing or normalizing chains and other appliances will cure the skin hardness which arises in service, neither of these heat treatments will prevent the subsequent development of this hardness when the chain or appliance is put into service again. Periodical annealing is, therefore, necessary.

The period which should be allowed between consecutive annealings will depend on the nature and amount of use of the chain or appliance. We believe it is the general practice of most large users of chains to specify definite periods for annealing different classes of chains.

As a matter of safety, all chains in ordinary use, which are of wrought iron and mild steel, are annealed once at least in every twelve months. These chains, when subjected to frequent or severe use or where employed in carrying molten metal, are annealed at least once every six months. Chains subjected to specially severe use, such as those on cranes or grabs used to unload coal, ore, scrap, etc., are annealed once every three months.

One great advantage of periodic annealing is the opportunity offered for careful examination of the chain, since, with removal of all grease and dirt by firing, the surface of the metal is exposed. The examinations are made by competent, practical men, conversant with the kind of flaws and defects likely to be found, and able to make due allowance for any wear or distortion when considering the safety of a chain. Though detection of minute cracks in the metal is often difficult, a fire test facilitates their discovery, and is applied, in case of doubt.

Previous to the inauguration of our present definite plan of control, the wear of chains was often allowed to reach serious proportions before replacement or repair was considered necessary; chains were found to be in use with links socketed to half their normal diameter. Under our present plan, where chains in use are subject to continuous wear, the examiner must eventually decide when the wear is sufficient to render the chain unsafe for its normal working load. This decision is usually left to the experience and judgment of the examiner. If a chain containing worn links becomes distorted, as it generally does, the chain is removed from service and the worn links are replaced. In some cases, a chain or appliance must not be used for its maximum safe working load if the wear on any part exceeds 10 per cent; in other cases wear is limited to a reduction in diameter of the iron of 1/32 inch for chains up to 1 inch, and 1/16 inch for chains over 1 inch. In all cases, the general condition of the chain is also taken into account. The wear of a chain is often local, and the life of a chain may be extended by changing ends, thus subjecting different links to wear.

It is now the practice at the Otis Steel Company to identify every chain in use in their various departments. New chains are marked by the manufacturer, but chains which have been in used for some time have an identifying letter for the department and a number for the chain stamped upon a metal marker which is bolted to the end links. We have developed a system of records which tie in with chain identifications. These records which are maintained by the chain inspector contain such information as:

1. Brief description with important dimensions; 2. Purpose for which used; 3. Reference number on the maker's test certificate; 4. Maximum permissible working load; 5. Date when issued for use; 6. Dates of annealing, examination, repairs; 7. Nature and extent of repairs.

Filing cards afford very convenient records where large numbers of lifting appliances are used. A record of each chain, hook, shackle or sling with its attachments is entered on a separate card, and the cards are filed according to departments. Different periods for annealing may be indicated by cards of different colors.

In each department there are also inspectors whose duties and responsibilities are to inspect all chains and chain assemblies and to observe just how the chains are used by workmen.

Inspectors are authorized to decide when a chain shall be removed from service for repairs, treatment or replacement. All materials thus removed are referred to the metallurgical department which then assumes all responsibilities for reconditioning or replacing chains and later returning them to department storeroom for future use. On a specified day each week, a meeting of the department safety committee is held, and the inspector, together with a representative of the metallurgical department, is included. Copies of inspector's reports are presented, and the uses and abuses of chain equipment are discussed.

At the outset of the chain program at the Otis Steel Company, we, of course, were primarily concerned with educating the employee in the proper use of the equipment already in use in the various departments. We stressed all the points previously discussed, selected inspectors, established central repair stations, posted safe load charts conspicuously about the plants, insisted upon good house-keeping in caring for chains, in fact, we did everything possible to make our lifting equipment safe. We found, in the course of our inspections, that while chain failures had been reduced to a remarkable degree, we were still having them and it was apparent that there was still work to be done. Examination of chains after the failures indicated that there were still instances of over-loading, but that far too many failures were being caused by inherently defective chains; and we were buying the best dredge chains on the market. Tabulation of the data gathered during the investigations of failures revealed that the double-refined wrought iron dredge chain which several generations of chain makers had perfected, did not entirely answer our problems.

We found that failures due solely to reduction of material by wear were less common, and that next to misuse, our greatest difficulties were being encountered by failures at the weld. These weld failures in general were due to the following causes:

1. Scale and dirt between the joining surfaces of the weld; 2. Welding at a low temperature; 3. Overheating, causing burnt and brittle metal; 4. Progressive deterioration in service. It was found that the hammering of the scarfs produced small depressions in which scale and dirt were imprisoned when the outer edges of the weld were properly untied. Thus non-adhesive areas were formed within the weld which sometimes extended to the surface of the metal, but were visible only as very fine cracks.

If a weld is made at a low temperature, the edges of the weld are not properly closed, as these parts cool first. This defect by hammering is sometimes unintentionally concealed. Perfectly good welds have at times rough edges which may mislead even an expert chain examiner.

We immediately set about finding a solution to our problems. The welds of the chains were giving us the most trouble, so we decided that in our preliminary investigations, we should consider all types of chain available.

Of the several samples of chain submitted for our first tests, we found that there was only one that showed any marked advantage over the others in tensile strength, ductility, and strength of welds. This chain on several check tests, performed exactly as it had in the first experiments; it not only exceeded its nearest competitor in tensile strength, but in no case did it break in the weld. Microscopic examination of transverse sections of broken links cut through the welds revealed, that the fusion of metal at the weld had been so perfect that it was very difficult to determine exactly where the joint was made.

Chemical analysis of the chains divulged that they were made of a material that was entirely new to the chain industry, an alloy, that conformed to the specification of the Society of Automotive Engineers for SAE 4615.

Two sets of chains were immediately purchased and placed in service in a department where they would be in almost constant use; here they were examined at least once every month for about a year and a half. Since no flaws, evidence of wear, or work-hardening was apparent at the end of that time, the metallurgical department, along with the department superintendent, recommended that the alloy chain be purchased for future replacements.

At the very outset of the service test,

the new alloy chains were received with enthusiasm, particularly by the crane followers. The new chains hung free from the crane hook, that is, they didn't kink or twist, which saved considerable time in making lifts. This non-kinking feature, is in itself an innovation in the field of chain manufacture. It is simple, but then, so many time and labor saving devices are simple.

A built up section at one side and at the center of each link at the weld prevents any link from slipping past the center link of the link preceding it—which results in a practically kinkless chain.

Alloy chains are now recognized as standard for all Otis plants. They are used in all sizes in which they are available from 9/32 inches to 7/8 inches, and they have been in general use for almost a year and a half without a single instance of failure due to defective material or workmanship.

As a comparison, I cite the following figures which are safe loads for double-refined wrought iron dredge chain and the alloy chain, using the standard safety factor of 4 in each instance.

| Size | Dredge Chains | Alloy |
|---|---|---|
| 1/2" | 4500 Lbs. | 14400 Lbs. |
| 9/16" | 5580 " | 18000 " |
| 5/8" | 6930 " | 20600 " |
| 3/4" | 10140 " | 42000 " |
| 7/8" | 14000 " | |
| 1" | 18600 " | |
| 1-1/16" | 21150 " | |
| 1-1/8" | 28800 " | |
| 1-1/4" | 34500 " | |
| 1-3/8" | | |

In comparing the figures I have quoted, please note that the safe working load of 1/2 inch alloy chain is 14400 lbs., notice also that the safe load of 7/8 inch dredge chain is 14000 lbs. It is apparent, therefore, that those of you that have been using large bulky chains that are hard to handle, can minimize this difficulty by reducing the size of the chain and still maintain the desirable factor of safety. However we recommend that you take advantage of the additional margin of safety of the alloy chains.

A motion picture on "Foundry Dust Control," produced by the Liberty Mutual Insurance Co., Boston, concluded the Monday session. The discussion which followed the addresses was based on the following points:

1. What is a good method for marking chains for identification and record purposes?

Stenciled metal markers can be fastened to all chains.

2. How often is it necessary to anneal alloy chains?

Mr. Bloom stated that alloy chains in use at the Otis Steel Co. as long as three years had not yet indicated any need for annealing. It is probable that the company will return the chains to the manufacturer from whom they were purchased when annealing or repair is found necessary.

3. How may foot injuries be avoided when handling chains?

Mr. Filmer, of the Youngstown Sheet & Tube Co., described a platform which may be located slightly above the floor and below the hooks on which the chains are hung for storage. As workmen remove or replace chains, they stand with their feet partly under this platform, so that falling chains may not cause serious injury. Safety shoes may, of course, be used also.

4. How may the difficulty of holding safety meetings for men employed on different shifts be overcome?

Many industries are holding safety meetings on various shifts, either day or night, under the foreman in charge of the shift.

5. What is the proper protection for hands when handling rough, oil-coated materials?

Mr. Ralston explained that a waxed glove is available which, in some instances, has been found quite satisfactory. Another suggestion was the use of hand holds made from burlap.

6. How may the use of protective clothing be made mandatory?

Mr. Ralston suggested that applicants for employment be made to agree, by placing their signatures on appropriate cards, to use safety equipment whenever it may be required. Without that compliance, men should not be permitted to work.

7. How many concerns require the use of abdominal belts as protection against hernia?

They are required in many instances where examinations show employees to be susceptible to hernia. There is no unanimity of opinion among doctors, some recommending the use of such belts, while others advise otherwise.

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## WEDNESDAY MORNING SESSION

### October 7, 1936

# Safe Practices in Welding

By C. V. DAVISON

Superintendent of Pipe Manufacturing, American Rolling Mill Co., Middletown, Ohio

If our welders are not instructed properly in how to do their jobs we may cause accidents to individuals who have put their confidence in our ability. Each day thousands stake their lives on welding, a great many of whom do not know what welding is. Check the welding jobs under your jurisdiction and visualize what might happen to the users if your welders do not do a sound job.

A welder can make a job which will look perfect on the surface but underneath will have lack of fusion, slag inclusions, or burnt material which may cause breakage unless there is a great margin of safety in the design. The X-ray can detect this condition, but unfortunately there are but few X-rays compared with the amount of welding done daily.

One solution to this problem is for the welding supervisor to get his welders sales-minded. The welder depends on the salesman for his work; the salesman depends on the welder's quality to get this work. He must have a job to sell that he knows will prove satisfactory. We try to educate our welders to know that a salesman has only five tools: quality, cost, service, a knowledge of his job, and good will. The welder can control the first three; these, combined with the fourth, make the fifth.

The approach to an ideal safety set up —safety in welding and safety from welding—may look complicated, but I shall outline how we approached our problem.

Late in 1934 our business increased to the point where it was necessary for us to take on additional welders, which we could not find in our territory. Thus we were forced to make welders, as welding, like many industries, had not trained many apprentices during the depression. We selected as a training instructor one of our best welders, who had a thorough knowledge of our products and procedures, and developed a course of training not only to help our older welders, but to develop new ones.

Each job was broken down into its component parts, safety in the plant and safety of our product in the field. We selected as an experimental group 35 men, a few of whom had had welding experience. These men had varied types of education from three years in grade school to some college training. We were very much surprised to learn how little some of the men whom we considered good welders knew about their equipment, how to use it safely.

One of the first things we studied was the safety switch which controls the current going to the welding generator. How many of your welders know that this switch should be disconnected when making repairs to equipment? Also that this switch should be pulled out with the left hand while standing at one side, so that if there is a flash when the circuit is broken, the workman will not be burned about the face, since the majority of these switches are set from four to five feet off the floor? This may seem like a minor detail, but through one man's knowledge of this point we avoided quite a serious accident when a switch was being pulled on a 440 line and the flame shot out several feet. Our workmen were also instructed always to open the safety switch before opening the cover of the starter for any reason.

They were shown why, they should never place metallic objects near the welding set. Under "Reactance" we have a paragraph which reads: "Never place metallic objects where they can contact the coil of the reactor while the unit is running. This may result in damage to the equipment or a severe burn to the workman."

We do some welding with resistance banks. The operator is instructed as to how these resistance banks function; he is also told before any attempt is made to repair a resistance bank to be sure that the safety switch feeding the bank is open. Otherwise he might be burned.

Welding leads are one part of our equipment which get terrible abuse, as they are often dragged across sharp corners of steel plates, concrete, or brick floors; such treatment tends to cut off the insulation. Often a welder, not understanding his job thoroughly, will select a lead too small to carry the necessary current, which may burn off the insulation.

The electrode holder is another greatly-abused tool which, when not properly taken care of, will cause excessive heating and may burn a worker. If the holder is thrown down carelessly, it may cause a flash which is likely to burn bystanders. Care should be taken in placing leads around the floor, as someone might trip, injuring himself as well as breaking a connection which might cause a flash.

We have had some flashes from welding hoods, due to their shape, misuse and leaks around the glasses. Our training has largely eliminated this condition; we have shown the operators what rough usage will do, and the trained man will not work with a hood which has holes that permit light rays to enter. We supply each welder with a slag hammer and brush to clean his weld and have tried to have each welder wear a light pair of goggles under his hood to cut out light rays and also to prevent flying objects from entering his eyes while chipping slag. This has been quite a problem, as it has been very hard to find a safety lens goggle light enough for this purpose.

We instruct our welders and their helpers in the proper methods of handling the materials with which they work —principally pipe, quite often of irregular shape.

We try to get the welders to put the ends of their electrodes in boxes; on the floor they present a falling hazard.

The gases given off from an electrode are not dangerous in the open, but when welding in a confined space, the worker should be instructed to make provision for fresh air. With all the work we have done along this line we do find our welders working in confined spaces without proper air. This point should be stressed, as a welder might become gassed when working alone and not be able to get relief until it is too late.

An arc screen is not used enough in a great many plants. The welder, if properly clothed, is safe from flashes and burns, but without screens he often subjects other workers to hazards. The best type of screen is a light, portable one made from pipe and fittings to which is attached a piece of awning. It should, if possible, entirely surround the job.

It is often necessary for a welder to do his own cutting, and sometimes this is done by men unfamiliar with the proper handling of oxygen cutting gases and cutting equipment. Sometimes the workers around a plant will foolishly turn on the valves and play with the adjusting screws on the regulators. Each man, before he starts to cut, should check the valves and regulators to see that they have not been tampered with. Oil or grease should not be placed on an oxygen connection, because these materials will not mix with oxygen except as an explosive.

Regulators on gas and oxygen containers are connected to the valve by threaded connections. Such connections should be protected from bumps or cross threading or they will become useless. Bottles, whether full or empty, should be stored in their proper places.

Oxygen bottles are charged with very high pressure and should be given special safety attention. Should a valve be broken, the pressure would exhaust with such force that the heavy bottle would turn into a rocket.

The safety cap should never be taken from the valve until the bottle is placed in position for use and made secure. Oil under pressure is highly explosive and should never be placed on threads or connection of oxygen bottles. When not to be used for some time, the valves on both oxygen and gas bottles should be turned off securely to avoid waste and fire hazard.

Too much pressure should not be exerted upon the hand screw of the regulator, or the mechanism inside may be injured. The hand screw should always be run out when the valve on the tank is closed, to protect the low pressure gage when the valve is reopened.

Gas connections are always made with left-hand threads, while oxygen connections are made with right-hand threads. This is done to reduce hazards and should be checked carefully before making connections.

Defective gages or regulators should not be used but should be reported to the foreman or service man in order that repairs may be made. Defective equipment often results in defective workmanship and in many cases makes the job dangerous.

Hoses should be protected from hot sparks and metal. They should never be run over, and excessive tension should not be placed on them. Oxygen and gas hose should have right and left-hand connections, respectively. Excessive pressures, which might burst the hose, should be avoided.

Torches are made to be used only as torches and should never be used as hammers or pry bars. Such treatment would result in distortion or breakage, making the unit useless. Leaks in connections, valves, tips or blow pipes are dangerous and should be reported to the foreman or maintenance man. It is very essential that tips be kept clean and in good condition always.

Goggles are purely a safety device. They should have non-shattering lenses of special amber-colored optical glass and should always be worn over the eyes while cutting, for protection against glare and flying particles of metal or slag. The outer clear glass should be changed for new lenses when it becomes spattered to the extent that vision is obstructed.

Friction lighters are small mechanical torch-lighting devices, composed of a wire handle, a file, and flint. When the handle is squeezed, the flint passes over the file, thereby causing sparks to fly. This provides a much safer method of lighting a torch than matches.

Good, tight-fitting wrenches should be used when changing any connections on cutting equipment. All nuts are made of brass and would easily be chewed up or the corners rounded off by the use of poor wrenches, pliers or pipe wrenches.

## Handling Material By Hand

**By C. E. RALSTON**

**Safety Director, Pittsburgh Plate Glass Company, Pittsburgh, Penn.**

When we realize that over 25 per cent of all compensable injuries are chargeable to hand handling and manipulation of materials, we may well wonder whether we have not been overlooking a fundamental question. Have we not been disposed to overlook hand labor because it is generally termed "common labor," which any man could do, and were we not inclined to feel that no special training was necessary? Records for New York State show a total of $5,000,000 paid in compensation for injuries chargeable to this classification.

Of all industrial injuries reported, 33 per cent are to hands and fingers and account for 18 per cent of the compensation paid; 24 per cent are to legs and feet, with 20 per cent of the compensation; and 11 per cent are to arms, with 13 per cent of the compensation costs.

"Falling objects" while being handled are chargeable with 5 per cent of all industrial cases with 2 per cent of the time lost and 6 per cent of the compensation. "Handling objects" are chargeable with 29 per cent of all industrial cases and 17 per cent of the compensation.

Another phase of this problem is that of infected cases. The estimated total cost of compensation paid for such injuries is $20,000,000 per year. Of this amount 72 per cent is chargeable to hand and finger cases, 17 per cent to legs and feet, and 7 per cent to arms.

A distribution of "Handling Object Cases" by industries would indicate the following:

| | |
|---|---|
| Glass Products | 40 per cent |
| Clay Products | 36 per cent |
| Foundries | 32 per cent |
| Steel Works | 26 per cent |
| Chemicals | 26 per cent |
| Construction | 26 per cent |

An analysis of the general problem naturally divides it into the following sub-divisions:

### Poor Physical Condition

While we find much opposition to phyical examination programs, we must recognize the fact that under existing laws no employer can legally operate without them. The laws made to protect the worker require the employer to furnish a safe place for him to work. This cannot be done if the employer does not know the condition of the man and his possible susceptibility to certain kinds and types of exposure. Strains, hernias, falls, vision, colds, constipation and many other items enter this picture and cause much grief.

The physical examination program must therefore take first place in a proper selection and placement plan.

Important items to be given consideration by the examining physician are: arthritis or rheumatism, tumors, tuberculosis, syphilis and bone abscesses, infections from abscessed teeth, diseased tonsils, infected sinuses, etc.

When two men are carrying a load and one slips, it is not always this man who suffers an injury. Frequently the sudden shifting of the load to the other causes him to be injured. If two men can barely handle the load, three should be used. This is not waste of labor—just good planning. The waste comes from having a man on the disabled list, non-productive, but an overhead expense, and this may be the deciding factor between profit and loss on a given job.

Care must be taken to see that the laborer is fitted for his work. The short, thickset type of man must be given the heavy lifting and handling jobs, while the lighter work goes to the slightly built tall men. While there is no definite rule, I believe that loads of not to exceed 100 pounds should be considered the efficient load limit for the average man. Fatigue or weakness will often be found as the cause of dropped loads. It is certainly inefficient for workers to lift to their capacity.

### Improper Method of Lifting and Conveying

I cannot help recalling many personal observations—both on construction work and in connection with regular operating conditions. The outstanding fact has been the lack of definite instructions by the supervisors and their apparent inability, or incompetence, to give such instructions. This includes their failure to properly recognize the mental capacity of the laborer, whether he be a foreigner, or an American with little education. On one construction job the foreman told an Italian laborer to go to a certain place and bring back a barrel of salt. The order was not clearly given and the man returned with a "buck saw" over his shoulder.

Training of labor supervisors, as well as of laborers, is required as much, if not more, than in other lines of labor effort.

An inadequate force is not only inefficient but dangerous. The distribution of the force to the load is of prime importance, whether handling boxes, crates, barrels, timbers, rails, pipes or other bulky, as well as lengthy, materials.

Team work is very essential and only obtained through careful and systematic training—one slow thinking, or acting, man can and will wreck the gang. They are a menace, not only to themselves, but others, unless their supervisor is constantly recognizing their weaknesses and places them accordingly.

Failure to obey orders may denote either mental or physical inability and should be a warning flag to the supervisor. In some cases this can be attributed to stubbornness or independent thinking, although we generally find only muscle and bone in common labor groups.

**Inadequate Hand and Foot Protection**

This is mainly the problem of the employer, worked out through the supervisor. Too often the employer fails to recognize that in hiring labor, he has hired only the man and fails to properly consider the hazards to which the man will be exposed. Protection against bodily injury, as well as protective clothing, should receive very careful consideration. All exposures should be analyzed, in justice to the laborer, and adequate protective equipment should be provided. In some cases this may only involve the hands, arms, feet and legs, while in others the body will be included, such as in handling pig-iron or other rough as well as heavy materials. Hot substances and acids call for special consideration and treatment as in such cases we find the face, head and eyes also involved.

Proper protective equipment for the hands will include gloves of various types as well as wrist protectors and hand laps. Leggings and special foot protectors, whether the latter be safety shoes, metal, or leather guards, will be clearly indicated from an analysis of the exposure. I fear that too often protective equipment is purchased entirely on a price basis and as a result many preventable injuries occur that never would have occurred had proper consideration been given the importance of the problem. Where inadequate equipment is furnished, there is bound to result a false sense of security and the responsibility of the employer is increased.

In addition to protective equipment, consideration should also be given to providing special hand tongs, or grips, for certain materials.

When the working conditions indicate the need for protective equipment, its use should be a requirement of employment —no protection, no job.

**Unsafe Practices**

Under this classification, we can consider too heavy, or bulky loads, or inadequate force. I recall many old-time stone masons and their handling of stones too heavy for one man to properly handle—hernias were common among the men—they had never been taught how to lift, such methods were not thought necessary nor given any consideration.

Walking backward with loads is a dangerous practice and this is particularly so in restricted areas. Vision is very important, as there is not only the stumbling hazard to be considered, but also that of bruised hands and arms against projecting piles of materials or parts of permanent structures.

Store-room hazards are present in practically all plants—such as handling materials with rough surfaces, as well as those which offer no hand hold. A man was moving a large paper carton by turning it over and over along the ground instead of using a hand truck or securing another man to help him. Some jagged pieces of glass become imbedded in the carton and his hand was severely cut by the sharp edges.

Care should be exercised in piling and blocking materials so that they will not roll, or slide, and so that they will furnish proper hand-hold when necessary to be rehandled.

Bulky materials should be carefully tipped to a balance and secure hand-holds obtained before any attempt is made to lift or move.

Piled materials should always be raised from the pile before any side movement in order to prevent dragging which might cause the balance of the pile to fall.

**Inadequate Regard for Inspection Hazards**

This condition can be accounted for in several ways—namely, ignorance, inability to think, inability to draw a personal lesson from the experience of others, overconfidence and a desire to make good on the job. These can only be overcome by careful and systematic handling on the part of the supervisor. His is the responsibility of putting over to the worker the value and advantages resulting from a close observance of rigid safety inspections.

### Systematic Organized Safety Effort

There should be little need to make a plea for more concerted action along this line. As safety men, we know how easily the small employer could be put out of business as the result of even a few accident losses. The larger employer, as well, cannot afford to overlook the situation—his losses, through waste of time, money and materials, will seriously affect his profits and hold his company up to the public as a very inefficient organization. The ever increasing cost of compensation insurance will undoubtedly be a factor in forcing more consideration for well organized safety work. Personally, I emphasize the side of humanity above the dollar and am satisfied from long experience that where humanity rules, the profits will be satisfactory. Where a real safety program is followed, without doubt efficiency and economy of the highest order will also prevail.

# The Present Status of Control of Dust and Fumes in Industry

**By H. B. MELLER**

**Managing Director, Air Hygiene Foundation of America, Inc.; Head, Air Pollution Investigation, Mellon Institute of Industrial Research, Pittsburgh, Pa.**

The problem divides itself naturally into medical, preventive engineering and legislative phases, and includes consideration of the responsibilities of employer and employee to each other and to the public.

It is axiomatic that, in case of physical disorder, impairment of function or disability, the more thoroughly the cause and course of action are known, the more certainly can possible remedies be applied or preventive measures taken.

In the diseases or affections under consideration, there are facts upon which preventive methods are based, and upon which further studies now in course or contemplated are, at least in part, predicated.

During the development of the present state of knowledge of the influence of some air contaminants on health, naturally many theories were advanced that later scientific work has modified or displaced. However, not always has the correction been as widely and thoroughly disseminated as was the original theory; this condition, perhaps, has led to some confusion in the minds of many who have not followed too closely the evolution of knowledge in this field.

### Classification of Dusts

There are available different published classifications of dusts. Included in such classifications are dusts, the exposure to inhalation of which are, or are likely to be, occupational. Those that are inherently toxic when inhaled or otherwise absorbed and which cause systemic poisoning, include lead, arsenic, mercury, manganese. Examples of dusts which have the ability to penetrate the deep lung tissues and to be retained there are quartz, flint, chert, asbestos, talc, coal, iron, clay, slate, and other types of rock dust.

Attention here will be centered upon this last group and upon pneumoconiosis, the general term used to designate lung conditions caused by dust. Silicosis, which is caused by the inhalation of free silica, has been prominent recently in the public press, sometimes in a way that made misunderstanding possible, if not probable.

Aside from silica, many of the insoluble mineral dusts may bring about slight changes in the lung tissues, which may be demonstrated on the roentgenogram if there is silica in the dust that is inhaled. As far as is known today, most of them are relatively or entirely harmless.

**Ability of Dusts to Cause Injury**

It has been established that the potentiality of silicious dusts to cause lung damage is, with few exceptions, dependent upon their content of free silica ($SiO_2$). The development of silicosis depends, therefore, upon the concentration of dust containing free silica in the air breathed. In other words, the total amount of free silica breathed and retained seems to be the primary factor; the length of time necessary for a sufficient accumulation is important, but less so than the total load.

Silica occurs also in chemical combination in silicates. Some of these compounds have been proved to be relatively harmless to health, some are still in the realm of doubt, and one—asbestos—may cause the industrial disease called asbestosis, which is the result of lung damage similar to, but not identical with nor as serious as, that produced by free silica.

**Importance of Particle Size.** The size of dust particles in the air which an individual may breathe is important. Not often are particles larger than 10 or 12 microns found in the deep lungs, except in the case of asbestos dust, where fibers as long as 200 microns have worked their way down lengthwise.

**Uncomplicated Silicosis.** Silicosis, uncomplicated by an infection, is more of an impairment than a disability. It is not seriously disabling until it reaches an advanced stage, and does not of itself greatly shorten the life of a silicotic.

**Silico-Tuberculosis.** When a silicotic dies, the immediate cause of death is usually some type of intervening lung infection. It is not known just why the presence of silica in the lungs increases susceptibility to tuberculosis, but when an adult with silicosis is exposed to tuberculosis, an active infection may occur, regardless of the previous state of health. It is thought probable that silica dust can reactivate healed tuberculous lung lesions of the adult type; how long after such lesions have healed the reactivation is possible is not certain. Exposure of silicotics to tuberculosis or of tuberculous individuals to silica dust is serious and should be avoided.

After silicosis has become well established in the lungs, medical science has not found a way to arrest the progress of the silicotic process toward the stage of disablement except through limiting or preventing further exposure to silica dust. Nor has medical science found a way to prevent tuberculosis from being superimposed upon silicosis, except through control of contact. The course of silicotuberculosis is chronic and is very difficult to influence by treatment, according to phthisiologists.

**Medical Control.** As a basis for intelligent determination of the physical fitness of a man for a job in a dusty trade, physical examination, with stereoscopic roentgenograms of the chest, is necessary. Along with this study goes, naturally, the preparation of an occupational history with detail as to the exact nature of previous work and of exposure to industrial dust—not a valueless recording of occupations as "laborer," "machinist," etc. Dr. Sayers, of the U. S. Public Health Service, has developed a method of securing information for a proper occupational history; among others, Cummings, of Saranac Laboratory, also has worked out a useful history blank.

Standards have been developed for the diagnosis of silicosis. There is also a suitable technic for taking roentgenograms of the chest in order to bring out the characteristic lung changes.

From the considerable amount of work that has been done, it is possible to forecast with a reasonable degree of accuracy the silicosis potentiality of various dusts.

Periodic physical examinations, including roentgenograms, are essential if employers are to be enabled accurately to learn the effect of individual exposure and intelligently to transfer affected workmen to lower dust concentrations before serious injury has been done, or to work out a system of rotation where indicated as desirable in order that exposure may be intermittent. Such examinations are helpful also in showing the efficiency of engineering control methods.

The ability to place responsibility in case of claim for injury is no small part of the value of such initial and periodic examinations.

**Asbestosis.** Clinical experience has shown that the inhalation of a sufficient amount of asbestos dust causes a serious type of fibrosis, which is not accompanied by an unduly high incidence of tuberculosis.

Other dusts and silicate compounds so far studied produce, at most, only a mild non-progressive reaction in the lungs, provided there is no significant amount of free silica in their composition. While not serious clinically, such conditions may give rise to considerable litigation.

Adequate statistics on morbidity and mortality from occupational disease, to serve as a basis for effectively focussing the efforts to study and control dust diseases of the lungs, are non-existent.

In concluding this section, the following quotation from a court decision in Wisconsin is pertinent (Schaefer v. Industrial Commission, 265 N. W. 390 (Supreme Court, February, 1936)):

". . . It will be necessary to distinguish carefully between medical or pathological disability and actual physical incapacity to work. The medical experts apparently ignore this distinction, and so increase the difficulty of arriving at a just result under the law."

### Preventive Engineering

It would be needless repetition to discuss in a technical way the engineering phases of dust control. All interested are referred to "Industrial Dust," by Drinker and Hatch, which deals comprehensively with the subject; U. S. Bureau of Mines Information Circulars 6840 and 6848, by Harrington and Davenport, a review of literature on "Prevention of Dust Diseases"; U. S. Public Health Service Bulletin 217, by Bloomfield and DallaValle, on "The Determination and Control of Industrial Dust"; Report Z9 of the American Standards Association; and to the U. S. Bureau of Mines for a list of approved protective devices.

It may be said that, in general, the engineering specialist can and will devise the necessary equipment to meet the conditions specified to him. But the setting of limits of permissible dust concentration is not his but the physician's responsibility. The engineer is concerned with keeping dustiness to or below the limits at present considered satisfactory.

### Methods of Determining Dust

Some dusts (as lead) are determined by chemical methods and the concentrations in air are recorded gravimetrically as milligrams per cubic meter. Others (as silica, where size is a factor in determining dangerous particles), are given by count. Neither method gives the whole story, but in both cases it may be possible to secure the information necessary for the purpose.

In one of the reports referred to earlier, there occurs this statement: "There is no doubt in the mind of anyone familiar with the present dust-sampling and dust-estimating methods that they will be amended and changed from time to time. At the present writing we would advise the use of the simplest possible procedures where dust control alone is in question. If one wishes to obtain values which can be compared with published data, it is generally necessary to copy with considerable care the technic used in the original case. This is another way of admitting the annoying fact that results by one method are usually not comparable to those obtained by another method."

In another place, the report says: "It is very doubtful if any useful purpose is served by determining accurately extremely dense dust concentrations—the only excuse for such data is to show the skeptic that the workplace is much dustier than it should be. . . .

"It is probable that any sampling procedure which fixes concentrations in groups 100 per cent apart is sufficient and that the results of any attempts to come closer to the concentration at the moment of sampling are simply misleading. Thus ranges such as 0-5, 5-10, 10-20, 20-40, etc., suffice for dust control."

As dust particles in the lungs are of the order of 1 micron, with rarely a particle over 10 microns, dust control for hygienic reasons should be aimed at particles in the size range found to have been breathed and retained. Again quoting: ". . . if one could avoid use of the dusts of 1 micron or less or exclude them from the dust which passes a 325-mesh screen, nearly *all* dust diseases would be eliminated."

### Dust Elimination

Obviously, it is better, when possible, to purchase equipment already supplied with exhaust hood, rather than to have to worry to fit one to equipment not designed to be hooded. Thus the responsibility for potential efficiency is upon the manufacturer.

There is available comparatively little information upon which to base the scientific design of hoods. The Preventive Engineering Committee of Air Hygiene Foundation includes in its recent report a table of minimum air velocities to capture certain industrial dusts (for use in granite cutting, grain elevators, paint spraying, sand pulverizing and electric welding).

For protective equipment such as dust respirators, air supplied masks, sand blast helmets, and goggles, very complete information is available, because of the work of the U. S. Bureau of Mines, the Bureau of Standards, and the American Standards Association in preparing and issuing specifications to be met if the equipment is to be used under conditions where approval is necessary.

Of course, all agree that, where possible, dust should be controlled at the source, and protective equipment used where this action cannot be accomplished.

### Permissible Dustiness

There are various figures that have been and are being used as guides to permissible dustiness where free silica is present. It should be noted that many of the data were not determined as the medical requirement, but as being attainable in good practice and apparently satisfactory from a safety standpoint.

In South Africa the figure is 1 milligram per cubic meter (or 300 particles per cubic centimeter, or approximately 8.5 million per cubic foot).

Dr. Lanza found in 1917 in the Joplin, Mo., district that, with good engineering practice, a figure of 1 milligram per 100 liters of air could be attained.

The U. S. Public Health Service, in its study in the anthracite region of Pennsylvania, found that 50 million particles per cubic foot with 5 per cent quartz in the coarse dust and 10 million particles per cubic foot with 35 per cent quartz were apparently satisfactory and often were attained.

The figure of 10-20 million particles per cubic foot for granite dust with 35 per cent quartz content is often quoted from the Vermont granite studies of the U. S. Public Health Service.

Some metal-mining companies have gone further, setting the maximum of permissible dustiness at 5 million particles per cubic foot.

Certainly, there is a degree of air cleanliness that is safe, from the standpoint of concentration of harmful dust. But the engineer may find himself in the position of practically being forced to control any dust, harmful or otherwise, if he would protect his employers against suits at common law and the possibility of award of damages to men who have breathed dust containing little or no free silica. A dusty workplace is difficult to defend in court. Neither courts nor compensation boards, and certainly not juries, have seemed to be greatly impressed with a low silica dust count in an otherwise dusty atmosphere.

Quoting from one of the reports referred to: "Each state is a unit—a sovereign—and it handles its problems in its own way. Uniformity is lacking, although of course the statutes of many states are similar. The courts of the various states follow such precedents as appeal to them; consequently, on any important question there is likely to be a divergence of opinion among the courts, and often the courts fall into two or more groups, each group following a different theory with respect to the same legal problem."

### Workmen's Compensation Acts

Workmen's compensation acts have been passed in 46 states (all except Arkansas and Mississippi) and the District of Columbia. These acts are compulsory as to private employers in 15 states and elective in 31 states. Insurance to cover the risk is compulsory in seven states.

A state fund, out of which compensation is paid, is maintained in 18 states; in two of these the employer may, by proving financial responsibility, carry his own risk with limited contribution to the state fund for the expense of administration; in 11 more of this group of states the employer is not required to avail himself of the privileges of the state fund and may provide compensation otherwise. In 28 states there is no provision for a state compensation fund.

Administration of the compensation act is vested in a commission, board, or single commissioner in 40 states; in six states the acts are administered by the local courts.

Again from the report: "The guiding principle in the early acts was the awarding of compensation for accidental injury, meaning thereby traumatic injury." (Traumatic means of or pertaining to a wound or wounds.) "In those years, the importance of disability due to occupational disease was not generally recognized. It however became increasingly apparent that 'injury' might be suffered gradually, and that the result of such gradual breaking down of the strength and resistance of the employee was more serious in many instances than traumatic injury. Courts therefore, in some states, wrestled with the problem of construing 'injury' so as to include disease and bring disease within the compensation acts."

In one state a diseased condition is compensable under the act if caused by the negligence of the employer. Occupational disease is compensable, to some extent, in 16 states and the District of Columbia; in five of these states silicosis is not included among the compensable diseases; in one state silicosis is the only occupational disease made compensable.

There is a legal obligation on the part of the employer to provide a safe place to work, and usually the matter of ventilation is featured. The mining laws approach uniformity as to air quantity and as to equipment for mechanical ventilation.

The right, at common law, to recover for occupational disease due to negligence of the employer, is important. In three states it has been held by the courts that the right never did exist; in three states the right is extremely doubtful; in 12 states it probably exists, although there is some doubt; in 12 other states, the right seems well settled, but is limited in eight of this group; in the remaining states and the District of Columbia, no court decisions can be found which decide the question as to whether or not such common law right exists. It should again be noted that occupational disease is compensable in three states in this last group.

"With the adoption of Occupational Disease Acts, new medical problems arise and more adequate provision is required for medical examination and treatment. This is especially true with respect to dust diseases, which call for diagnosis by skilled specialists experienced in that field."

**Examination Before Employment**

1. **Under Compensation Acts:** The New Mexico Act contains a provision requiring the workman, at the time of his employment, or thereafter at the request of the employer, to submit himself to an examination.

The New York Act of 1936, covering silicosis and other dust diseases, provides, in the opening paragraph:

"It is hereby declared to be the policy of the legislature of this state, in enacting this article, to prohibit through every lawful means available, any requirement as a prerequisite to employment which compels an applicant for employment in any occupation coming within the purview of this article to undergo a medical examination."

The North Carolina Act, effective March 26, 1935, contains a provision requiring examination both prior to employment and from time to time during employment.

In the compensation acts of no other states were found provisions with respect to examination prior to the time of employment.

2. **Under Other Statutes:** Five states (Louisiana, Maine, New Jersey, New York, and Pennsylvania) have statutes requiring physical examination before an employee is permitted to work under compressed air or in caissons.

**Examination During Employment**

The five states mentioned in the preceding paragraph require periodic examinations during the course of employment under compressed air or in caissons.

Missouri statutes provide for examination, as often as once a month, by a competent licensed and reputable physician, of all employees who come into direct contact with certain poisonous agencies or injurious processes.

Three states (New Jersey, Ohio and Pennsylvania) require employers to cause to be examined at least once a month, employees engaged in any work or process exposing them to lead dust, lead fumes or lead solutions.

**Examination After Claim for Disability Arises**

No two state acts contain identical provisions, but in all (including the District of Columbia) that have compensation acts, there is provision for physical examination after claim for disability arises.

In five states (Kentucky, Massachusetts, New York, North Carolina, and West Virginia), definite recognition has been given to the importance of some sort of medical board composed of specially qualified physicians and surgeons, and charged with the duty of diagnosing occupational disease and of advising the administrative board or commission with respect thereto. The laws of these five states are quite different and should be studied separately for details, but in each occupational disease, including silicosis, is compensable.

The importance of roentgenograms in any thorough physical examination for pneumoconiosis is well known. This importance is recognized in the Acts of New Jersey, New York, North Carolina, and West Virginia.

**Medical Treatment**

In the 17 states (including Maryland) in which occupational disease is, to some extent, compensable, the acts usually entitle the claimant to a limited amount of medical, surgical, and hospital care, measured in money cost or length of time covered by treatment.

These points were raised in the discussion following the addresses:

1. How much time is required for completing a training course?

Mr. Davison said that the training course in their plant ordinarily covered a period of one and one-half years, but that some students completed it sooner. The time required depends upon the individual.

2. Is it advisable to limit the number of students per teacher?

Ten students per instructor is a good ratio.

3. Which gases present the greatest harzards in welding?

Silicon gases are the most harmful. The risk, however, has largely been overcome by manufacturers of welding supplies.

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## THURSDAY MORNING SESSION

### October 8, 1936

# Metals Section Safety Contest

Two hundred and two units were registered in the 1936 Contest of the Metals Section. During the Contest period 267,792 employees worked 561,788,579 man-hours with an average frequency rate of 8.030, a decrease of 4 per cent from the 1935 rate of 8,354. Ninety-five units completed the Contest with a frequency rate below the average, and 8 per cent of the units finished with perfect records. Nineteen plaques and eight certificates were awarded in the Contest.

The plaques were presented by John B. Gibson, Publicity Director, Hawthorne works, Western Electric Company, Chicago, and Vice President for Community Safety Councils, National Safety Council, as follows:

**Steel Mills Division, Group A**—Continental Steel Corporation, Kokomo Division, Kokomo, Indiana, 4,141,806 man-hours, 12 injuries.

**Steel Mills Division, Group B and C**—Youngstown Sheet and Tube Company, South Chicago Works, Chicago, Illinois, 1,198,735 man-hours, 1 injury.

**Rolling, Finishing & Fabricating Division, Group A**—The Chase Brass and Copper Company, Cleveland, Ohio, 2,245,-286 man-hours, 5 injuries.

**Rolling, Finishing & Fabricating Division, Group B**—Six tied for first place—Revere Copper and Brass, Inc., Baltimore Division, Baltimore, Md., 1,042,599 man-hours, no injuries; Central Tube Company, Ambridge, Penn., 1,037,084 man-hours, no injuries; Continental Steel Corporation, Chapman Price Division, Indianapolis, Indiana, 833,146 man-hours, no injuries; Republic Steel Corporation, Grand Crossing Plant, Chicago, Illinois, 603,234 man-hours, no injuries; Union Drawn Steel Company, Beaver Falls, Penn., 443,363 man-hours, no injuries; Lehigh Structural Steel Co., Allentown, Penn., 319,353 man-hours, no injuries.

**Foundries Division**—Three tied for first place—Lycoming Manufacturing Company, Plants Nos. 2 and 3, Williamsport, Penn., 669,449 man-hours, no injuries; Haynes Stellite Co., Kokomo, Ind., 481,481 man-hours, no injuries; American Rolling Mill Co., Sixth Street Foundry, Ashland, Ky., 142,948 man-hours, no injuries.

**Heavy Machine Shops Division, Group A**—Lycoming Manufacturing Company, Plant No. 1, Williamsport, Penn., 1,842,-474 man-hours, no injuries.

**Heavy Machine Shops Division, Group B**—Three tied for first place—C. Hager & Sons Hinge Manufacturing Company, St. Louis, Mo., 805,007 man-hours, no injuries; D & B Pump and Supply Company, Los Angeles, California, 208,253 man-hours, no injuries; Noera Manufacturing Co., Waterbury, Conn., 214,792 man-hours, no injuries.

**Light Machine Shop Division**—Three tied for first place—Western Clock Company, La Salle, Ill., 5,309,320 man-hours, no injuries; Ilg Electric Ventilating Company, Chicago, Ill., 370,222 man-hours, no injuries; Tite-Flex Metal Hose Company, Newark, New Jersey, 146,536 man-hours, no injuries.

## New Developments in Safeguarding

**By JOHN A. OARTEL**

**Safety Director, Carnegie-Illinois Steel Corp., Pittsburgh, Pa.**

Safety kinks assembled by Mr. Oartel during the past year were presented as film strips, 56 views being shown.

The first strip dealt with prevention of falling of material; with good housekeeping; piling and storage; keeping loose material from crane runways and other elevated places; and similar safe practices. It included 30 views reproduced from photographs which originally appeared in the National Safety News during the past year.

The second strip illustrated new developments in safeguarding and ways of promoting safety. It included 13 views taken in the Ohio and Chicago District plants of the Carnegie-Illinois Steel Corporation and 13 photos received from other companies, including the Ashland and Butler Divisions of the American Rolling Mill Company; the Duluth Works of the American Steel & Wire Company; the Republic Steel Corporation; the Ford Motor Company; the National Tube Company; and the Pittsburgh Limestone Company.

The Thursday session closed with a round-table discussion, "Your Hour," led by H. J. Griffith, Jones & Laughlin Steel Corp., in the absence of T. H. McKenney, past general chairman of the section, who was unable to attend.

*ADJOURNMENT*